8-1-2023

2023-2024 Graduate Catalog

University of Alabama in Huntsville

UAH 2023-2024 Graduate Catalog Table of Contents

The University of Alabama in Huntsville

The University of Alabama in Huntsville is a research-intensive, internationally recognized technological university serving Alabama and beyond. Our mission is to explore, discover, create, and communicate knowledge, while educating individuals in leadership, innovation, critical thinking, and civic responsibility and inspiring a passion for learning.

Although this catalog intends to reflect currently any policies or rules of The Board of Trustees of The University of Alabama referred to or incorporated herein, users are cautioned that changes or additions to such policies and rules, including those relating to tuition and/or fees, may have become effective since the publication of this material. In the event of such a conflict, the current statements of Board policy contained in the official minutes and manual of rules, by-laws, and guidelines shall prevail.

The University of Alabama in Huntsville also reserves the right in its sole discretion and at any time to modify any policy, procedure, benefit, or program described or set forth in this catalog and to make any other changes it deems necessary and appropriate. Students enrolling in the University are subject to current policies and rules as contained herein and as subsequently stated or modified by official institutional action.

Academic Information

The Graduate School at The University of Alabama in Huntsville provides the following academic options and opportunities in support of its educational programs:

Collaborative Programs

UAH has the ability to establish collaborative agreements allowing graduate students to take courses at and potentially offer dual degrees with approved institutions. Collaborative agreements are subject to change.

Transient Student Program (UA, UAB, UAH, Auburn University)

In some designated programs, a student enrolled at any campus of the University of Alabama System or Auburn University may register as a transient student at the other institution with the approval of both Graduate Deans, or their representatives, and the department or school in which the student wishes to take the courses. The amount of coursework that may be taken by a student under such an arrangement will be determined by the supervisory committee, with appropriate approvals at the other university. A student earning a master's degree at either institution must complete a majority of the required coursework at the institution granting the degree. For a course to be applicable for credit beyond the hours presently transferable toward a master's degree or beyond the master's, the course must be approved in advance by the student's major department and the Graduate Dean. The Deans of the Graduate Schools will serve as liaison officers in arranging programs for which the additional hours may be transferred.

Joint and Shared Programs within the University of Alabama System (UA, UAB, UAH)

A *Joint program* is one that is mutually sponsored by two or more campuses, leading to a single degree that is conferred by all participating institutions. A *Shared program* is mutually sponsored by two or more institutions and benefits from their collaborative efforts. UAH maintains the following Joint programs with UA and UAB:

- Ph.D. in Civil Engineering (https://catalog.uah.edu/grad/colleges-departments/engineering/civil-environmental-engineering/civil-engineering-phd-joint-with-uab/) (UAH/UAB)
- Ph.D. in Materials Science (https://catalog.uah.edu/grad/colleges-departments/interdisciplinary-programs/material-science-phd/#requirementstext) (UAH/UA/UAB)
- Ph.D. in Applied Mathematics (https://catalog.uah.edu/grad/colleges-departments/science/mathematical-sciences/mathematical-science-phd/) (UAH/UA/UAB)
- Ph.D. in Nursing (https://catalog.uah.edu/grad/colleges-departments/nursing/nursing-joint-nursing-science-phd/) (UAH/UA Capstone College of Nursing)

UAH maintains the following Shared program with UAB:

- Ph.D. in Computer Engineering (https://catalog.uah.edu/grad/colleges-departments/engineering/electrical-computer-engineering/computer-engineering-phd-shared-with-uab/)

Visiting Graduate Student Agreement between UAH and Alabama A&M University

A *Visiting Student program*, which is established between two institutions, allows a student at either institution to request permission to attend a course at one of the other institutions. This type of agreement allows UAH students to take degree-specific courses at an approved institution, while also allowing students from the other institutions to take courses at UAH.

A cooperative arrangement exists between UAH and Alabama A&M University (AAMU) for graduate students pursuing a degree in Biological Sciences. Under this arrangement, graduate students may request permission to take BIO or NRE courses at AAMU. Similarly, graduate students at AAMU can take Biology courses at UAH. Conditions permitting UAH graduate students to take AAMU courses include the following:

1. A student must be a full-time student or a full-time University employee who is a part-time student. The credit hours to be taken at the host institution shall be counted in determining the full-time or part-time status of the student.
2. The course desired must be unavailable at the student's home institution.
3. Visiting students are normally limited to one course per semester at the host institution except where the second course is a laboratory required to accompany the first course, or the second course is a one-hour course in basic military science.
4. A student must have an overall 2.000 GPA and meet all prerequisites of the host institution.
5. A student's request must be approved by their advisor and other appropriate personnel.
6. Students will be admitted by the host institution to a course based upon availability of space, to be determined by the class enrollment on the last day of regular registration.

Interested students should contact the UAH Office of the Registrar for appropriate forms (https://www.uah.edu/registrar/forms/visiting-student/).

Agreements between UAH and Selected International Universities

UAH develops and maintains various dual degree agreements with partner International universities. These agreements allow selected students from specific programs in partner institutions to matriculate at both institutions after satisfying predefined coursework and other degree requirements.

Cooperative Education and Career Development Program

Student Services Building, Room 205
256.824.6741
chargerjobs@uah.edu
www.uah.edu/career-services (http://www.uah.edu/career-services/)

Career Center

Career Services

Career Services assists students in all phases of career planning and preparation including resume writing and critique, interview preparation, developing networking skills, career assessments, and career coaching through one-on-one appointments as well as workshops and information sessions. Our services provide students with the knowledge and resources to make informed career choices and personal skills to reach their objectives.

Career Services coordinates on and off-campus recruiting opportunities and hosts two comprehensive career fairs each fall and spring semester for students in all majors. Career Fair allows our students the opportunity to speak with multiple employers in one location about cooperative education (co-op), internships, and degreed positions. Attendees are required to dress professionally and bring copies of their resumes for distribution.

Cooperative Education and Internships

Cooperative Education and Internships provide a unique, structured educational experience that allows students to gain practical, professional work experience while completing degree requirements. Through the integration of classroom theory and professional practices, students increase their understanding of the work world.

The Cooperative Education program offers alternating and parallel options. Students working on an alternating schedule rotate semesters of full-time study with semesters of full-time work in their majors. Some students may complete continuous parallel (part-time work) assignments concurrently with a reduced class load. Cooperative Education work experiences are progressive in responsibilities, monitored by the University, and directly related to the students' academic and career goals. Students participating in Cooperative Education are required to register their Cooperative Education through the Career Center.

Internships are one semester, degree-related employment opportunities where students work one-on-one with professionals to gain practical experience in their field. Several academic programs on campus offer credit for internships; students should check with their academic advisor to learn about any credit-bearing internship opportunities within their program of study.

Charger Path

Charger Path is UAH’s exclusive comprehensive career management system and all newly enrolled students receive an account during their first week of classes. In this system, students update their profiles, upload their resumes and apply for positions including co-ops, internships, and professional

degree opportunities. Through Charger Path, students receive career announcements, view upcoming workshops and information sessions, have access to on-campus recruiting schedules, and make appointments with the Career Center.

JUMP

The UAH Joint Undergraduate Master's Program (JUMP) allows undergraduate students to study at the graduate level. By taking graduate courses during the senior year, students can reduce the time it takes to get a graduate (M.S. or M.A.) degree. Visit uah.edu/jump (https://www.uah.edu/admissions/graduate/discover-uah/joint-undergraduate-masters-program/) to view a current listing of all JUMP-eligible programs.

Benefits of JUMP:

1. There is no entrance exam.
2. Undergraduate courses can be double-counted towards a graduate degree.
3. Graduate courses taken as a JUMP student are charged at the undergraduate tuition rate.
4. There is no Graduate School application fee.

How to JUMP:

For admission to JUMP, students must meet the overall GPA requirements of the academic program. GPA includes all transfer coursework. Students should contact the JUMP advisor of their academic program for more information about admission requirements and about how to submit the JUMP application. View more information at uah.edu/jump (https://www.uah.edu/admissions/graduate/discover-uah/joint-undergraduate-masters-program/).

JUMP Requirements and Rules:

- Students must receive at least a B in each JUMP course for it to count towards a graduate degree.
- Students must maintain a minimum overall GPA throughout the JUMP program until graduation. GPA requirements vary by academic program.
- All coursework must be completed within six years of taking the first JUMP class.
- Once all undergraduate degree requirements have been met, students apply to their graduate program through a simplified application process.
- If a change is made to the initial JUMP application, both a JUMP change form and a change to the student's undergraduate Program of Study (POS) must be submitted for approval to the student's JUMP advisor.
- Students cannot hold a GTA, GRA, or graduate scholarship or fellowship until the undergraduate degree is completed.
- Students must begin their graduate program within one year of their undergraduate graduation.

Graduate Degree Completion:

Within the last term of undergraduate enrollment, JUMP students must submit the online application for graduate admission in order to continue in JUMP and register for graduate classes. Admission to the UAH Graduate School will be granted if students have maintained the minimum requirements of their JUMP academic program.

Students who do not maintain JUMP requirements will have to follow the normal graduate application process for their program. Previously completed graduate coursework through JUMP will be counted as if the student had been a non-degree-seeking graduate student. Students must apply to the UAH Graduate School and meet all the admissions requirements set by the academic department for new graduate applicants.

More information is available at http://uah.edu/jump (http://uah.edu/jump/)

Online Learning

The University of Alabama in Huntsville offers a number of academically challenging online and hybrid-online programs. Please review a listing of available programs here: http://www.uah.edu/online-learning (http://www.uah.edu/online-learning/).

Courses offered in the online and hybrid modalities will be clearly designated as such in the course listing for each semester.

State Authorization

The state of Alabama is a member of the SARA compact. The State Authorization Reciprocity Agreement is an agreement among member states, districts, and territories that establishes comparable national standards for interstate offering of postsecondary online education courses and programs. It is intended to make it easier for students to take online courses offered by postsecondary institutions based in another state. For more information, including a current list of states in the SARA compact, please visit http://www.nc-sara.org/. The University of Alabama in Huntsville is an approved SARA institution.

The University of Alabama in Huntsville seeks to offer degree programs and course offerings in every state, working through the National Council for State Authorization Reciprocity Agreement (NC-SARA) where applicable, or directly with states to ensure that required approvals are secured. The state

of Alabama is a member of NC-SARA and The University of Alabama in Huntsville is an approved NC-SARA institution. For more information about NC-SARA, please visit NC-SARA.

The University of Alabama in Huntsville offers degree programs and individual courses that may require approval for supervised practicum experience outside of the state of Alabama. Examples include clinical, practica, student teaching, or internships. This requirement applies both to online programs and to main campus programs if the supervised experience occurs outside of the state of Alabama. Prior to engaging in any supervised experience outside of the state of Alabama, please refer to https://www.uah.edu/academic-affairs/offices/oirea/state-authorizations (https://www.uah.edu/academic-affairs/offices/oirea/state-authorizations/) for detailed requirements.

Additionally, The University of Alabama in Huntsville offers degree programs that may lead to professional licensure, and licensure requirements vary from one profession to another and from state to state. If you are interested in obtaining professional licensure, please check with the appropriate licensing body in the state where you intend to practice. Additional information can be found at https://www.uah.edu/academic-affairs/offices/oirea/state-authorizations/professional-licensures. (https://www.uah.edu/academic-affairs/offices/oirea/state-authorizations/professional-licensures/)

For further information regarding SARA requirements on the UAH campus please see http://www.uah.edu/academic-affairs/offices/oira/state-authorizations (http://www.uah.edu/academic-affairs/offices/oira/state-authorizations/)

Topics include: Timeline for approval, International Residents, Territories and Provinces, Military Bases, Additional Resources, Professional Licensure, & Grievance Procedures

Study Abroad

The Office of Study Abroad, within the Office of International Services, serves as the coordinating office for study abroad opportunities at UAH.

Faculty-Led Courses

Each year, UAH offers a number of faculty-led study abroad courses typically ranging from two to four weeks in length and conferring three to six academic credit hours in the course(s) offered.

Summer, Semester, and Academic-Year Programs

UAH works with international partners and education abroad organizations to offer students summer, semester, or academic-year study abroad programs at sites in Africa, Asia, Australia, and Europe. Students can participate in these programs and earn academic credit toward their degrees at UAH. Programs are with affiliate partners or exchange agreement partners.

Internship, Research, and Service Abroad Opportunities

Students may consult with the Office of Study Abroad about interning, researching, and completing service projects abroad. Please note that many of these opportunities have specific application procedures and may be competitive in the selection process.

To learn more about specific countries and programs, please visit the Study Abroad programs page (https://www.uah.edu/study-abroad/programs/) for more information or by emailing studyabroad@uah.edu.

The Office of Study Abroad is located in the Student Services Building, Room 218.

Admissions

Graduate Admissions

The University of Alabama in Huntsville (UAH) welcomes inquiries and applications from interested persons who wish to further their education. The UAH Graduate School has more than 80 degree and certificate programs in Arts, Humanities & Social Sciences, Business, Education, Engineering, Nursing, and Science. The Graduate Admissions staff is available to assist prospective students in exploring graduate program offerings and in navigating the admissions process. In addition, program coordinators for each graduate program are available to engage with prospective students to discuss their enrollment plans and opportunities at UAH.

To find contact information for the program coordinator for your academic program of interest, please visit the graduate program listing page (https://www.uah.edu/admissions/graduate/discover-uah/graduate-programs/). General admissions application questions can be emailed to gradadmissions@uah.edu. Further information about graduate admission requirements and the application process is available on the graduate admissions website (https://www.uah.edu/admissions/graduate/).

Application Procedure

Application Process

To be considered for admission to a doctoral, master’s, or graduate certificate program, students must submit a completed graduate application for admission, pay a nonrefundable application fee, and submit transcripts from previously attended academic institutions. Depending on the academic

program, students may also be required to submit additional supplemental items, which may include test scores, resume/CV, recommendation letters, personal statement, writing sample, and/or proof of a professional license. These required items vary by the academic program. Students can view these requirements within the application portal. For more specific information about graduate admission requirements and the application process, visit uah.edu/grad-apply (https://www.uah.edu/admissions/graduate/apply-for-admission/).

Prospective students should apply well in advance of the priority application deadline to ensure adequate time to submit all required documents and receive a departmental decision. Students who fail to enroll in classes within one year of their date of admission must submit a new application.

Concurrent Degrees

An applicant for an additional graduate program (including a different degree in the same discipline, *e.g.,* adding a master's program to a Ph.D. program or adding a certificate) who has been previously admitted to the Graduate School must apply for admission to the new program by submitting a new graduate application for admission. The student must consult with the chairs of both departments/programs in which the two-degree programs are to be pursued.

Disciplinary History Review

UAH is committed to ensuring a safe learning environment for all students, faculty, and staff. As a part of this commitment, students who indicate on their admissions application that they have pending criminal charges or have been convicted of a crime may be required to disclose information as a required step in the application process. In addition, students who have ever been expelled or dismissed from an educational institution for disciplinary reasons may also be required to disclose information as a required step in the application process. A previous conviction, pending criminal charges, or other expulsion or dismissal does not automatically bar admission to the University but does require review and evaluation.

Ownership of Submitted Documents

All credentials and documents submitted become the property of The University of Alabama in Huntsville. The originals or copies of the originals will not be returned to the applicant or forwarded to another institution, agency, or person.

Fraudulent Records

If it is found that an applicant has made a false or fraudulent statement or an omission on the application for admission, the residency statement, or any other accompanying documents or statements, the applicant may be denied admission. If the student is already enrolled when the fraud is discovered, the case will be adjudicated using the procedures specified for violations of the Student Code of Conduct and may result in the student's admission being rescinded and the student being dismissed from the University.

Conditional Admission

The Graduate School may conditionally admit applicants who do not satisfy all of the requirements for unconditional admission (https://catalog.uah.edu/grad/admissions/graduate-admission-requirements/), but who do show reasonable potential for doing graduate work. Conditional admission requires the approval of the chair of the department in which the applicant plans to pursue an advanced degree.

If a conditionally admitted student has an overall grade average of B (3.000) or better for all graduate work attempted up to and including the semester in which the student completes 12 semester hours of graduate work at UAH, then the student assumes the status of an unconditionally admitted student. Otherwise, the student is dismissed from the Graduate School. Under exceptional cases, a student may be readmitted upon a justified recommendation of the faculty in the student's major department and approval of the Graduate Dean.

Graduate Admission Requirements

Unconditional Admission

To qualify for unconditional admission to the UAH Graduate School, applicants must hold a bachelor's degree, or equivalent, from an approved institution and have a minimum grade-point average of a 3.000 on their undergraduate record*. Although there is no university-level admission test score requirement (e.g., GRE, GMAT or MAT), individual academic programs may require a minimum admissions test score for unconditional admission. View more information about individual program test score requirements on the Graduate Admissions Test Score Requirements webpage (https://www.uah.edu/admissions/graduate/apply-for-admission/test-score-requirements/).

Meeting the above unconditional admission requirements does not automatically ensure a student acceptance to an academic program. Applicants should consult their academic program for specific additional admission requirements. See college/departmental sections for specific admissions information.

International applicants should also visit the International Student catalog page (p. 13) to review additional requirements.

**Individual academic programs may have higher GPA requirements for unconditional admission.*

Graduate Assistantships

Graduate assistantships are offered to encourage graduate-degree work, promote teaching, and promote research. Graduate assistants have a graduate degree as their primary goal, and the assistantships are part of their graduate education. Assistantships are available through various departments of instruction, under the auspices of the Graduate School. Any student qualified for admission to the Graduate School is eligible to apply for a graduate assistantship.

A student eligible for an assistantship may be appointed as a Graduate Teaching Assistant (GTA), Graduate Research Assistant (GRA), or Graduate Administrative Assistant (GAA). Full assistantships usually require 20 hours per week service to the University, but may require more or fewer hours per week in exceptional cases. All full-time graduate assistants must be registered for a minimum of nine semester hours (six semester hours in the summer term) during any semester in which an appointment is held. Exceptions require permission of the Graduate Dean. Normally, all courses for which the student is registered shall be graduate credit courses. Exceptions must be approved by the Department Chair and Graduate Dean.

All assistantship appointments are subject to the continuing availability of funds. Appointments are made by the department only when resources to support them are assured, but students are cautioned that a variety of circumstances could cause positions to be terminated prior to the end of the appointment period. All assistantships are awarded contingent upon satisfactory progress toward a graduate degree. Assistantship support may continue through one additional semester after the semester in which degree requirements are completed.

Benefits

Tuition and Fees

A graduate assistant who holds a full assistantship (20 hours per week) appointment will receive a tuition waiver for 9 to 12 hours per semester (six hours in the summer term) and fees up to nine credit hours. Tuition and fees for students who hold less than a full assistantship appointment are prorated accordingly.

Stipend

Assistantship stipends vary in amount by type, program, and student academic progress. Students receive an offer letter indicating the amount of the stipend. Further information may be obtained in the department or in the Graduate School.

Graduate Teaching Assistantships

GTAs share the faculty's responsibility for teaching. The purpose of this assistantship is two-fold: one is to support the departmental teaching program, and the other is to aid the student's professional development. GTAs must have completed at least 18 semester hours of graduate coursework in their discipline to qualify as the instructor of record in any class.

GTAs may also qualify for other duties assigned, which do not require 18 semester hours of graduate coursework. These duties may include working as a laboratory instructor, tutor, grader, or other activities related to the educational mission of the department. Only students in good academic standing are eligible for and may be awarded a teaching assistantship. The GTA's teaching load will necessarily vary from one department to another, and the load should be proportional to the normal full-time teaching load carried by other faculty members in the department.

If a student holding an assistantship withdraws from courses during the semester such that their course load is below the minimum required hours, that student can be required to reimburse the University for tuition and health insurance prorated on the remaining course load. Students holding an assistantship that do not continue to make satisfactory progress toward their degree may have their assistantship revoked.

Graduate Research Assistantships

A GRA performs research under the supervision of a faculty member. At times, a research project to which the research assistant is appointed may eventually lead to a thesis or dissertation topic; however, a research supervisor cannot guarantee that a particular project will provide suitable material for a thesis or dissertation. All assistantship appointments are subject to the continuing availability of funds. Appointments are made only when resources to support them are assured, but a financial emergency in the University could cause positions, including those of graduate assistants, to be terminated prior to the end of the appointment period. Assistantship support normally will not continue past the end of the semester in which the assistant expects to complete degree requirements. Some contracts or grants may specify U.S. citizenship as a prerequisite for appointment.

Graduate Administrative Assistants

A GAA performs administrative duties under the supervision of a faculty/staff member. As a condition of an administrative assistantship appointment, a 20-hour per week graduate assistant must be registered for at least nine semester hours of graduate credit courses during any semester (Fall or Spring), and for at least six hours during the summer term. Minimum course loads for appointments of lesser work hours per week are prorated accordingly.

Further Information

If a student holding an assistantship withdraws from courses during the semester such that the course load is less than the minimum required hours, that student can be required to reimburse the university for tuition prorated on the remaining course load. Graduate assistants who do not make satisfactory progress towards their degrees may have their assistantships revoked.

International Students

International students must be registered for a minimum of nine graduate credit hours their first semester. This requirement also applies if the student begins their first semester during the summer session. English proficiency is a prerequisite for classroom or laboratory instruction for any non-native English speakers wishing to obtain an assistantship. Please visit the International (https://catalog.uah.edu/grad/admissions/additional-admission-requirements-international-students/) Student section of the catalog (https://catalog.uah.edu/grad/admissions/additional-admission-requirements-international-students/) for more information regarding language requirements.

Graduate Fellowships

Several fellowship award programs exist, which can provide graduate student stipends, tuition allowances, and funds for other purposes. Examples of such fellowships are the ACHE Alabama EPSCoR Fellowship, NASA FINESST, NASA Graduate Student Research Program (GSRP), NASA Space Technology Graduate Research (NSTGR), National Science Foundation Fellowships, Alabama Space Grant Consortium, and the National GEM Consortium Fellowship Program. Announcements of these fellowships are typically made annually via brochures, departmental announcements, sponsored websites, and email distribution. Interested students are encouraged to be proactive in requesting fellowship information from affiliate offices.

Endowed fellowships/scholarships for graduate students exist in several departments. Please contact your department/graduate program director or the Financial Aid office to ask about specific graduate-level awards.

International Students

Additional Admission Requirements for International Students

Language Proficiency for Admission

All applicants whose native language is not English must demonstrate English language proficiency necessary to succeed in degree programs at UAH as indicated by completing at least one of the following standardized English proficiency exams with the respective minimum score listed below:

TOEFL iBT: all sub-scores must be greater than or equal to 18

TOEFL Essentials: all sub-scores must be greater than or equal to 8

Pearson's Test of English: 54

IELTS: 6.0

Duolingo: 105

*College and/or departments may require a higher minimum language score for admission.

UAH reserves the right to verify and double-check the applicant’s English proficiency when deemed necessary.

Language proficiency is only one factor in admission decisions. To confirm the full admission requirements for specific degree programs, please refer to the application for your particular degree. An applicant who has earned a bachelor's degree, or higher, from an accredited U.S. institution will be exempted from providing standardized test results for English language proficiency.

Nonnative English-speaking Graduate Teaching Assistants

To be considered for positions as teaching assistants or graduate assistants, students must demonstrate at least one of the following minimum standardized English language proficiency test scores:
TOEFL iBT: no sub-score below 22
TOEFL Essentials: no sub-score below 9.5
IELTS: no sub-score below 6.5

Supplemental Application Documents

Documents required for an application will vary depending on the program selected, and will be identified within the application portal. Unofficial transcripts may be considered during the admission process, but official transcripts must be received before a student can register for classes. International students will need to submit proof of financial support before immigration form I-20 can be issued.

Please review the catalog admissions page (p. 10) for additional information regarding required documents.

Priority admittance will be given to international students who have applied and submitted all required documents by:

Spring: October 1
Summer: February 1
Fall: May 1

Non-Degree Admission

Students interested in earning graduate credit but who are not applicants for a graduate degree program at UAH may be admitted as non-degree graduate students. Admission in this category requires proof of a bachelor's degree from an accredited institution and department and/or college approval.

- **This category is not available to students with non-immigrant visa status.**
- **Non-degree students are not eligible for Federal financial aid**.

All courses taken while in non-degree status require the approval of the department chair. Students must maintain the same grade point average requirements expected of conditionally admitted graduate students. Graduate courses numbered 500 and above may be taken while in this category provided that all prerequisites have been met.

Individuals admitted as graduate non-degree students may decide to complete an application for admission to a graduate degree or certificate program. If admitted, credit earned as a non-degree graduate student may be applied toward a graduate degree or certificate program subject to the following conditions and limitations:

- All grades earned in 500-level courses or above during non-degree status and applied to a graduate degree or certificate program must have been B or higher;
- No more than 12 graduate semester hours for courses taken as a non-degree student may be applied to a degree program.
- Courses used to satisfy degree or certificate requirements are subject to approval by the academic department, and grades for those courses become part of the student's graduate program GPA.

To apply to as a non-degree student, please visit the Graduate Non-Degree Application webpage. (https://www.uah.edu/admissions/graduate/apply-for-admission/non-degree-students/)

Provisional Admission

A student (other than an individual with non-immigrant visa status) whose application to the Graduate School is not complete or is pending approval, may, with a departmental recommendation, be admitted to UAH on a provisional basis. Students admitted in this category may register for graduate-level courses for one semester with approval from the department(s), provided that all prerequisites for those courses have been met. Students may be admitted provisionally for one semester only. Within that period they must complete their application materials in time to be considered for regular admission prior to the start of the next semester, usually by the 10th week of the semester. Students who do not complete the application process within the allowed period, or are subsequently not admitted to the graduate program, will not be allowed to take additional graduate classes as a degree-seeking student.

Once a student gains regular admission to the Graduate School, all policies regarding conditional or unconditional admission become effective in the provisionally admitted semester. Graduate credit for courses at the 500-level or above taken as a provisional student may, with the approval of the degree department, be applied toward a graduate degree program only if the grades earned in such courses were B or higher.

- **Students admitted provisionally are not eligible for Federal financial aid.**
- **This category is not available to students with non-immigrant visa status.**

Seniors Taking Graduate Courses

UAH seniors may take up to nine semester hours of courses (500 or 600 level) for graduate credit while completing requirements for the baccalaureate if they meet the following qualifications:

1. An approved degree application is on file;
2. Overall GPA, or GPA for the last 40 semester hours, is at least 3.500;
3. Fewer than 13 semester hours remain for degree completion;

4. A total course load of no more than 12 hours per semester;
5. Permission of the instructor.

Students initiate the request process by completing the Request for Approval of Graduate Credit by UAH Senior, (Form 16) (https://www.uah.edu/registrar/forms/general/), which is available on the Registrar's website, and requires the approval of the Department Chair and Graduate Dean. Graduate tuition and fee rates apply to courses taken in this category. A student may not use courses taken for graduate credit as part of the baccalaureate degree under this option. Please note, this is not the same as the Joint Undergraduate Master's Program (JUMP).

JUMP

Seniors may wish to enroll in JUMP, which allows undergraduate students to double-count their undergraduate courses for their graduate (M.A. or M.S.) degree. For more information, please visit: http://www.uah.edu/jump (http://www.uah.edu/jump/).

Tuition Scholarships

A limited number of tuition scholarships may be awarded to students without assistantship appointments who have unconditional admission status and are in good academic standing. Such scholarships may be awarded for up to nine graduate semester hours per semester (six semester hours in the summer term). Students receiving tuition scholarships are bound by the same rules as graduate assistants with respect to course withdrawal, contingency of the award on satisfactory performance toward the graduate degree, general eligibility, and special department requirements.

The departmental faculty select the proposed awardees from qualified applicants. An appointment letter, similar to a graduate assistantship letter but without assigned duties, is prepared by the Department Chair and sent through the College Dean to the Graduate Dean for approval at least one month prior to the start of the semester in which the scholarship is proposed.

Additional scholarships may be available. Please visit the UAH Financial Aid website to learn more: http://www.uah.edu/admissions/graduate/financial-aid (http://www.uah.edu/admissions/graduate/financial-aid/)

Colleges and Departments

College of Arts, Humanities, and Social Sciences

Morton Hall 116
Telephone: 256.824.6200
Email: dean-ahs@uah.edu

Degrees

Master of Arts
Doctor of Philosophy

Dean: Sean Lane, Ph.D.

Mission

The arts, humanities and social sciences allow people to explore and deeply understand the human condition. Its disciplines have never been more critical to helping solve challenging and complex societal problems. The College of Arts, Humanities, and Social Sciences (CAHS) seeks to advance knowledge in research and creative activity and to help make the world better and more inclusive. The College prepares students to be inquisitive, reflective, life-long learners; to solve problems collaboratively; to meaningfully engage with a rich, diverse world; and to be leaders in their careers and as members of their communities.

CAHS is committed to excellence in teaching, research, and service in the following disciplines:

- Fine arts,
- Humanities,
- Social and behavioral sciences, and
- Teacher education.

The College strives to provide superior liberal arts education characterized by close interaction between teachers and learners. Its goals are to impart to each student the following:

- a spirit of intellectual curiosity,
- critical thinking skills,
- abilities in writing and oral communication,
- aesthetic awareness and creativity,
- familiarity with human history and behavior,
- a knowledge of languages and cultures, and
- an understanding of the bases of ethical behavior and the duties of citizenship.

Believing in the centrality of liberal learning to the mission of a university, the College is committed to maintaining a diverse community of teacher-scholars of the highest quality and to providing an environment that encourages personal and professional growth. It considers teaching and research mutually enriching activities and strives to make its knowledge and expertise available to professional programs on campus and to the educational needs of society. Through its graduates and programs, the College contributes to the cultural, intellectual, and economic growth of the state and nation.

Facilities

The College of Arts, Humanities, and Social Sciences utilizes the facilities and resources of the entire university. However, the College is housed primarily in three buildings, namely Morton Hall, Wilson Hall, and Roberts Hall. Critical to study of the liberal arts is the Salmon Library. Supporting facilities include the instructional computer laboratories on the second floor of Salmon Library, art galleries in several buildings, and Union Grove Gallery and Meeting Hall, an historic church moved to campus in 1974 and currently used as an art gallery and a meeting place for students and faculty.

The Humanities Center

The Humanities Center was established in 1991 with the aid of an award from the National Endowment for the Humanities (NEH). The NEH award was a challenge grant that was subsequently matched by funds from other sources, including public, corporate, and private giving, to create the three endowments that support the Center's activities in five areas:

1. hiring of eminent and visiting scholars,
2. library enhancement grants,
3. public programming grants,
4. faculty travel, and
5. faculty research.

Degrees and Programs

Graduate study in the College of Arts, Humanities, and Social Sciences brings together faculty and advanced students to share the excitement of creative learning. All degree candidates plan a Program of Study with faculty members who share the student's intellectual interests. Students design, in consultation with a faculty advisor, a graduate program fitted to their particular interests and needs.

The College of Arts, Humanities, and Social Sciences offers programs of study leading to the Master of Arts degree in

- English,
- History,
- Professional Communication,

- Psychology, and
- Public Affairs.

The College of Arts, Humanities, and Social Sciences offers programs of study leading to the Ph.D. degree in

- Applied Experimental Psychology.

Class A teacher certification is available with degree programs in English and History. Teacher certification may be achieved through either traditional (including the Strengthened Subject Matter Option or the Technology Option) or non-traditional "fifth year" approaches. Those students who have earned graduate degrees in appropriate disciplines may be eligible for certification-only programs.

Discipline Graduate Programs

Discipline	Degree	Focus
English	M.A.	Literature, Teacher Preparation, Teaching English to Speakers of Other Languages, Technical Communication
History	M.A.	American History, European History, Teacher Preparation
Professional Communication	M.A.	Preparation to work in communication intensive fields; Basic understanding of communication processes
Public Affairs	M.A.	Public Policy, Public Administration
Psychology	M.A.	Experimental, with concentration in Industrial/Organizational Psychology
Psychology	Ph.D.	Applied Experimental Psychology, with concentrations in Human Factors and Psychology and Law

Teacher Preparation Graduate Programs

Discpline	Degree	Focus	Teacher Certification	Traditional	Strengthened Subject Matter Option	Traditional w/ Technology	Nontraditional Fifth Year	Certification Only[1]
English	M.A.	English Language Arts	6-12	Yes	Yes	Yes	Yes	Yes
History	M.A.		6-12	Yes	Yes	Yes	Yes	Yes
Biology[2]	M.S.		6-12	Yes	Yes	Yes	Yes	Yes
Chemistry[2]	M.S.		6-12	Yes	Yes	Yes	Yes	Yes
Mathematics[2]	M.A.		6-12	Yes	Yes	Yes	Yes	Yes
Physics[2]	M.S.		6-12	Yes	Yes	Yes	Yes	Yes

1 For those who have already earned appropriate graduate degrees, but who seek teacher certification.
2 Offered within the College of Science.

Master's Programs in Arts, Humanities, and Social Sciences

Certificates in Arts, Humanities, and Social Sciences

English Graduate Certificates

- Technical Communication Certificate (p. 23)
- User Experience Certificate (p. 24)

History Graduate Certificates

- Comparative Cultures and Conflicts Certificate (https://catalog.uah.edu/grad/colleges-departments/arts-humanities-social-sciences/history-ma/comparative-cultures-conflicts/)

Political Science Graduate Certificates

- International Security Policy (ISP) Certificate (p. 26)

English

Students wishing to pursue graduate work in English have a number of choices. The English M.A. Program includes both a thesis (https://catalog.uah.edu/grad/colleges-departments/arts-humanities-social-sciences/english-ma/thesis/) and a non-thesis (https://catalog.uah.edu/grad/colleges-departments/arts-humanities-social-sciences/english-ma/capstone/) option. Additionally, we offer several certificates that prepare graduates to pursue professional opportunities in technical writing (http://catalog.uah.edu/grad/colleges-departments/arts-humanities-social-sciences/english-ma/tech-writing/) or user experience (https://catalog.uah.edu/grad/colleges-departments/arts-humanities-social-sciences/english-ma/ux-cert/), and teaching in English (https://catalog.uah.edu/grad/colleges-departments/arts-humanities-social-sciences/english-ma/english-ma-alternative-fifth-year-program-class-a-certification-english/). Students are encouraged to consult with the Director of Graduate Studies (ehgrad@uah.edu) to select the program that best meets their needs.

Specific requirements for each program are available under the Programs tab on this page.

Master of Arts in English:

- English, MA Thesis Option (p. 22)
- English, MA Capstone Project (p. 21)
- English, MA with Technical Communication Certificate (p. 22)
- English, MA Alternative Fifth Year Program for Class A Certification (p. 20)
- JUMP Program (http://catalog.uah.edu/undergrad/academic-information/jump/)

Graduate Certificates:

- Technical Communication Certificate (p. 23)
- User Experience Certificate (p. 24)

English, MA - Alternative Fifth Year Program for Class A Certification in English

The Alternative Fifth-Year Program for Class A Certification in English M.A. program is for students who have earned a bachelor's degree and have decided that they want to teach English in Alabama's public schools. At the end of this program, students will have both an M.A. in English and a recommendation for a Class A teaching certificate. Students will also have sufficient coursework in English to teach Advanced Placement courses or lower-division English courses at the university level. Students with undergraduate degrees in either English or Language Arts will most likely not need to take additional coursework before being admitted to the program. Other coursework may include undergraduate courses in speech, theatre, and/or journalism (at least two out of the three). Students can take the relevant coursework during their first semesters as an M.A. student prior to applying for the Education certification. The M.A. program itself consists of 24 credit hours in English, of which 18 hours must be in literature; 24 hours of graduate Education courses; a one-hour practicum in Education; and a three- to six-hour internship. Students will need to complete a capstone project for this program, as the course requirements do not allow room for a thesis. The program usually advises students to take the English component first, because in the event that students change their minds and decide against becoming certified, the English courses, unlike those in Education, will still lead toward an M. A. degree. The program generally requires five semesters to complete prior to the semester-long internship. Students should expect to work closely with both an advisor in the College of Education and the Director of English Graduate Studies (ehgrad@uah.edu) to be sure they are meeting all state-level requirements for teacher certification, as such requirements are subject to change.

Students will also need to meet the additional requirements listed below.

Basic Requirements:

- 27 hours of coursework for the thesis option (or nine courses) or 33 hours of coursework for the capstone option. At least one-third of the hours taken toward the degree should be at the 600 level.

- Students must complete all coursework toward the degree within 10 years of the first course taken. Courses taken between 6 and 10 years prior to the degree program completion date must be re-validated by departmental exams negotiated with the specific faculty member who has responsibility for that course; any graduate course more than 10 years old may not be used.
- Up to nine hours of graduate work in English may be transferred from other institutions with the approval of the Graduate Dean. At least nine hours in English courses numbered 500 or higher must be completed at UAH (exclusive of thesis hours).
- Full-time students will need to take a course load of nine hours per semester. While students are permitted to take up to 13 semester hours per term, they should consult with the Director of English Graduate Studies (ehgrad@uah.edu) about doing so.
- Students must maintain a 3.000 GPA in all courses taken at the graduate level. If in any semester students' cumulative GPAs fall below 3.000, they will be placed on probation.

Additional English courses required:

Code	Title	Semester Hours
600 level Literature Elective		3
600 level Literature Elective		3
600 level Literature Elective		3
600 level Literature Elective		3
500 or 600 Literature Elective		3
500 or 600 Literature Elective		3
EH 500	COMPOSITION STUDIES FOR TEACHERS	3
or EH 601	ACTION RESEARCH IN WRITING STUDIES	
ESL 510	INTRODUCTION TO LANGUAGE SYSTEMS	3
or ESL 520	INSTRUCTIONAL AND ACADEMIC LANGUAGE ACROSS CONTENT DOMAINS	

Required Education courses:

Code	Title	Semester Hours
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 521	SECONDARY ELA INSTRUCTION WRITING TO READ	3
ED 530	APPLIED MULTICULTURALISM	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 698	HIGH SCHOOL INTERNSHIP	6
Total Semester Hours		**30**

In addition to the requirements for any applicant to this program, the Alabama State Department of Education (ALSDE) has additional requirements. Because such requirements do shift regularly (and are outside UAH’s control), students are advised to confirm with ALSDE that they meet the current requirements. However, at this time, students admitted to any of the programs that include teacher certification must have a cumulative GPA of at least 2.500.

English, MA - Capstone Option

Basic Requirements:

- Thirty-three hours of coursework (11 courses). At least one-third of the hours taken toward the degree should be at the 600 level.
- All work toward the degree must be completed within 10 years of the first course taken. Courses taken between 6 and 10 years prior to the program completion date must be re-validated by departmental exams administered by the specific faculty member who has responsibility for that course; any graduate course more than 10 years old may not be counted.
- Up to nine hours of graduate work in English may be transferred from other institutions with the approval of the Director of English Graduate Studies. At least nine hours in English courses numbered 600 or above must be completed at UAH (exclusive of thesis hours).

- A full-time student must take a minimum of nine hours per semester. A student is permitted to take up to 13 semester hours per term, but should first consult with the Director of English Graduate Studies (ehgrad@uah.edu) about doing so.
- A student must maintain a 3.000 GPA in all courses taken at the graduate level. A student whose cumulative GPA falls below 3.000 will be placed on Academic Probation Status.

Capstone Requirements:

The Capstone project should be completed in a student's final semester of the M.A. program. The Capstone project typically consists of the expansion of a paper or major project originally completed in an M.A. course. The project is typically framed toward a professional goal (academic conference presentation or academic journal publication, work application portfolio, creative writing publication, *etc.*). A graduate student will choose a Capstone director and develop goals and a completion plan for the project. Capstone project department deadlines:

1. Selection of supervisor: December 1 (for Spring graduation); May 1 (for Fall graduation)
2. Submission of Non-Thesis Capstone Proposal: January 20 (for Spring graduation); August 20 (for Fall graduation). The proposal will be subject to revision at this point, but should be finalized as an acceptable plan NO LATER THAN two weeks after initial submission (to allow time for the work to be completed).
3. Submission of completed Non-Thesis Capstone Project: March 15 (for Spring graduation); October 20 (for Fall graduation)

The Capstone project concludes with an interview about the project's process by the chair of the Capstone and a second, appointed department faculty member. See the Graduate School information page for final Capstone (non-thesis) project deadlines (https://www.uah.edu/graduate/resources/thesis-dissertation-and-dnp-project/dates-deadlines/). For more information contact the Director of English Graduate Studies (ehgrad@uah.edu). **Please be advised** that since most faculty members are on nine-month contracts and thus not employed by the university during the summer, it is usually not possible to schedule thesis defenses between mid-May and mid-August.

English, MA - Thesis Option

Basic Requirements:

- Thirty-three hours total, including 27 hours of coursework (or nine courses) and six hours (or two courses) of thesis credit. At least one-third of the hours taken toward the degree should be at the 600 level.
- All work toward the degree must be completed within 10 years of the first course taken. Courses taken between 6 and 10 years prior to the program completion date must be re-validated by departmental exams administered by the specific faculty member who has responsibility for that course; any graduate course more than 10 years old may not be used.
- Up to nine hours of graduate work in English may be transferred from other institutions with the approval of the Director of English Graduate Studies. At least nine hours in English courses numbered 500 or above must be completed at UAH (exclusive of thesis hours).
- A full-time student must take a minimum of nine hours per semester. A student is permitted to take up to 13 hours per semester after consulting with the Director of English Graduate Studies (ehgrad@uah.edu) about doing so.
- A student must maintain a 3.000 GPA in all courses taken at the graduate level. A student whose cumulative GPA falls below 3.000 shall be placed on Academic Probation Status.

Thesis Requirements:

This program leads to an M.A. in English, and includes the thesis option. A student takes 27 hours of coursework (nine courses) in English, plus a minimum of six hours of thesis credit (two courses), once a thesis advisor and a topic have been selected. If not finished with the thesis at the end of six hours, additional thesis hours may be taken subject to the rules about time-to-completion of the degree. Thesis hours must be taken during the semester in which a student defends and completes the thesis, and during any other semester in which the advisor's assistance is required. For more on the thesis, contact the Director of English Graduate Studies (ehgrad@uah.edu).

English, MA with Technical Communication Certificate

Technical Communication Certificate Requirements:

This program leads to an M.A. in English with a Graduate Certificate in Technical Communication. In addition to the basic requirements listed below, this program requires coursework in technical writing and editing as well as coursework in a technical or allied field. Those courses will be determined in consultation with the Director of Technical Writing (rw0019@uah.edu). The program requires 11 courses (33 hours) for completion. Students will need to complete either a Capstone Project or a Thesis. The other course requirements are as follows:

Code	Title	Semester Hours
EH 501	THEORY AND PRACTICE IN TECHNICAL COMMUNICATION	3
EH 603	EDITING FOR PUBLICATION	3
EH Technical Writing Elective, 600 level		3
EH Technical Writing Elective		3
Allied Field Course		3
Allied Field Course		3
Literature Electives		18
Total Semester Hours		**36**

Basic Requirements:

- Twenty-seven hours of coursework **for the thesis option** (or 9 courses) or 33 hours of coursework **for the capstone option**. At least one-third of the hours taken toward your degree should be at the 600 level.
- All work toward the degree must be completed within 10 years of the first course taken. Courses taken between 6 and 10 years prior to the program completion date must be re-validated by departmental exams administered by the specific faculty member who has responsibility for that course; any graduate course more than 10 years old may not be used.
- Up to nine hours of graduate work in English may be transferred from other institutions with the approval of the Director of English Graduate Studies. At least nine hours in English courses numbered 500 or above must be completed at UAH (exclusive of thesis hours).
- A full-time student must take a minimum of nine hours per semester. A student is permitted to take up to 13 hours per semester after consulting with the Director of English Graduate Studies (ehgrad@uah.edu) about doing so.
- A student must maintain a 3.000 GPA in all courses taken at the graduate level. A student whose cumulative GPA falls below 3.000 shall be placed on Academic Probation Status.

Technical Communication Certificate

The English Department offers an 18-credit-hour Graduate Certificate in Technical Communication. This certificate prepares students for careers in technical communication, technical editing, proposal writing, and user experience. In preparation for future employment, certificate students gain exposure to real-world documents and writing opportunities, both in class and through optional internships. The program routinely offers special studies courses in topics including Proposal Writing, Document Design, and Writing about Science and Technology. Students also use current technical communication software.

The Graduate Certificate requires EH 501 and EH 603 as well as two English electives (including EH 542, EH 552, EH 554, EH 601, EH 602, EH 649, and EH 662). In addition, students take two related graduate courses outside of English in an allied field selected in consultation with the Director of Business and Technical Writing (rw0019@uah.edu). Graduate Certificate in Technical Communication students enroll in the following Program of Study:

Code	Title	Semester Hours
EH 501	THEORY AND PRACTICE IN TECHNICAL COMMUNICATION	3
EH 603	EDITING FOR PUBLICATION	3
EH Technical Writing Elective		3
EH Technical Writing Elective 600 level		3
Allied Field Course		3
Allied Field Course		3
Total Semester Hours		**18**

Students who wish to earn the Graduate Certificate in Technical Communication must be admitted to the Graduate School (https://www.uah.edu/admissions/graduate/) but may pursue the certificate independent of a master's degree program. These courses may also count toward a master's degree in English if the student meets admission requirements for the M.A.

No more than six credit hours taken at another institution may be applied to the certificate, and certificate courses taken at UAH must include EH 501 and EH 603.

For further information about UAH programs in technical communication, contact Dr. Ryan Weber, Director of Business and Technical Writing, at rw0019@uah.edu.

User Experience Certificate

The University of Alabama in Huntsville offers an interdisciplinary 18-hour Graduate Certificate in User Experience, hosted by the College of Arts, Humanities, and Social Sciences. This certificate prepares students for careers in user experience (UX), which involves understanding users and designing better technologies, products, and services to meet users' needs. UX professionals conduct research, design prototypes, test products, and organize information, all to ensure that users' needs are met. This certificate provides students both foundational knowledge in UX and the opportunity to take electives that contribute to user experience knowledge and practice.

The Graduate Certificate in User Experience requires a total of six courses, including four core courses: CM 542 / EH 542: Usability Studies, CM 552 / EH 552: User-Centered Design, CM 662 / EH 662: Information Architecture, and CM 670: Advanced Communication Methods. Students may take these core courses in any order. Certificate students also take six hours of electives in fields such as communication arts, English, psychology, marketing, management, and computer science. Students choose electives in consultation with the Director of the User Experience Programs; in some cases, prerequisites may apply. Students can also complete an internship in UX as part of their certificate. Graduate students in the Graduate Certificate in User Experience enroll in the following Program of Study:

Code	Title	Semester Hours
Core Courses		
CM 670	ADVANCED COMMUNICATION METHODS	3
EH 542	USABILITY STUDIES	3
or CM 542	USABILITY STUDIES	
EH 552	USER-CENTERED DESIGN	3
or CM 552	USER-CENTERED DESIGN	
EH 662	INFORMATION ARCHITECTURE	3
or CM 662	INFORMATION ARCHITECTURE	
Electives		**6**
Approved UX Electives		
Total Semester Hours		**18**

Students who wish to earn the Graduate Certificate in User Experience must be admitted to the Graduate School. No more than six credit hours taken at another institution may be applied to the certificate. For further information about the Graduate Certificate in User Experience, please contact Dr. Ryan Weber, Director of User Experience Programs, at rw0019@uah.edu.

History, MA

In addition to the requirements of UAH's graduate school, the History Department requires the following for the Master of Arts degree:

Plan A: Thesis with Language

1. 30 semester hours total.
2. HY 605 is required.
3. At least nine additional semester hours in courses numbered 600 or above (excluding thesis semester hours at UAH). At least 50 percent of the semester hours for a graduate degree (excluding thesis semester hours) in courses numbered 600 or above.
4. At least twelve additional semester hours in courses numbered 500 or above (excluding thesis semester hours at UAH).
5. Within the 24 non-thesis semester hours, 18 semester hours of graduate work in history.
   a. Three semesters hours in US history, three semester hours in Europe (ancient/modern), and three semester hours in world (Asia, Latin America, Middle East, or world/comparative) are required.
   b. Twelve semester hours may be transfer credit approved by the departmental graduate committee.
   c. Six semester hours of elective graduate courses in a related subject approved by the graduate committee.
6. Master's thesis carrying a minimum of six semester hours credit; In order to write a thesis, the student must have a 3.750 GPA in the first 12 semester hours taken, complete the Letter of Intent (https://drive.google.com/file/d/1n5KmtjAaM-YiJ_TnsCaHn_aNDaoooANh/view/?usp=sharing), and have that letter approved and signed.
7. Reading proficiency in French, German, Latin, Russian, or Spanish.
8. Successful oral defense of the student's thesis required.

Plan B: Thesis without Language

Same as above, excluding language requirement.

Plan C: Non-Thesis

1. 33 semester hours total.
2. HY 605 is required.
3. Fifteen additional semester hours in courses 600 or above. At least 50 percent of the semester hours for a graduate degree (excluding thesis semester hours) in courses numbered 600 or above.
4. At least 15 additional semester hours in courses numbered 500 or above (excluding thesis semester hours at UAH).
5. Within 33 program semester hours, a student must take
    a. Three semesters hours in U.S. history, three semester hours in European history (ancient/modern), and three semester hours in world history (Asia, Latin America, Middle East, or world/comparative) are required.
    b. Twelve semester hours in history may be transfer credit approved by the departmental graduate committee.
    c. Six semester hours of elective graduate courses a related subject approved by the graduate committee.
6. Oral and written comprehensive examination covering coursework. Students must demonstrate competency in at least two fields of history or complete HY698 (https://catalog.uah.edu/grad/course-descriptions/hy/) and do an oral comprehensive exam covering their research and courses.

The requirements for the Master of Arts degree for those students seeking Class A certification are the same as above with the following exceptions:

Class A Teacher Certification in History (non-thesis)

1.
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33 semester hours total;
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2. Nine semester hours in courses 600 or above in Education;
3. HY 605 is required;
4. Six additional semester hours in courses 600 or above are required. At least 50 percent of the semester hours for a graduate degree (excluding thesis semester hours) in courses numbered 600 or above;
5. At least 15 additional semester hours in history courses numbered 500 or above (excluding thesis semester hours at UAH);
6. Within the 24 semester hours in history, a student must take
    a. Three semesters hours in U.S. history, three semester hours in European history (ancient/modern), and three semester hours in world history (Asia, Latin America, Middle East, or world/comparative) are required.
    b. Twelve semester hours in history may be transfer credit approved by the departmental graduate committee.
    c. Six semester hours of elective graduate courses a related subject approved by the graduate committee.
7. Oral and written comprehensive examination covering coursework. Students must demonstrate competency in at least two fields of history.
8. The College of Education will coordinate and direct any supplementary requirements.

The History Department does not recommend undertaking an MA thesis in History and teacher certification. If a student wishes to pursue this option, they should consult with the History Department Chair.

Graduate Certificates

- Comparative Cultures and Conflicts (p. 25)

Comparative Cultures and Conflicts Certificate

The Comparative Cultures and Conflicts (CCC) certificate program offers post-baccalaureate students a Program of Study that provides global context for their work in civilian and military sectors. The program contextualizes the cultural, diplomatic, military, and economic variables that influence world societies and investigates how these societies interact with the United States (U.S.) and the global community as a whole.

CCC STUDENT LEARNING OUTCOMES

Upon completion of the certificate, students will be able to:

1) analyze contemporary global patterns to show how various regions and cultures develop over time,

2) explain the historical causes and contexts of contemporary conflicts, both within and among states,

3) discuss the historical context of U.S. relations and interactions with the world,

4) compare the ways nations, groups, and individuals experience conflict,

5) practice historical thinking as central to engaged citizenship and leadership, and

6) communicate historical knowledge and interpretation coherently in writing and in oral presentations.

CCC REQUIREMENTS

Course Requirements: To complete the CCC program, students must complete 15 credit hours selected from the following History classes:

Code	Title	Semester Hours
Courses		
HY 538	MODERN AMERICA	3
HY 539	RECENT AMERICAN HISTORY	3
HY 540	FOREIGN REL U.S. SINCE 1920	3
HY 545	COMPTVE MILITARY PLCY & STRAT	3
HY 572	US MILITARY HISTORY SINCE 1920	3
HY 573	US-LATIN AMERICAN RELATIONS	3
HY 575	SECTARIANISM ISLAMIC WORLD	3
HY 576	BEING YOUNG MODERN MIDDLE EAST	3
HY 585	NAZI GERMANY AND THE HOLOCAUST	3
HY 586	COMMUNISM &LEGACY IN RUS/E-EUR	3
HY 620	STUDIES 20TH CENT AM HY	3
HY 645	READINGS AMERICAN MILITARY HY	3
HY 690	STUDIES IN MODERN EUROPE	3
HY 695	STUDIES IN WORLD HISTORY	3
3 of the 15 semester hours may be from Political Science, selected from the following:		
PSC 540	REGIONAL STUDIES	3
PSC 562	DECISION-MAKING IN FOREIGN & SECURITY POLICY	3
PSC 564	AMERICAN FOREIGN POLICY	3
PSC 566	NATIONAL SECURITY STRATEGY & POLICY	3
PSC 570	ISSUES IN SECURITY POLICY	3

Portfolio Requirements: In the final semester of study, certificate candidates will prepare a Capstone Portfolio and Presentation for the Comparative Conflicts and Cultures Steering Committee, which consists of the Department Chair and three additional participating faculty members. The committee will assess the portfolio and presentation. This portfolio will feature three papers or projects prepared for three different classes completed as part of the certificate program, as well as a cover letter which specifically discusses how the papers included within the portfolio address the first five Student Learning Outcomes (SLOs; see above). It is not expected that each paper address all SLOs, but the portfolio as a whole must display the student's mastery of each SLO. Students will complete a Capstone Presentation of approximately 20 minutes in length, which will discuss the papers within the portfolio and the cover letter. Following the presentation, the Comparative and Cultures Steering Committee will ask the student questions about the student's broader experience within the program.

Political Science - Public Affairs and Policy, MA

The MA program in Public Affairs & Policy serves the needs of students who are employed in public or private sector organizations in which the principles and practices of public policy formation, implementation, and evaluation, as well as the political dynamics that shape domestic or international policies, are relevant. The program also serves the needs of students who have recently completed an undergraduate program and wish to enhance their academic experience or further their educational objectives.

The Master of Arts in Public Affairs and Policy requires 33 semester hours of approved graduate coursework from the following courses.

Code	Title	Semester Hours
Foundation Courses [1]		**9**
PSC 600	THE AMERICAN POLITY	
PSC 601	THE PUBLIC POLICY PROCESS	
PSC 635	PROGRAM EVALUATION & METHODS	
Political Science Electives		**21**
Select 18 semester-hours from the following:		
PSC 520	FEDERALISM & INTERGOVERMENTAL RELATIONS	
PSC 540	REGIONAL STUDIES	
PSC 551	LAW, COURTS & PUBLIC POLICY	

PSC 561	ECONOMIC DEVELOPMENT IN THE SOUTHERN HEMISPHERE	
PSC 562	DECISION-MAKING IN FOREIGN & SECURITY POLICY	
PSC 564	AMERICAN FOREIGN POLICY	
PSC 566	NATIONAL SECURITY STRATEGY & POLICY	
PSC 570	ISSUES IN SECURITY POLICY	
PSC 580	SPECIAL TOPICS IN POLITICAL SCIENCE	
PSC 610	PUBLIC MANAGEMENT PROFESSIONS	
PSC 611	PUBLIC PERSONNEL ADMINISTRATION	
PSC 612	BUDGETARY PROCESS	
PSC 615	SPECIAL TOPICS IN PUBLIC AFFAIRS	
PSC 630	PUBLIC VALUES & PUBLIC POLICY	
PSC 695	INTERNSHIP IN GOVERNMENT	
PSC 698	DIRECTED READINGS & RESEARCH	
PSC 699	MASTER'S THESIS	
Capstone Course [2]		**3**
PSC 690	CAPSTONE	
Other Options [3]		
Total Semester Hours		**33**

1 Although these courses are required, they are not strictly prerequisites for other courses in the program. However, it is advised that students complete them as early in their program as practical.
2 The Capstone course is required and should be taken during the last year of the program.
3 Students may take or transfer a maximum of nine hours of coursework from outside of the department, including from other universities. Students must consult with the department chair to determine the appropriate coursework from other departments.

International Security Policy (ISP) Certificate

The International Security Policy Certificate program provides students who are working, seeking to work, or interested in the field of International Security Policy with a shorter graduate program experience. The ISP Certificate program focuses on the political forces in the international environment that contribute to how policymakers define their national interests and form policies to strengthen their national security. Students complete the program with an enhanced understanding of the dynamics of U.S. national security policymaking, including the political actors and institutions that make such policies.

Prerequisites for the Certificate:

- If a student does not have at least three courses in Political Science as an undergraduate (including American Government), prior to taking the required coursework they must take PSC 600.

The ISP Certificate is awarded upon the completion of 12-15 semester-hours of graduate coursework from the following courses:

Code	Title	Semester Hours
Required Courses:		
PSC 540	REGIONAL STUDIES	3
PSC 562	DECISION-MAKING IN FOREIGN & SECURITY POLICY	3
PSC 566	NATIONAL SECURITY STRATEGY & POLICY (Electives (Choose one):)	3
or PSC 564	AMERICAN FOREIGN POLICY	
Electives (Choose one):		
PSC 564	AMERICAN FOREIGN POLICY	3
PSC 566	NATIONAL SECURITY STRATEGY & POLICY	3
PSC 570	ISSUES IN SECURITY POLICY	3
PSC 601	THE PUBLIC POLICY PROCESS	3

Courses completed in the ISP Certificate Program may also be applied to the M.A. program in Public Affairs and Policy.

Professional Communication, MA

The Master of Arts in Professional Communication prepares students to work in communication intensive jobs, including professional speaking, social media management, advertising, public relations, writing, editing, human resources, fundraising, event management, training, and organizational consulting, among other things. The program accepts students with a variety of undergraduate degrees and experience.

Students in the M.A. in Professional Communication must complete 33 total hours, including the core requirements and either Plan I (non-thesis) or Plan II (thesis). They may select electives freely OR follow one of the **suggested** emphases below. All students must complete 33 hours, including 12 hours of 600-level coursework (excluding CM 699). No more than 12 hours of the 33 hours may be taken in a discipline other than CM.

Code	Title	Semester Hours
Core (required of all students)		
CM 631	ADVANCED COMMUNICATION THEORY	3
CM 633	INTERPERSONAL COMMUNICATION	3
CM 655	COMMUNICATION AND CULTURE	3
CM 670	ADVANCED COMMUNICATION METHODS	3
CM 675	RHETORICAL CRITICISM	3

Plan I: MA without Thesis

- Choose 18 hours of electives, which may be freely chosen OR follow one of the **suggested** emphases identified below. Note: Students are not required to complete an area of emphasis.

Plan II: MA with Thesis

- Choose 12 hours of electives, which may be freely chosen OR follow one of the **suggested** emphases identified below. Note: Students are not required to complete an area of emphasis.
- Six hours of CM 699 Master’s Thesis

Code	Title	Semester Hours
Suggested Emphases for Electives		
Social Media		
CM 505	ADVANCED MEDIA WRITING	
CM 535	SOCIAL MEDIA	
CM 540	PUBLIC RELATIONS CAMPAIGNS	
CM 554	NEW MEDIA WRITING & RHETORIC	
User Experience		
CM 552	USER-CENTERED DESIGN	
CM 542	USABILITY STUDIES	
CM 662	INFORMATION ARCHITECTURE	
Advertising/Public Relations		
CM 505	ADVANCED MEDIA WRITING	
CM 520	PUBLIC RELATIONS WRITING	
CM 540	PUBLIC RELATIONS CAMPAIGNS	
CM 544	ADVERTISING	
Professional Writing		
EH 601	ACTION RESEARCH IN WRITING STUDIES	
EH 603	EDITING FOR PUBLICATION	
Six hours selected from one of the following areas:		
Technical Writing		
EH 501	THEORY AND PRACTICE IN TECHNICAL COMMUNICATION	
EH 649	SPECIAL TOPICS	
Media Writing		
CM 505	ADVANCED MEDIA WRITING	
EH 554	NEW MEDIA WRITING & RHETORIC	

Communication Studies	
CM 509	CONTEMPORARY RHETORICAL THEORY
CM 591	THE RHETORIC OF PUBLIC MEMORY
CM 610	COMMUNICATION PEDAGOGY
Human Resources Management	
MGT 600	ORGANIZATIONAL THEORY, BEHAVIOR, & ENVIRONMENT
MGT 560	EMPLOYEE STAFFING & DEVELOPMENT
MGT 562	EMPLOYMENT LAW FOR MANAGERS
MGT 561	STRATEGIC COMPENSATION MANAGEMENT
or MGT 631	HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR
Teaching English as a Second Language*	
ESL 500	POLICY AND PRACTICE IN EDUCATIONAL LINGUISTICS
ESL 510	INTRODUCTION TO LANGUAGE SYSTEMS
ESL 520	INSTRUCTIONAL AND ACADEMIC LANGUAGE ACROSS CONTENT DOMAINS
ESL 640	INSTRUCTIONAL AND EVALUATION OF LANGUAGE USAGE
ESL 650	PRACTICUM, TESOL

*To earn a TESOL certificate, contact the TESOL Advisor, Dr. Andrea Word-Allbritton (andrea.word@uah.edu)

Other Areas of Emphasis

Students in the M.A. in Professional Communication program may take electives within the major, as well as up to four courses from other graduate programs, but **no more than 12 hours of the 33 hours may be taken in a discipline other than CM.** Below are some of the example electives.

Code	Title	Semester Hours
Electives		
CM 505	ADVANCED MEDIA WRITING	3
CM 508	CLASSICAL RHETORICAL THEORY	3
CM 509	CONTEMPORARY RHETORICAL THEORY	3
CM 518	LEGAL ARGUMENT	3
CM 520	PUBLIC RELATIONS WRITING	3
CM 530	MASS MEDIA IN AMERICA	3
CM 533	DARK SIDE INTERPERSONAL COMM	3
CM 540	PUBLIC RELATIONS CAMPAIGNS	3
CM 544	ADVERTISING	3
CM 551	ORGANIZATIONAL TRAIN & DEVELOP	3
CM 610	COMMUNICATION PEDAGOGY	3
CM 640	SPECIAL TOPICS	3
EH 500	COMPOSITION STUDIES FOR TEACHERS	3
EH 501	THEORY AND PRACTICE IN TECHNICAL COMMUNICATION	3
EH 512	SPECIAL TOPICS IN CREATIVE WRITING	3
EH 554	NEW MEDIA WRITING & RHETORIC	3
EH 601	ACTION RESEARCH IN WRITING STUDIES	3
EH 602	PRACTICUM IN TECHNICAL COMMUNICATION	3
EH 603	EDITING FOR PUBLICATION	3
MGT 560	EMPLOYEE STAFFING & DEVELOPMENT	3
MGT 561	STRATEGIC COMPENSATION MANAGEMENT	3
MGT 562	EMPLOYMENT LAW FOR MANAGERS	3
MGT 600	ORGANIZATIONAL THEORY, BEHAVIOR, & ENVIRONMENT	3
MGT 631	HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR	3
MGT 622	MANAGING HUMAN CAPITAL	3
MGT 629	LEADERSHIP: THEORY & PRACTICE	3

Psychology, MA

1. Thesis students must complete at least 30 credit hours of graduate coursework, including a minimum of six semester hours of thesis.

Only six semester hours may be transfer courses that are approved by the graduate committee of the department.

2. Students' Programs of Study must include:

Code	Title	Semester Hours
PY 607	PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING	1
PY 608	GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION	1
PY 610	EXPERIMENTAL DESIGN	3
PY 611	STATISTICS FOR EXPERIMENTAL METHODS	4
PY 641	CONCENTRATED READINGS/RESEARCH SPECIALIZED AREA	3
PY 699	MASTER'S THESIS	6
Total Semester Hours		**18**

3. In addition, students' Programs of Study will include other graduate-level courses in psychology selected with the advice of the student’s advisor.

If approved by the graduate committee of the department, the student’s Program of Study may include up to six semester hours of graduate credit from related departments at UAH.

4. Students must pass an oral defense of their thesis.

5. Students must meet requirements for the Master of Arts degree as specified by the Graduate School.

UAH's Joint Undergraduate Master's Program (JUMP) allows undergraduate students to study at the graduate level. By taking graduate courses in your senior year, you could reduce the time taken to get a graduate (M.S. or M.A.) degree.

To be eligible for the Psychology JUMP Program, students must have a grade of B or better in each of the following: PY 101, PY 102, PY 300, PY 304, PY 302, one group A course (PY 316, PY 414, PY 436, PY 480) and one group B course (PY 301, PY 375, PY 415, PY 435). Students interested in the Psychology JUMP Program should pursue the Psychological Sciences Track rather than the Psychological Services Track. Their current Psychology GPA (including any transfer coursework) must be 3.50 or better and their overall GPA (including transfer coursework) must be 3.25 or better.

Students who meet these criteria and complete the JUMP paperwork may then take up to 12 hours of Psychology graduate course credit, which will count toward both their BA and MA degrees if they make a B or better in these courses. In addition, the student who maintains at least a 3.0 GPA in these graduate courses will be automatically admitted to the MA program without having to take the GRE or formally apply for acceptance.

More information available at https://www.uah.edu/jump (https://www.uah.edu/jump/)

Psychology, MA - Industrial/Organizational Psychology Specialization

In the M.A. in Experimental Psychology program, students who are interested in applying psychology in business settings may choose an Industrial/Organizational psychology specialization. The courses in this specialized sequence prepare students for jobs in industry or more extensive study in a Ph.D. program. Graduates with this background are prepared for jobs that require the following skills:

- training
- psychometrics
- job analysis
- personnel selection
- interviewing
- performance appraisal
- empirical research
- statistical analysis
- technical writing

The projected job growth in these areas, nationally, is higher than average.

We welcome both full-time and part-time students. Two of our courses are available through Distance Learning: PY 502 and PY 503. Students will have opportunities to work in faculty research labs in our small, personalized department.

Prerequisites for the M.A. program are a Bachelor's degree in Psychology, including coursework in experimental design and statistics. Prospective students who do not yet have these pre-requisites can take the necessary pre-requisites in our undergraduate curriculum prior to applying to the graduate program; students should contact the Chair of the Psychology Department to discuss this possibility.

Program Requirements

The student's Program of Study must include the following if the student will complete a thesis:

Code	Title	Semester Hours
Required Courses		
PY 502	INDUSTRIAL & ORGANIZATIONAL PSYCHOLOGY	3
PY 530	PSYCHOMETRICS	3
PY 607	PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING	1
PY 608	GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION	1
PY 610	EXPERIMENTAL DESIGN	3
PY 611	STATISTICS FOR EXPERIMENTAL METHODS	4
PY 641	CONCENTRATED READINGS/RESEARCH SPECIALIZED AREA	3
PY 699	MASTER'S THESIS	6
Elective Courses		
Select 6 semester hours of the following:		6
PY 503	HUMAN FACTORS PSYCHOLOGY	3
PY 508	TEAMWORK & TEAM PROCESSES	3
PY 650	SUPERVISED RESEARCH	3-6
PY 675	INTERNSHIP IN APPLIED PSYCHOLOGY	1-3
MGT 560	EMPLOYEE STAFFING & DEVELOPMENT	3
MGT 600	ORGANIZATIONAL THEORY, BEHAVIOR, & ENVIRONMENT	3
MGT 629	LEADERSHIP: THEORY & PRACTICE	3
MGT 631	HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR	3
ISE 790	ADV STATISTICAL APPLICATIONS	3
Total Semester Hours		**30**

The student's Program of Study must include the following if the student will not complete a thesis:

Code	Title	Semester Hours
Required Courses		
PY 502	INDUSTRIAL & ORGANIZATIONAL PSYCHOLOGY	3
PY 530	PSYCHOMETRICS	3
PY 607	PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING	1
PY 608	GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION	1
PY 610	EXPERIMENTAL DESIGN	3
PY 611	STATISTICS FOR EXPERIMENTAL METHODS	4
PY 650	SUPERVISED RESEARCH	6
PY 675	INTERNSHIP IN APPLIED PSYCHOLOGY	3
Elective Courses		
Select 9 semester hours of the following:		6
PY 503	HUMAN FACTORS PSYCHOLOGY	3
PY 508	TEAMWORK & TEAM PROCESSES	3
MGT 560	EMPLOYEE STAFFING & DEVELOPMENT	3
MGT 600	ORGANIZATIONAL THEORY, BEHAVIOR, & ENVIRONMENT	3
MGT 629	LEADERSHIP: THEORY & PRACTICE	3
MGT 631	HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR	3
ISE 790	ADV STATISTICAL APPLICATIONS	3
Total Semester Hours		**33**

Psychology, PhD - Applied Experimental Psychology

The Doctor of Philosophy degree in Applied Experimental Psychology (AEP) is a research-oriented degree awarded upon the demonstration of scholarly competence. The purpose of the AEP Ph.D. program is to prepare graduates to solve complex real-world problems by utilizing their knowledge of scientific theory and the skills involved in conducting high-quality research. The program serves to develop professionals who can tackle important issues facing the Huntsville business and government community, the state of Alabama, and the nation. The program appeals to both traditional students and students who are already working and want to utilize a unique hybrid/online curriculum.

To obtain the Ph.D. degree in AEP, each student must satisfy all requirements of the Graduate School, as well as those of the AEP program. Admission to the Ph.D. program in AEP is dependent upon satisfactory performance on the Preliminary Qualifying Examination.

Post-baccalaureate and master's-level applicants choose between two concentrations to complete the 72-hour curriculum: Human Factors and Psychology-Law. The program is ideal for those whose technical careers in STEM-related fields have given them much in the way of practical technical experience, but who are looking to advance their positions into areas of leadership and development within their organizations.

The AEP Ph.D. program includes a minor and a choice of two concentrations to allow students an opportunity to develop a breadth of knowledge in their specific areas of interest. Students in the doctoral program complete and earn the master's degree as part of the doctoral program. The Graduate School requires 30 hours of graduate-level coursework for the master's degree. Students entering the Ph.D. program post-baccalaureate may select elective courses offered in the Psychology Department at the 500 level and above. Students should consult with the Program Director to make certain the elective courses are suitable for the master's degree.

Students entering the Ph.D. program post-masters may request exemption from specific required courses based upon the completion of similar graduate-level work at UAH or elsewhere. Approval of substitutions/exemptions needs to be granted by a major professor and the Department Chair. Students seeking this exemption must provide an official transcript showing completion of the course(s) upon which they are basing their exemption request and must demonstrate mastery of the required subject matter in a manner to be determined by the relevant faculty members.

Upon completion of the Ph.D. program in Applied Experimental Psychology, the student will be able to:

- identify and explore important problems in the modern world through the application of psychological approaches by conducting original and independent research in the laboratory or the field,
- critically evaluate and determine the validity of research performed by others,
- develop oral and written communication skills necessary to creatively produce research and effectively communicate these research findings to both academic and lay audiences,
- develop teaching expertise through lectures to Psychology students, industry professionals, or conference presentations, depending on the career plans of the student,
- synthesize principles of basic and advanced statistics and research methods to independently design and conduct applied experimental psychology research, and
- train in the professional culture and norms expected of Ph.D. professionals including appropriate ethical standards.

Course Requirements

The Human Factors Concentration is a program within the Experimental Psychology Ph.D. Students may be admitted to this program with either a post-master's degree (with or without a psychology background) or a post-baccalaureate degree (with a psychology background).

Post-Master's to Ph.D. Curriculum for Students with a Psychology Background

Core Courses (Choose four three-credit-hour courses)

Code	Title	Semester Hours
PY 701	HUMAN SYSTEM INTEGRATION	3
PY 702	COMPUTATIONAL CONCEPTS & INTRODUCTION TO SOFTWARE PROGRAMMING	3
PY 703	COMPUTATIONAL CONCEPTS & INTRODUCTION TO SOFTWARE PROGRAMMING	3
PY 704	HUMAN MACHINE SYSTEM DESIGN	3
PY 705	USABILITY EVALUATION AND TESTING	3
PY 706	MANAGEMENT OF COMPLEX SYSTEMS	3

PY ELECTIVE IN CONCENTRATION	3
Total	12

Electives (Choose one three-credit-hour course)

Code	Title	Semester Hours
PY 707	ERGONOMICS AND REGULATIONS IN USER CENTERED DESIGN	3
PY 708	RAPID PROTOTYPING	3
PY 709	HUMAN ARTIFICIAL INTELLIGENCE INTERACTION	3
PY 710	MACHINE LEARNING FOR SOCIAL/BEHAVIORAL RESEARCH	3
PY 711	COMPUTATIONAL PSYCHOLOGY	3
PY 712	SOCIAL COGNITIVE NEUROSCIENCE	3
PY 530	PSYCHOMETRICS	3
PY 675	INTERNSHIP IN APPLIED PSYCHOLOGY	3
Total		3

Other Required Courses

Code	Title	Semester Hours
PY 799	DISSERTATION	18
PY MINOR		9
Total		42

Additional Coursework for Post-Master's to Ph.D. Curriculum for Students without Psychology Background

Code	Title	Semester Hours
PY 607	PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING	1
PY 608	GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION	1
PY 610	EXPERIMENTAL DESIGN	3
PY 611	STATISTICS FOR EXPERIMENTAL METHODS	4
PY 719	HISTORY & SYSTEMS	3
Total		12

Post-Baccalaureate to Ph.D. Curriculum

Courses required for Master's Degree en route to Ph.D.

Code	Title	Semester Hours
PY 607	PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING	1
PY 608	GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION	1
PY 610	EXPERIMENTAL DESIGN	3
PY 611	STATISTICS FOR EXPERIMENTAL METHODS	4
PY 641	CONCENTRATED READINGS/RESEARCH SPECIALIZED AREA	3
PY 502	INDUSTRIAL & ORGANIZATIONAL PSYCHOLOGY	3
PY 503	HUMAN FACTORS PSYCHOLOGY	3
PY ELECTIVES		6
PY 699	MASTER'S THESIS	6
Total		30

Ph.D. Core Courses (Choose four three-credit-hour courses)

Code	Title	Semester Hours
PY 701	HUMAN SYSTEM INTEGRATION	3
PY 702	COMPUTATIONAL CONCEPTS & INTRODUCTION TO SOFTWARE PROGRAMMING	3
PY 703	COMPUTATIONAL CONCEPTS & INTRODUCTION TO SOFTWARE PROGRAMMING	3
PY 704	HUMAN MACHINE SYSTEM DESIGN	3
PY 705	USABILITY EVALUATION AND TESTING	3
PY 706	MANAGEMENT OF COMPLEX SYSTEMS	3
PY ELECTIVE IN CONCENTRATION		3
Total		12

Ph.D. Electives (Choose one three-credit-hour course)

Code	Title	Semester Hours
PY 707	ERGONOMICS AND REGULATIONS IN USER CENTERED DESIGN	3
PY 708	RAPID PROTOTYPING	3
PY 709	HUMAN ARTIFICIAL INTELLIGENCE INTERACTION	3
PY 710	MACHINE LEARNING FOR SOCIAL/BEHAVIORAL RESEARCH	3
PY 711	COMPUTATIONAL PSYCHOLOGY	3
PY 712	SOCIAL COGNITIVE NEUROSCIENCE	3
PY 530	PSYCHOMETRICS	3
PY 675	INTERNSHIP IN APPLIED PSYCHOLOGY	3
Total		3

Other Required Ph.D. Courses

Code	Title	Semester Hours
PY 799	DISSERTATION	18
PY MINOR		9
Total hours for Ph.D.		72

Minor in Quantitative Psychology

Code	Title	Semester Hours
PY 713	QUANTITATIVE STATISTICAL METHODS	3
PY 714	MULTIVARIATE STATISTIICS	3
PY MINOR ELECTIVE		3
Total		9

Minor Elective (Choose one three-credit-hour course)

Code	Title	Semester Hours
PY 715	R FOR DATA SCIENCE	3
PY 718	ADVANCED STRUCTURAL EDUATION MODELING	3
PY 711	COMPUTATIONAL PSYCHOLOGY	3
PY 710	MACHINE LEARNING FOR SOCIAL/BEHAVIORAL RESEARCH	3
PY 530	PSYCHOMETRICS	3

Course Requirements

The Psychology-Law Concentration is a program within the Experimental Psychology Ph.D. Students may be admitted to this program with either a post-master's degree (with or without a psychology background) or a post-baccalaureate degree (with a psychology background).

Post-Master's to Ph.D. Curriculum for Students with a Psychology Background

Core Courses (Choose four three-credit-hour courses)

Code	Title	Semester Hours
PY 780	APPLIED COGNITIVE PSYCHOLOGY	3
PY 775	PROSEMINAR IN SOCIAL PSYCHOLOGY	3
PY 725	EYEWITNESS PSYCHOLOGY	3
PY 730	FORENSIC/INVESTIGATIVE INTERVIEWS	3
PY 735	CHILD WITNESSES	3
PY 740	INTERROGATION & DECEPTION	3
PY ELECTIVE IN CONCENTRATION		3
Total		12

Electives (Choose one three-credit-hour course)

Code	Title	Semester Hours
PY 745	WRONGFUL CONVICTION	3
PY 750	ASSESSMENT OF COMPETENCY TO STAND TRIAL	3
PY 712	SOCIAL COGNITIVE NEUROSCIENCE	3
PY 505	PSYCHOPHARMACOLOGY	3
PY 537	PSYCHOBIOLOGY OF STRESS AND ILLNESS	3
PY 530	PSYCHOMETRICS	3
PY 675	INTERNSHIP IN APPLIED PSYCHOLOGY	3
Total		3

Other Required Courses

Code	Title	Semester Hours
PY 799	DISSERTATION	18
PY MINOR		9
Total		42

Additional Coursework for Post-Master's to Ph.D. Curriculum for Students without Psychology Background

Code	Title	Semester Hours
PY 607	PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING	1
PY 608	GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION	1
PY 610	EXPERIMENTAL DESIGN	3
PY 611	STATISTICS FOR EXPERIMENTAL METHODS	4
PY 719	HISTORY & SYSTEMS	3
Total		12

Post-Baccalaureate to Ph.D. Curriculum

Courses required for Master's Degree en route to Ph.D.

Code	Title	Semester Hours
PY 607	PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING	1
PY 608	GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION	1
PY 610	EXPERIMENTAL DESIGN	3

PY 611	STATISTICS FOR EXPERIMENTAL METHODS	4
PY 534	PSYCHOLOGY AND LAW	3
PY 641	CONCENTRATED READINGS/RESEARCH SPECIALIZED AREA	3
PY ELECTIVES		9
PY 699	MASTER'S THESIS	6
Total		30

Ph.D. Core Courses (Choose four three-credit-hour courses)

Code	Title	Semester Hours
PY 780	APPLIED COGNITIVE PSYCHOLOGY	3
PY 775	PROSEMINAR IN SOCIAL PSYCHOLOGY	3
PY 725	EYEWITNESS PSYCHOLOGY	3
PY 730	FORENSIC/INVESTIGATIVE INTERVIEWS	3
PY 735	CHILD WITNESSES	3
PY 740	INTERROGATION & DECEPTION	3
PY ELECTIVE IN CONCENTRATION		3
Total		12

Ph.D. Electives (Choose one three-credit-hour course)

Code	Title	Semester Hours
PY 745	WRONGFUL CONVICTION	3
PY 750	ASSESSMENT OF COMPETENCY TO STAND TRIAL	3
PY 712	SOCIAL COGNITIVE NEUROSCIENCE	3
PY 505	PSYCHOPHARMACOLOGY	3
PY 537	PSYCHOBIOLOGY OF STRESS AND ILLNESS	3
PY 530	PSYCHOMETRICS	3
PY 675	INTERNSHIP IN APPLIED PSYCHOLOGY	3
Total		15

Other Required Ph.D. Courses

Code	Title	Semester Hours
PY 799	DISSERTATION	18
PY MINOR		9
Total hours for Ph.D.		72

Minor in Quantitative Psychology (PY Minor)

Code	Title	Semester Hours
PY 713	QUANTITATIVE STATISTICAL METHODS	3
PY 714	MULTIVARIATE STATISTIICS	3
PY MINOR ELECTIVE		3
Total		9

Minor Elective (Choose one three-credit-hour course)

Code	Title	Semester Hours
PY 715	R FOR DATA SCIENCE	3
PY 718	ADVANCED STRUCTURAL EDUATION MODELING	3
PY 711	COMPUTATIONAL PSYCHOLOGY	3

PY 710	MACHINE LEARNING FOR SOCIAL/BEHAVIORAL RESEARCH	3
PY 530	PSYCHOMETRICS	3

PY 500 - INTRODUCTION TO CLINICAL & COUNSELING
Semester Hours: 3

PY 500 introduces clinical/counseling psychology and professional psychology. History of diagnosis and treatment, theoretical models in counseling, contemporary practice models, research basis of clinical/counseling psychology, empirically validated techniques, and doctoral program models are covered.

PY 502 - INDUSTRIAL & ORGANIZATIONAL PSYCHOLOGY
Semester Hours: 3

Application of basic principles of learning, motivation, and perception to typical industrial and organizational problems. Same as ISE 502.

PY 503 - HUMAN FACTORS PSYCHOLOGY
Semester Hours: 3

Study of human performance in human-technology-environment systems. Consideration of human capabilities and limitations as related to controls and displays, and the role of human cognition in decision-making and training effectiveness. Same as ISE 503.

PY 504 - THEORIES OF COUNSELING
Semester Hours: 3

This course is designed to introduce theories of psychotherapy and the process of psychotherapy and counseling. This course is a survey of counseling/psychotherapy models and techniques with emphasis on Empirically Validated Therapies (EVT) and traditional models with substantial support in the research and clinical literature.

PY 505 - PSYCHOPHARMACOLOGY
Semester Hours: 3

Introduction to drug classification and action with emphasis on physiological and psychological interactions. Same as BYS 505.

PY 506 - PSYCHOLOGY OF WOMEN
Semester Hours: 3

Examines theory and research in the psychological functioning of women, both in the United States and other nations. Topics include achievement and education, mental and physical health issues, biological influences on women's behavior, and victimization of women.

PY 507 - CROSS-CULTURAL PSYCHOLOGY
Semester Hours: 3

Examines psychological similarities and differences between members of industrialized and non-industrialized cultures. Comparisons will include development, social interaction, personality, cognition, psychological health and treatment, work, and acculturation.

PY 508 - TEAMWORK & TEAM PROCESSES
Semester Hours: 3

This course provides a basic introduction to teams and teamwork processes. The foundation of the course is research-based; topics will be approached from the context of empirical research that has been conducted. The types of research designs that are typically used in team research are addressed.

PY 509 - PSYCHOLOGY OF AGING
Semester Hours: 3

PY 509 examines psychological processes in adulthood and aging. Emphasis is placed on contemporary theories, methodological issues and how psychological, biological, social and environmental factors interact to predict growth, maintenance or decline in abilities throughout adulthood and aging.

PY 510 - TASK ANALYSIS & PROTOTYPING
Semester Hours: 3

This course introduces students to methods for analyzing user actions as they interact with software and tools to complete tasks. Students apply a range of prototype techniques from fast, low-fidelity prototypes to interactive high-fidelity prototypes.

PY 514 - ADVANCED LEARNING
Semester Hours: 3

Analysis of learning principles from simple relationships with animals to the complexities of human language and problem solving.

PY 515 - ADVANCED DEVELOPMENTAL PSYCHOLOGY
Semester Hours: 3

Examination of cognitive, psychoanalytic, ethological, behavioral, and humanistic theories of development.

PY 520 - SPECIAL TOPICS
Semester Hours: 3

Pre-announced special areas in seminar discussion, laboratory work, or practicum. May be taken twice for credit.

PY 530 - PSYCHOMETRICS
Semester Hours: 3

History and development of psychological testing with special emphasis given to both theory and process of effective evaluation.

PY 533 - PSYCHOPATHOLOGY
Semester Hours: 3

Selected disorders such as depression, anxiety disorders, and personality disorders from different theoretical orientations with emphasis on cognitive behavioral theory.

PY 534 - PSYCHOLOGY AND LAW
Semester Hours: 3

This seminar is a survey of the major topics represented in the field of Psychology and Law. We will focus on how psychological research can contribute to a better understanding of issues related to law.

PY 537 - PSYCHOBIOLOGY OF STRESS AND ILLNESS
Semester Hours: 3

Overview of physiological stress responses and their influence on health behavior and illness. Same as BYS 537.

PY 580 - PROSEMINAR: COGNITIVE
Semester Hours: 3

Critical examination of the cognitive approach to areas of study within psychology. Students are responsible for library research, writings, and presentation of selected topics.

PY 607 - PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING
Semester Hour: 1

Focus on developing knowledge and skills relevant to future goals regarding teaching, either in academic or professional settings.

PY 608 - GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION
Semester Hour: 1

Focus on developing knowledge and skills relevant to future goals, such as career exploration, internship opportunities, resume writing, and graduate program exploration. Required of first year students.

PY 610 - EXPERIMENTAL DESIGN
Semester Hours: 3

Design and use of the experiment as an inferential tool. Issues pertaining to reliability, validity, manipulation of independent variables, and sampling will be examined. Implementing statistical techniques for analysis of data generated by experimental designs.

PY 611 - STATISTICS FOR EXPERIMENTAL METHODS
Semester Hours: 4

Statistical techniques for analysis of data generated by experimental designs.

PY 612 - MULTIVARIATE ANALYSIS
Semester Hours: 3

Covers how to conduct, interpret, and summarize multivariate analyses. Prerequisite: PY 611 (B- or better).

PY 615 - GRADUATE SEMINAR
Semester Hours: 3

Intensive analysis of selected theoretical or applied topics relating to psychological development. May be taken more than once for credit.

PY 624 - HUMAN FACTORS IN SYSTEM DESIGN
Semester Hours: 3

Introduces basic principles of methods analysis and ergonomics. Methods analysis topics include: work measurement tools, work sampling, job analysis, job evaluation, and development and use of flow and activity charts for methods improvement. Same as ISE 624.

PY 641 - CONCENTRATED READINGS/RESEARCH SPECIALIZED AREA
Semester Hours: 3

Independent readings and/or experiments in an area within the student's field of specialization. One requirement is a research proposal, which will be reviewed by the faculty advisor. May be taken more than once for credit. Prerequisite: Instructor approval.

PY 650 - SUPERVISED RESEARCH
Semester Hours: 1-6

Laboratory or applied research concerning a particular topic, approved and supervised by a PY faculty member. The student may work on an independent or group project. May be taken more than once for credit.

PY 675 - INTERNSHIP IN APPLIED PSYCHOLOGY
Semester Hours: 1-6

Students are placed in a field setting under the supervision of a faculty member and a site supervisor. Students receive site-specific training, experience, and individual supervision.

PY 699 - MASTER'S THESIS
Semester Hours: 6

Master's Thesis (0 - 6 semester hours) Required each semester a student is working and receiving faculty direction on a master's thesis. Prerequisite: PY 641.

PY 701 - HUMAN SYSTEM INTEGRATION
Semester Hours: 3

Discover how to adress human-related issues in system development in an integrated manner. Explore principles of human factors engineering, personnel selection, training, safety, and other HSI technical domans. Learn how these activities should be integrated to reduce personnel costs and improve system performance.

PY 702 - COMPUTATIONAL CONCEPTS & INTRODUCTION TO SOFTWARE PROGRAMMING
Semester Hours: 3

Introduces basic-computational concepts and programming skills needed to work with interactive systems. Draws on topics such as log analysis, visualization, prototyping, and data mining. Students analyze data to inform user research and design.

PY 703 - COMPUTATIONAL CONCEPTS & INTRODUCTION TO SOFTWARE PROGRAMMING
Semester Hours: 3

Three broad categories of topics within human-computer interaction (HCI) are covered: (a) principles and characteristics of the interaction between humans and computers; (b) techniques for designing and evaluating user-centered systems; and (c) cutting-edge research and development in HCI.

PY 704 - HUMAN MACHINE SYSTEM DESIGN
Semester Hours: 3

Techniques for man-machine system designs in which cognitive and dynamic aspects are of major importance. Applications to computer-interface design, auto/semiautomated systems, military systems, etc. Topics include information processing, decision making, reaction times and signal detection theory.

PY 705 - USABILITY EVALUATION AND TESTING
Semester Hours: 3

This course covers all of the aspects of specifying, planning, executing, and reporting usability assessments on products, services and systems. Formative and summative assessments are covered, as are "discount" usability methods. This course is project based.

PY 706 - MANAGEMENT OF COMPLEX SYSTEMS
Semester Hours: 3

Focuses on how to design and improve complex work systems. Emphasis on agile development, including sprints using scrum teams to achieve rapid interaction design with system users, developers and owners. Investigates decision support systems, sense making and adaptation in amgibuous situations.

PY 707 - ERGONOMICS AND REGULATIONS IN USER CENTERED DESIGN
Semester Hours: 3

Covers internationa, military and occupational health and safety standard requirements, regulations and guidelines for ergonomics of human-centered design principles and activities throughout the life cycle of human interactive or work systems.

PY 708 - RAPID PROTOTYPING
Semester Hours: 3

Review fundamentals of designing and prototyping human-centered interactive systems and environments that include software and hardware components. Students build projects using electronic devices and fabrication tools. Provides hands on experience in a project-based, studio environment.

PY 709 - HUMAN ARTIFICIAL INTELLIGENCE INTERACTION
Semester Hours: 3

Addresses agency and initiative, AI and ethics, bias and transparency, confidence and errors, human augmentation and amplification, trust, mised-initiative systems, and programming by example. Students should be comfortable with programming; assignments with primarily use Javascript.

PY 710 - MACHINE LEARNING FOR SOCIAL/BEHAVIORAL RESEARCH
Semester Hours: 3

Covers a wide range of learning algorithms that can be applied to a variety of problems such as decision trees, rule-based classification, support vector machines, Bayesian networks, and clustering. This course does not assume any prior exposure to machine learning theory or practice.

PY 711 - COMPUTATIONAL PSYCHOLOGY
Semester Hours: 3

The application of computational principles to understanding human behavior. Hands on experience with modeling tools to analyze large data sets.

PY 712 - SOCIAL COGNITIVE NEUROSCIENCE
Semester Hours: 3

Addresses interactions between social-level phenomena, cognitive-level processes, and neural mechanisms that underlie these events. This course will cover basic neurophysiology and cognitive processing theory with the goal of understanding how these foster social preception, cognition and actions.

PY 713 - QUANTITATIVE STATISTICAL METHODS
Semester Hours: 3

Covers methods developed for rigorous quantitative inquiry in Psychology. Students will become familiar with various research design, measurement, and advanced analytic strategies broadly applicable to theory-driven and data-informed quantitative research, the strengths and limitations of each.

PY 714 - MULTIVARIATE STATISTIICS
Semester Hours: 3

Course covers advanced-level multivariate statistical methods (e.g., GLM, MANOVA, MANCOVA), discriminant function analysis, canonical correlation analysis, cluster analysis, and principal components analysis. The focus of this course will be on conceptual understanding and computer applications.

PY 715 - R FOR DATA SCIENCE
Semester Hours: 3

This class will learn how to manipulate larger data sets with current best practices and advancements in data science. This will all be taught using R, a programming environment that is well suited for data science.

PY 718 - ADVANCED STRUCTURAL EDUATION MODELING
Semester Hours: 3

Provides the basic theoretical background necessary for the application of Structural Equation Modeling (SEM) to research problems including model specification, identication, path analysis, estimation, testing fit, respecification, confirmatory factor analysis the interpretation of SEM results. Prerequisite: PY 611.

PY 719 - HISTORY & SYSTEMS
Semester Hours: 3

Survey of psychological systems (theory, research, perspectives) regarding human behavior and mental processes from ancient times to the present.

PY 725 - EYEWITNESS PSYCHOLOGY
Semester Hours: 3

The course covers research and application of psychology knowledge or concepts to the legal system, emphasizing eyewitness memory and topics as, description accuracy, weapon focus, line-up construction, line up administration, showup identification, confidence, and post identification feedback.

PY 730 - FORENSIC/INVESTIGATIVE INTERVIEWS
Semester Hours: 3

Covers the science of forsenic interviewing and detecting deception from an applied cognitive and social perspective. The topics will include: false confessions, The Reid method of interrogation, detecting deception, and implications of research for justice system practices and policies.

PY 735 - CHILD WITNESSES
Semester Hours: 3

Children and adolescents all too frequently become involved in the legal system as victims, witnesses, or perpetrators of crime. This course will apply relevant development research and theory to legal issues of chldren and adolescents.

PY 740 - INTERROGATION & DECEPTION
Semester Hours: 3

In this course students will learn about the science of interrogations and confessions and how to detect deception.

PY 745 - WRONGFUL CONVICTION
Semester Hours: 3

This class will examinethe contributing factors of wrongful convictions as outlined in the Innocence Projct and the National Registry of Exonerations, including eyewitness identification; false confessions, jailhouse informants, police and prosecutorial misconduct and junk science.

PY 750 - ASSESSMENT OF COMPETENCY TO STAND TRIAL
Semester Hours: 3

This course will address the various factors that courts evaluate when determining whether a defendant is competent to stand trail.

PY 762 - PERFORM MEASUR/PRODU IMPROVEMT
Semester Hours: 3

Productivity and performance defined and used to analyze current competitive position of important sectors of US industry with respect to national and international competition.

PY 775 - PROSEMINAR IN SOCIAL PSYCHOLOGY
Semester Hours: 3

Social psychological theories (e.g., attitudes, social cognition, social influence and persuasion) will be examined to understand and address several areas in legal system, including interrogations, conducting line-ups, interviewing child and adult witnesses; jury decision making, race and gender.

PY 780 - APPLIED COGNITIVE PSYCHOLOGY
Semester Hours: 3

This course introduces the basic processes involved in human information processing, including perception, attention, memory, knowledge representations, language, problem-solving, reasoning, and decision-making.

PY 799 - DISSERTATION
Semester Hours: 6

Dissertation (0-6 semester hours) Required each semester a student is working and receiving faculty direction on a dissertation.

College of Business

Dean's Office
Business@uah.edu (business@uah.edu)
256.824.4424
BAB 202

Graduate Advising
gradbusiness@uah.edu
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BAB 102

Mission

Our mission is to fuel innovation in business, spark new ideas through research, and launch the careers of our students.

- We tap the creativity, expertise, and energy of our students, faculty, and community to fuel innovation in business practices and business education.
- Our faculty and students spark ideas, foster discovery, create and communicate knowledge, and develop frameworks for solutions to challenges facing business and society today and in the future.
- Our academic programs, emphasize leadership, innovation, analytical reasoning, ethical decision-making, and critical thinking to launch the careers of our diverse population of students.

Accreditation

The College of Business is accredited by AACSB International (https://www.aacsb.edu/). AACSB provides the highest standard of accreditation offered to business schools worldwide, with fewer than 25 percent of U.S. business schools and fewer than 5 percent of worldwide business schools achieving the distinction. To maintain AACSB accreditation, we must have a specific plan and sufficient resources to support high quality undergraduate and graduate programs, a highly qualified faculty who maintain credentials through continuous research or engagement with practice, and a process for assessing that our students are learning what we teach. We report to AACSB annually and undergo a comprehensive review every five years.

Graduate Degrees and Certificates

The College of Business offers seven graduate degrees and seven graduate certificates.

- Master of Accountancy (MAcc) (p. 43)
- Master of Business Administration (MBA) (p. 45)
- M.S. in Business Analytics (p. 52)
- M.S. in Cybersecurity (Management Track) (p. 49)
- M.S. in Information Systems (p. 47)
- M.S. in Management-Human Resource Management (p. 51)
- M.S. in Supply Chain Management (p. 50)
- Graduate Certificate in Business Analytics (p. 53)
- Graduate Certificate in Cybersecurity Studies (p. 54)
- Graduate Certificate in Enterprise Resource Planning (p. 54)
- Graduate Certificate in Federal Contracting & Procurement Management (p. 55)
- Graduate Certificate in Human Resource Management (p. 56)
- Graduate Certificate in Supply Chain Management (p. 56)
- Graduate Certificate in Technology & Innovation Management (p. 57)

Admissions Requirements

1. Apply online. Application instructions can be found at https://www.uah.edu/admissions/graduate/apply-for-admission (https://www.uah.edu/admissions/graduate/apply-for-admission/).

2. Transcripts: Send your official transcripts to UAH Graduate Admissions through an electronic delivery service. UAH Graduate Admissions accepts official transcripts from Parchment (https://www.parchment.com/) and Student Clearinghouse (https://www.studentclearinghouse.org/students/).
If your school does not have access to these services, request that your official hard-copy transcripts be sent to:

    UAH Graduate Admissions
    301 Sparkman Drive
    SSB, Suite 222
    Huntsville, AL 35899

3. Entrance Exam (GMAT/GRE) and Exam Waiver Criteria:

    GMAT (preferred)
    Minimum score: 500
    http://www.mba.com/gmat (http://www.mba.com/gmat/)

    GRE (accepted)
    Minimum score: 300 verbal and quantitative and a 3.000 on analytical writing
    http://www.taketheGRE.com (http://www.takethegre.com/)
    Institutional code: 1854

    Test score waiver criteria for each program can be found at https://www.uah.edu/admissions/graduate/apply-for-admission/test-score-requirements (https://www.uah.edu/admissions/graduate/apply-for-admission/test-score-requirements/).

4. Supplemental Documentation: Submit your resume within your Charger Status account.

Graduate Assistantships

A limited number of graduate assistantships are available to select full-time students on a competitive basis. Graduate assistantships are awarded at either a 10 or 20 hour per week service to the College, carry a stipend, and have up to nine semester hours of tuition paid. The assistantship application is available here (http://www.uah.edu/admissions/graduate/financial-aid/assistantships/).

Graduate Teaching Assistantships (GTA) are awarded to students who assist with the College's undergraduate teaching mission as tutors, graders, and coordinators of program activities. Graduate Research Assistantships (GRA) are made available through externally funded grants or contracts. GRAs do research under the supervision of a faculty member or center director. Because GRAs assist with specific research activities, the ability of applicants to assist with these specific activities is considered when awarding assistantships.

Degree Requirements

The following academic requirements are those of the Graduate School and the College of Business:

1. Overall grade point average must be B (3.000) or better on all graduate credit hours at UAH. In addition, the grade point average must be B (3.000) or better on courses taken in the current graduate degree program;
2. No grade lower than a C- may be counted toward a graduate degree;
3. At least 30 percent of the hours required for a graduate degree must be completed in courses numbered 600 or above;
4. A grade of B- or better is required in the specified capstone course of the graduate degree.

Expectations about Degree Progress

Course Load: The typical semester course load for a full-time graduate student is 9 to 12 semester hours. The typical semester course load for a student employed full-time is 3 to 6 semester hours.

Time Limit: The degree must be earned within 10 years or by the end of the 30th semester. There are three semesters a year; fall, spring, and summer. The time clock starts when the first course is taken (including transfer credit).

Master's Programs in Business:

- Master of Accountancy (MAcc) (p. 43)
- Master of Business Administration (MBA) (p. 45)
- M.S. in Business Analytics (p. 52)
- M.S. in Cybersecurity (Management Track) (p. 49)
- M.S. in Information Systems (p. 47)
- M.S. in Management-Human Resource Management (p. 51)
- M.S. in Supply Chain Management (p. 50)

Certificates in Business:

- Graduate Certificate in Business Analytics (p. 53)
- Graduate Certificate in Cybersecurity Studies (p. 54)
- Graduate Certificate in Enterprise Resource Planning (p. 54)
- Graduate Certificate in Federal Contracting & Procurement Management (p. 55)
- Graduate Certificate in Human Resource Management (p. 56)
- Graduate Certificate in Supply Chain Management (p. 56)
- Graduate Certificate in Technology & Innovation Management (p. 57)

Accountancy, MAcc

For an overview of the program, click here (https://www.uah.edu/business/grad/degrees/macc/).

Program Prerequisites

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Program prerequisites include a bachelor's degree in any field and satisfactory (i.e., "C" or higher) completion of
the following courses within business prerequisites and accounting prerequisites.
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Code	Title	Semester Hours
Business Prerequisites		
Written and oral communications		
Calculus or MA 120 equivalent		
Computer applications		
Statistical analysis		
Legal environment of business		

Principles of accounting (financial and managerial)		
Principles of economics		
Principles of finance		
Principles of marketing		
Operations management		
Organizational theory, behavior, and environment		
Accounting Prerequisites		
ACC 308	ACCOUNTING INFORMATION SYSTEMS I	
or ACC 408	ACCOUNTING INFORMATION SYSTEMS II	
ACC 310	INTERMEDIATE FINANCIAL ACCOUNTING I	
ACC 311	INTERMEDIATE FINANCIAL ACCOUNTING II	
ACC 313	INDIVIDUAL/SMALL BUSINESS INCOME TAX	
ACC 414	COST ACCOUNTING	
ACC 431	PRINCIPLES OF AUDITING	

Degree Requirements

The MAcc program consists of 30 semester hours of graduate coursework. The capstone course, ACC 603, must be taken at UAH and must be completed with a grade of B- or better.

The MAcc curriculum consists of the following courses:

Code	Title	Semester Hours
Required Courses		
ACC 513	CORPORATE AND PARTNERSHIP TAXATION	
ACC 515	ADVANCED FINANCIAL ACCOUNTING	
ACC 516	ADVANCED COST ACCOUNTING	
ACC 517	ACCOUNTING FOR STATE & LOCAL GOVERNMENTS AND NON-PROFITS	
ACC 603	FINANCIAL ACCOUNTING PROBLEMS & ANALYSIS	
ACC 607	ACCOUNTING ANALYTICS	
ACC 613	TAX RESEARCH	
ACC 642	ADVANCED AUDITING TOPICS	
5xx or 6xx Level ACC Elective [1]		
5xx or 6xx Level Business Elective [2]		
Total Hours		**30**

1. ACC 600 and ACC 602 may not be used in the MAcc program.
2. Courses numbered 600 cannot be used.

Additional Information

CPA Examination in Alabama

Students planning to sit for the CPA examination in Alabama can find the current requirements at the Alabama State Board of Public Accountancy. (https://www.asbpa.alabama.gov/)

Thesis Option

A thesis option requires 30 semester hours of graduate work, including six semester hours of thesis credit. Students interested in this option should contact the Graduate Advisor before completing 12 semester hours of graduate study.

Transfer Credit

In accordance with the Graduate School transfer policy (p. 376), students may transfer up to 12 semester hours of acceptable graduate credit earned in an approved institution and may count it toward a master's degree. No transferred credit may be more than 10 years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

The College of Business will only review business discipline course(s) for transfer credit if the institution is accredited by AACSB International (https://www.aacsb.edu/). The department chair may, at their discretion, approve or reject the proposed course credit transfer.

Inquiries about the transferability of specific courses should be directed to the Graduate Advisor, who will consult with the department chair to determine whether the course will be accepted for transfer credit.
In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the department and by the graduate dean prior to the student enrolling at the other institution.

For more information, contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building, Room 102
256.824.6732
gradbusiness@uah.edu (gradbiz@uah.edu)

Master of Business Administration, MBA

For an overview of the program click here (https://www.uah.edu/business/grad/degrees/mba/).

Program Prerequisites

Program prerequisites include a bachelor's degree in any field and demonstration of competency in statistics.

Degree Requirements

The MBA consists of 36 semester hours of graduate coursework. MGT 698, Strategic Management, is the capstone course and should be taken toward the end of the student's program. A student must earn a grade of B- or better in MGT 698.

Code	Title	Semester Hours
Required Courses		
ACC 600	FOUNDATIONS OF ACCOUNTING FOR MANAGERS AND ENGINEERS [1]	
ACC 602	MANAGERIAL ACCOUNTING	
ECN 600	FOUNDATIONS OF ECONOMICS [1]	
ECN 626	MANAGERIAL ECONOMICS AND TECHNOLOGY	
FIN 601	FINANCIAL DECISIONS UNDER UNCERTAINTY	
MGT 622	MANAGING HUMAN CAPITAL	
MGT 629	LEADERSHIP: THEORY & PRACTICE	
MKT 601	MARKETING STRATEGY & ANALYSIS	
MSC 600	QUANTITATIVE METHODS [1]	
MSC 605	OPERATIONS MANAGEMENT	
MSC 622	ANALYTICS FOR MANAGERS	
or MKT 604	NEW PRODUCT DEVELOPMENT	
or MGT 601	TECHNOLOGY & INNOVATION MANAGEMENT	
or IS 601	MANAGEMENT OF INFORMATION TECHNOLOGY	
MGT 698	STRATEGIC MANAGEMENT	
Total Hours		**36**

1 MBA students whose previous studies include the undergraduate equivalents of ACC 600 , ECN 600, and/or MSC 600 can substitute a 3-credit-hour graduate-level course for each of the latter.

Optional Concentrations

MBA students may take nine semester hours of graduate coursework to complete a concentration in one of the following areas:

- Business Analytics
- Cybersecurity
- Engineering Management
- Federal Contracting and Procurement Management

- Information Systems **(available online)**
- Marketing
- Supply Chain Management **(available online)**
- Technology and Innovation Management

Those students whose previous studies included the undergraduate equivalents of ACC 600, ECN 600, and/or MSC 600, may substitute graduate courses toward a concentration. Students without the undergraduate equivalents must take up to nine additional hours to complete a concentration.

Business Analytics

Code	Title	Semester Hours
Required Courses		**9**
MSC 550	INTRODUCTION TO ANALYTICS AND PROGRAMMING	
Choose two of the following:		
IS 571	BUSINESS ANALYTICS & AI	
IS 640	DATA MANAGEMENT AND DATA MINING	
MSC 641	ADVANCED ANALYTICS	
MSC 610	MODELING & SIMULATION	
or MSC 615	DECISION MODELING	

Cybersecurity

Code	Title	Semester Hours
Required Courses		**9**
IS 501	CYBERSECURITY PRINCIPLES	
IS 550	CYBERSECURITY MANAGEMENT	
or IS 560	NETWORKING & IT INFRASTRUCTURE	
IS 577	NETWORK DEFENSE & SECURITY	
or IS 663	COMPUTER FORENSICS	

Engineering Management

Code	Title	Semester Hours
Required Courses		**9**
EM 660	ENGR MGMT THEORY	
EM 666	ENGR PROJECT MANAGEMENT	
or MGT 640	PRINCIPLES OF PROJECT MANAGEMENT	
EM 760	ENGR MGMT STRUCTURES & SYSTEMS	

Federal Contracting and Procurement Management

Code	Title	Semester Hours
Required Courses		**9**
MGT 501	INTRODUCTION TO CONTRACT MANAGEMENT [1]	
MGT 502	CONTRACT EVALUATION & AWARD	
MGT 503	CONTRACT PRICING & COST ANALYSIS	

Information Systems

Code	Title	Semester Hours
Required Courses		**9**
IS 601	MANAGEMENT OF INFORMATION TECHNOLOGY	
IS 680	ENTERPRISE RESOURCE PLANNING SYSTEMS	
IS 512	SYSTEMS ANALYSIS & DESIGN	
or IS 640	DATA MANAGEMENT AND DATA MINING	

Marketing

Code	Title	Semester Hours
Required Courses		**9**
MKT 570	SOCIAL MEDIA MARKETING	
MKT 604	NEW PRODUCT DEVELOPMENT	
MKT 602	MARKETING RESEARCH DESIGN	
or MSC 510	LOGISTICS MANAGEMENT	
or MSC 615	DECISION MODELING	

Supply Chain Management

Code	Title	Semester Hours
Required Courses		**9**
IS 522	SUPPLY CHAIN MANAGEMENT SYSTEMS	
MSC 510	LOGISTICS MANAGEMENT	
MSC 611	SUPPLY CHAIN MANAGEMENT	

Technology and Innovation Management

Code	Title	Semester Hours
Required Courses		**9**
MGT 505	NEW VENTURES STRATEGIES	
MGT 601	TECHNOLOGY & INNOVATION MANAGEMENT	
MGT 640	PRINCIPLES OF PROJECT MANAGEMENT	

Additional Information

Transfer Credit

In accordance with the Graduate School transfer policy (p. 376), students may transfer up to 12 semester hours of acceptable graduate credit earned in an approved institution and may count it toward a master's degree. No transferred credit may be more than 10 years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

The College of Business will only review business discipline course(s) for transfer credit if the institution is accredited by AACSB International (https://www.aacsb.edu/). The Department Chair may, at their discretion, approve or reject the proposed course credit transfer. Also, coursework taken through the Defense Acquisition University (DAU) that has been evaluated to be worth graduate-level credit can be considered.

Inquiries about the transferability of specific courses should be directed to the Graduate Advisor, who will consult with the Department Chair to determine whether the course will be accepted for transfer credit.

In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the department and by the Graduate Dean prior to the student enrolling at the other institution.

For more information contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building, Room 102
256.824.6732
gradbusiness@uah.edu

Information Systems, MS

For an overview of the program click here (https://www.uah.edu/business/grad/degrees/ms-is/).

Program Prerequisites

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Program prerequisites include a bachelor’s degree in any field and demonstration of competency
in each of the following areas:
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1. **Computer Applications Competency.** Students must demonstrate this competency by passing an on-line computer applications competency exam or by successful completion of the IS 146 or its equivalent. IS 146 or its equivalent will not count towards the requirements of the MS-IS degree.
2. **Computer Programming Competency.** Students must demonstrate this competency by passing an on-line computer programming exam or by successful completion of IS 210 or its equivalent. IS 210 or its equivalent will not count towards the requirements of the MS-IS degree.

Degree Requirements

The MS-IS program consists of 30 semester hours of graduate coursework.

IS 691, Information Systems Strategy and Applications, is the capstone course and should be taken toward the end of the student’s program. A student must earn a grade of B- or better in IS 691.

Code	Title	Semester Hours
Required Courses		
IS 512	SYSTEMS ANALYSIS & DESIGN [1]	
IS 550	CYBERSECURITY MANAGEMENT	
IS 560	NETWORKING & IT INFRASTRUCTURE [1]	
IS 571	BUSINESS ANALYTICS & AI [1]	
IS 601	MANAGEMENT OF INFORMATION TECHNOLOGY	
IS 640	DATA MANAGEMENT AND DATA MINING	
IS 680	ENTERPRISE RESOURCE PLANNING SYSTEMS	
IS 691	INFORMATION SYSTEMS STRATEGY & APPLICATIONS	
5xx or 6xx Level Elective [2]		
5xx or 6xx Level Elective		
Total Hours		**30**

1 MS-IS students whose previous studies include the undergraduate equivalents of IS 512 , IS 560, and/or IS 571 must substitute a 3-credit-hour graduate-level IS course for each applicable course.

2 Recommended Elective: IS 522

Additional Information

Thesis Option

A thesis option is available. Students interested in this option should contact both the faculty member who the student wants to serve as the thesis advisor, and the Graduate Advisor in the College of Business, before completing 12 hours of graduate study. If selected, the student will register for the IS 699 Masters Thesis course for six credit hours in lieu of six credit hours of electives.

Transfer Credit

In accordance with the Graduate School transfer policy (p. 376), students may transfer up to 12 semester hours of acceptable graduate credit earned in an approved institution and may count it toward a master's degree. No transferred credit may be more than 10 years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

The College of Business will only review business discipline course(s) for transfer credit if the institution is accredited by AACSB International (https://www.aacsb.edu/). The department chair may, at their discretion, approve or reject the proposed course credit transfer.

Inquiries about the transferability of specific courses should be directed to the Graduate Advisor, who will consult with the department chair to determine whether the course will be accepted for transfer credit.

In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the department and by the graduate dean prior to the student enrolling at the other institution.

For more information contact:

Tressa Hillman-Moore

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256.824.6732
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Cybersecurity, MS Interdisciplinary - Management Track

For an overview of the Master of Science program in Cybersecurity - Business track (MSCBS-M) click here (https://www.uah.edu/business/grad/degrees/mscbs/).

Program Prerequisites

Prerequisites for the MSCBS-M track include a bachelor's degree in any field and demonstration of competency in each of the following two areas:

1. **Information Systems Competency.** Students must demonstrate this competency by successful completion of IS 301 or its equivalent, which will not count towards the requirements of the Business track of the MSCBS degree.
2. **Computer Programming Competency.** Students must demonstrate this competency by successful completion of IS 310 or its equivalent, which will not count towards the requirements of the Business track of the MSCBS degree.

Degree Requirements

The MS-CBS program consists of 30 scredit hours of graduate coursework. The coursework includes a five-course core that is required of all students, nine credit hours of management track required courses, and six credit hours of electives. The directed elective choices are designed to provide students with a broader understanding of multiple cybersecurity functions normally expected in an organization.

IS 692/CPE 692/CS 692 is the capstone course and should be taken toward the end of the student's program. Students must earn a grade of B- or better in the capstone course.

Code	Title	Semester Hours
Cybersecurity Core Courses		**9**
IS 550	CYBERSECURITY MANAGEMENT [1]	
IS 663	COMPUTER FORENSICS	
or CS 580	MOBILE DIGITAL FORENSICS	
IS 692	CYBERSECURITY PRACTICUM	
or CPE 692	CYBERSECURITY CAPSTONE	
or CS 692	CYBERSECURITY CAPSTONE	
Management Track-required Courses		**15**
IS 501	CYBERSECURITY PRINCIPLES [1]	
IS 560	NETWORKING & IT INFRASTRUCTURE [1]	
IS 577	NETWORK DEFENSE & SECURITY [1]	
IS 650	SELECTED RESEARCH TOPICS [2]	
or IS 580	SEMINAR IN MANAGEMENT INFORMATION SYSTEMS	
IS 670	BUSINESS CONTINGENCY PLANNING	
Elective, select two courses from the following: [3]		**6**
IS 571	BUSINESS ANALYTICS & AI [1]	
IS 640	DATA MANAGEMENT AND DATA MINING	
CPE 534	OPERATING SYSTEMS	
CPE 645	COMPUTER NETWORK SECURITY	
CPE 646	MOBILE & WIRELESS NETWORKS	
CPE 647	UBIQUITOUS COMPUTING	
CPE 648	ADVANCED COMPUTER NETWORKS	
CPE 649	ADV CYBERSECURITY ENGINEERING	
CS 685	APPLIED CRYPTOGRAPHY	
CS 687	DATABASE SYSTEMS	

CS 553	CLIENT/SERVER ARCHITECTURES	
CS 565	NETWORK SECURITY	
CS 617	DES & ANALY OF ALGORITHM	
CS 650	SOFT'W ENGINEERING PROC	
CS 670	WIRELESS SENSOR NETWORKS	
CS 690	ADVANCED OPERATING SYSTEMS	
Total Hours		**30**

1 MS-CBS students whose previous studies include the undergraduate equivalents of IS 501, IS 550, IS 560, IS 571, and/or IS 577 must substitute a 3-credit-hour graduate-level IS course for each applicable course.
2 Students may substitute an IS course approved by the Department Chair.
3 Students are required to satisfy the prerequisites for any elective they choose. Students who wish to substitute some other courses as directed electives may seek prior approval for such a substitution by contacting the Graduate Advisor in the College of Business.

Additional Information

Thesis Option

A thesis option is available. Students interested in this option should contact both the faculty member who the student wants to serve as the thesis advisor, and the Graduate Advisor in the College of Business, before completing 12 hours of graduate study. If selected, the student will register for the IS 699 Master’s Thesis course for six credit hours in lieu of six credit hours of electives.

Transfer Credit

In accordance with the Graduate School transfer policy (p. 376), students may transfer up to twelve semester hours of acceptable graduate credit earned in an approved institution and may count it toward a master's degree. No transferred credit may be more than ten years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

The College of Business will only review business discipline course(s) for transfer credit if the institution is accredited by AACSB International (https://www.aacsb.edu/). The Department Chair may, at their discretion, approve or reject the proposed course credit transfer.

Inquiries about the transferability of specific courses should be directed to the Graduate Advisor in the College of Business, who will consult with the Department Chair to determine whether the course will be accepted for transfer credit.
In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the Department and by the Graduate Dean prior to the student enrolling at the other institution.

For more information contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building Room 102
256.824.6732
gradbusiness@uah.edu

Supply Chain Management, MS

For an overview of the program click here (https://www.uah.edu/business/grad/degrees/ms-sclm/).

Program Prerequisites

Program prerequisites include a bachelor’s degree in any field and demonstration of competency in statistics.

Degree Requirements

The MS-Supply Chain Management program consists of 30 semester hours of graduate coursework. MGT 693, Supply Chain Strategy & Practicum, is the capstone course and should be taken toward the end of the student’s program. A student must earn a grade of B- or better in MGT 693.

Code	Title	Semester Hours
Required Courses		
ACC 600	FOUNDATIONS OF ACCOUNTING FOR MANAGERS AND ENGINEERS [1]	
IS 522	SUPPLY CHAIN MANAGEMENT SYSTEMS	
MGT 501	INTRODUCTION TO CONTRACT MANAGEMENT	

MSC 510	LOGISTICS MANAGEMENT	
MSC 600	QUANTITATIVE METHODS [1]	
MSC 605	OPERATIONS MANAGEMENT	
MSC 611	SUPPLY CHAIN MANAGEMENT	
MSC 615	DECISION MODELING	
MSC 693	SUPPLY CHAIN STRATEGY	
5xx or 6xx Level Elective [2]		
Total Hours		**30**

1 Students whose previous studies include the undergraduate equivalents of ACC 600 and/or MSC 600 can substitute a 3-credit-hour graduate-level course for each applicable course.

2 Recommended Elective: MGT 503

Additional Information

Thesis Option

A thesis option is available. Students interested in this option should contact both the faculty member who the student wants to serve as the thesis advisor, and the Graduate Advisor in the College of Business, before completing 12 hours of graduate study. If selected, the student will register for the IS 699 Masters Thesis course for six credit hours in lieu of six credit hours of electives.

Transfer Credit

In accordance with the Graduate School transfer policy (p. 376), students may transfer up to 12 semester hours of acceptable graduate credit earned in an approved institution and may count it toward a master's degree. No transferred credit may be more than 10 years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

The College of Business will only review business discipline course(s) for transfer credit if the institution is accredited by AACSB International (https://www.aacsb.edu/). The Department Chair may, at their discretion, approve or reject the proposed course credit transfer. Also, coursework taken through the Defense Acquisition University (DAU) that has been evaluated to be worth graduate level credit can be considered.

Inquiries about the transferability of specific courses should be directed to the Graduate Advisor, who will consult with the Department Chair to determine whether the course will be accepted for transfer credit.

In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the department and by the Graduate Dean prior to the student enrolling at the other institution.

For more information contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building, Room 102
256.824.6732
gradbusiness@uah.edu

Management - Human Resource Management, MSM

For an overview of the program click here (https://www.uah.edu/business/grad/degrees/hrm/).

Program Prerequisites

Program prerequisites include a bachelor’s degree in any field and demonstration of competency in statistics.

Degree Requirements

The MSM-HRM program consists of 30 semester hours of graduate coursework.

MGT 695, Strategic Human Resource Management, is the capstone course and should be taken toward the end of the student’s program. A student must earn a grade of B- or higher in MGT 695.

Code	Title	Semester Hours
Required Courses		
ACC 600	FOUNDATIONS OF ACCOUNTING FOR MANAGERS AND ENGINEERS [1]	
MGT 560	EMPLOYEE STAFFING & DEVELOPMENT [2]	
MGT 561	STRATEGIC COMPENSATION MANAGEMENT [2]	
MGT 562	EMPLOYMENT LAW FOR MANAGERS [2]	
MGT 622	MANAGING HUMAN CAPITAL	
MGT 629	LEADERSHIP: THEORY & PRACTICE	
MGT 631	HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR	
MSC 600	QUANTITATIVE METHODS [1]	
MSC 605	OPERATIONS MANAGEMENT	
MGT 695	STRATEGIC HUMAN RESOURCE MANAGEMENT	
Total Hours		**30**

1 Students whose previous studies include the undergraduate equivalents of ACC 600 and/or MSC 600 can substitute a 3-credit-hour graduate-level course for each applicable course.

2 Students whose previous studies include the undergraduate equivalents of MGT 560, MGT 561, and/or MGT 562 must substitute a 3-credit-hour graduate-level course for each applicable course.

Additional Information

Thesis Option

A thesis option is available. Students interested in this option should contact both the faculty member who the student wants to serve as the thesis advisor, and the Graduate Advisor in the College of Business, before completing 12 hours of graduate study. If selected, the student will register for the MGT 699 Master’s Thesis course for six credit hours in lieu of six credit hours of electives.

Transfer Credit

In accordance with the Graduate School transfer policy (p. 376), students may transfer up to 12 semester hours of acceptable graduate credit earned in an approved institution and may count it toward a master's degree. No transferred credit may be more than 10 years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

The College of Business will only review business discipline course(s) for transfer credit if the institution is accredited by AACSB International (https://www.aacsb.edu/). The Department Chair may, at their discretion, approve or reject the proposed course credit transfer.

Inquiries about the transferability of specific courses should be directed to the Graduate Advisor, who will consult with the Department Chair to determine whether the course will be accepted for transfer credit.

In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the department and by the Graduate Dean prior to the student enrolling at the other institution.

For more information contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building, Room 102
256.824.6732
gradbusiness@uah.edu

Business Analytics, MS

For an overview of the program click here. (https://www.uah.edu/business/grad/degrees/analytics/)

Program Prerequisites

Program prerequisites include a bachelor’s degree in any field and demonstration of competency in statistics.

Degree Requirements

The MS-Business Analytics program consists of 30 semester hours of graduate coursework.

MSC 692, Business Analytics Practicum, is the capstone course and should be taken toward the end of the student's program. A student must earn a grade of B- or higher in MSC 692.

Code	Title	Semester Hours
Required Courses		
ACC 600	FOUNDATIONS OF ACCOUNTING FOR MANAGERS AND ENGINEERS [1]	
IS 571	BUSINESS ANALYTICS & AI	
IS 640	DATA MANAGEMENT AND DATA MINING	
MSC 550	INTRODUCTION TO ANALYTICS AND PROGRAMMING	
MSC 600	QUANTITATIVE METHODS [1]	
MSC 605	OPERATIONS MANAGEMENT	
MSC 610	MODELING & SIMULATION	
MSC 615	DECISION MODELING	
MSC 641	ADVANCED ANALYTICS	
MSC 692	BUSINESS ANALYTICS PRACTICUM	
Total Hours		**30**

1 Students whose previous studies include the undergraduate equivalents of ACC 600 and/or MSC 600 can substitute a 3-credit-hour graduate-level course for each applicable course.

Additional Information

Thesis Option

A thesis option is available. Students interested in this option should contact both the faculty member who the student wants to serve as the thesis advisor and the Graduate Advisor before completing 12 hours of graduate study. If selected, the student will register for the MSC 699 Master's Thesis course for six credit hours in lieu of six credit hours of electives.

Transfer Credit

In accordance with the Graduate School transfer policy (p. 376), students may transfer up to 12 semester hours of acceptable graduate credit earned in an approved institution and may count it toward a master's degree. No transferred credit may be more than 10 years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

The College of Business will only review business discipline course(s) for transfer credit if the institution is accredited by AACSB International (https://www.aacsb.edu/). The Department Chair may, at their discretion, approve or reject the proposed course credit transfer.

Inquiries about the transferability of specific courses should be directed to the Graduate Advisor, who will consult with the department chair to determine whether the course will be accepted for transfer credit.

In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the department and by the Graduate Dean prior to the student enrolling at the other institution.

For more information, contact:

Tressa Hillman-Moore

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Business Administration Building, Room 102
256.824.6732
gradbusiness@uah.edu

Graduate Certificate, Business Analytics

The Graduate Certificate in Business Analytics prepares graduates to employ contemporary business analytics techniques and systems in commercial and governmental environments, and provides students with an understanding of their importance in organizations and their power to enhance organizational performance.

Because it is a graduate program, some of the credit hours earned in the business analytics certificate program can also be applied toward a master's degree. All credits hours earned in the business analytics certificate program can also be applied toward the Master of Science in Business Analytics.

Code	Title	Semester Hours
Required Courses		
IS 571	BUSINESS ANALYTICS & AI [1]	
MSC 550	INTRODUCTION TO ANALYTICS AND PROGRAMMING	
MSC 600	QUANTITATIVE METHODS [2]	
MSC 641	ADVANCED ANALYTICS	
MSC 610	MODELING & SIMULATION	
or MSC 615	DECISION MODELING	
Total Hours		**15**

1 Students whose previous studies include the undergraduate equivalent of IS 571 must substitute a 3-credit-hour graduate course.
2 Students whose previous studies include the undergraduate equivalent of MSC 600 may substitute a 3-credit-hour graduate-level course.

For more information contact:

Tressa Hillman-Moore

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256.824.6732
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Graduate Certificate - Cybersecurity Studies

The Graduate Certificate in Cybersecurity Studies is a specialized program that is designed to prepare students for a range of career opportunities within the cybersecurity field. UAH is certified as a national Center of Academic Excellence in Information Assurance/Cyber Defense Education. The certificate program includes 15 semester hours of classes and covers topics including cryptography, data and information security, network defense, and digital forensics. A subset of these certificate courses may be used to satisfy requirements for the MS-Information Systems and MS-Cybersecurity-Management Track programs.

Code	Title	Semester Hours
Required Courses		
IS 501	CYBERSECURITY PRINCIPLES [1]	
IS 550	CYBERSECURITY MANAGEMENT [1]	
IS 560	NETWORKING & IT INFRASTRUCTURE [1]	
IS 577	NETWORK DEFENSE & SECURITY [1]	
IS 663	COMPUTER FORENSICS	
Total Hours		**15**

1 Students whose previous studies include the undergraduate equivalent of IS 501, IS 550, IS 560, and/or IS 577 must substitute a 3-credit-hour graduate-level course.

For more information contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building Room 102
256.824.6732
gradbusiness@uah.edu

Graduate Certificate, Enterprise Resource Planning

The Graduate Certificate in Enterprise Resource Planning is designed for students who want a more in-depth knowledge of enterprise systems. UAH is a member of the SAP University Alliance, and students will have the opportunity to get hands-on experience using SAP - one of the leading software solutions for enterprise systems. Students completing the certification will also be well positioned to obtain certification as an SAP Business Associate (TERP 10). Training for the certification and discounted certification exams are provided periodically at UAH for students in the program. A subset of the

certificate courses may be used to satisfy some requirements for the MS-Information Systems, MS-Supply Chain Management, MS-Business Analytics, or the MBA program. The required courses for the Graduate Certificate in Enterprise Resource Planning include the following:

Code	Title	Semester Hours
Required Courses		
IS 522	SUPPLY CHAIN MANAGEMENT SYSTEMS [1]	
IS 571	BUSINESS ANALYTICS & AI [1]	
IS 601	MANAGEMENT OF INFORMATION TECHNOLOGY	
IS 640	DATA MANAGEMENT AND DATA MINING	
IS 680	ENTERPRISE RESOURCE PLANNING SYSTEMS	
Total Hours		**15**

1 Students whose previous studies include the undergraduate equivalent of IS 522 and/or IS 571 must substitute a 3-credit-hour graduate-level course.

For more information contact:

Tressa Hillman-Moore

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Business Administration Building Room 102
256.824.6732
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Graduate Certificate, Federal Contracting and Procurement Management

The Graduate Certificate in Federal Contracting and Procurement Management is a program that is designed to provide professional development for students pursuing careers in contract management with either the Federal government or with government contractors. The program is designed for students possessing a bachelor's degree in a field other than federal contracting, acquisition or procurement management. The certificate program consists of 15 semester hours. For students interested in completing both the MBA and the Certificate, a subset of these courses may be used to satisfy course requirements for the Federal Contracting and Procurement concentration within the MBA program. The required courses for the Graduate Certificate in Federal Contracting and Procurement Management include the following:

Code	Title	Semester Hours
Required Courses		**12**
MGT 501	INTRODUCTION TO CONTRACT MANAGEMENT [1]	
MGT 502	CONTRACT EVALUATION & AWARD [1]	
MGT 503	CONTRACT PRICING & COST ANALYSIS [1]	
BLS 506	GOVERNMENT CONTRACT LAW [1]	
Choose one of the following electives:		**3**
ACC 540	BASIC GOVERNMENT CONTRACT ACCOUNTING [2]	
IS 522	SUPPLY CHAIN MANAGEMENT SYSTEMS [2]	
MSC 510	LOGISTICS MANAGEMENT [2]	
Total Hours		**15**

1 Students whose previous studies include the undergraduate equivalent of MGT 501, MGT 502, MGT 503, and/or BLS 506 must substitute a 3-credit-hour graduate course for each applicable course.

2 Students whose previous studies include the undergraduate equivalent of ACC 540, IS 522, and/or MSC 510 must choose a different elective option from the provided list.

For more information contact:

Tressa Hillman-Moore

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Business Administration Building Room 102
256.824.6732

gradbusiness@uah.edu

Graduate Certificate, Human Resource Management

The Graduate Certificate in Human Resource Management prepares graduates to employ contemporary Human Resource Management systems and practices in commercial and governmental environments, and provides students with an understanding of their importance in organizations and their power to enhance organizational performance through Human Resource Management.

All credits hours earned in this certificate program can also be applied towards the MSM – Human Resource Management.

Code	Title	Semester Hours
Required Courses		
MGT 560	EMPLOYEE STAFFING & DEVELOPMENT [1]	
MGT 561	STRATEGIC COMPENSATION MANAGEMENT [1]	
MGT 562	EMPLOYMENT LAW FOR MANAGERS [1]	
MGT 629	LEADERSHIP: THEORY & PRACTICE	
MGT 631	HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR	
Total Hours		**15**

1 HRM certificate students whose previous studies include the undergraduate equivalents of MGT 560 , MGT 561, and/or MGT 562 must substitute a 3-credit-hour graduate-level course for each applicable course.

For more information contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building Room 102
256.824.6732
gradbusiness@uah.edu

Graduate Certificate, Supply Chain Management

The Graduate Certificate in Supply Chain Management is a program that is designed to provide professional development for individuals pursuing careers in logistics and supply chain management with the federal government, government contractors, manufacturers, or service organizations. The program is designed for individuals possessing a bachelor degree in a field other than supply chain management. The certificate program consists of 15 semester hours. For students who are also interested in completing either the MS-Supply Chain Management or the MBA, a subset of the certificate courses may be used to satisfy some of the requirements within those programs. The required courses for the graduate certificate in Supply Chain Management include the following:

Code	Title	Semester Hours
Required Courses		**15**
IS 522	SUPPLY CHAIN MANAGEMENT SYSTEMS	
MSC 510	LOGISTICS MANAGEMENT	
MSC 600	QUANTITATIVE METHODS [1]	
MSC 611	SUPPLY CHAIN MANAGEMENT	
MSC 605	OPERATIONS MANAGEMENT	
Choose one of the following electives if MSC 600 is waived.		
MSC 550	INTRODUCTION TO ANALYTICS AND PROGRAMMING	
MSC 622	ANALYTICS FOR MANAGERS	
MSC 615	DECISION MODELING	
Or other graduate course approved by the MSC faculty		
Total Hours		**15**

1 Students whose previous studies include the undergraduate equivalent of MSC 600 can substitute a 3-credit-hour graduate-level course.

For more information contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building Room 102
256.824.6732
gradbusiness@uah.edu

Graduate Certificate in Technology, Innovation Management, and Entrepreneurship

The Graduate Certificate in Technology, Innovation Management, and Entrepreneurship focuses on management in technology-intensive environments. The certificate program introduces participants to the role technology and innovation play in transforming industries, organizations, and work. It provides insight into the processes of product development, human resource management, marketing, and technical project management within high tech environments. The certificate consists of 15 semester hours. The required courses for the Graduate Certificate in Technology and Innovation Management include the following:

Code	Title	Semester Hours
Required Courses		
MGT 505	NEW VENTURES STRATEGIES	
MGT 601	TECHNOLOGY & INNOVATION MANAGEMENT	
MGT 629	LEADERSHIP: THEORY & PRACTICE	
MGT 631	HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR	
MGT 640	PRINCIPLES OF PROJECT MANAGEMENT	
Total Hours		**15**

For more information contact:

Tressa Hillman-Moore

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Business Administration Building Room 102
256.824.6732
gradbusiness@uah.edu

College of Education - Curriculum and Instruction

323 Roberts Hall
Telephone: 256.824.6180
Email: education@uah.edu
Dean: Beth N. Quick, Ed.D.

Degrees

Master of Science in Kinesiology (M.S.)

Master of Arts in Teaching (M.A.T.) (multiple concentrations; initial teaching certification only)

Master of Education in Differentiated Instruction (M.Ed.) (multiple concentrations; advanced teaching certification; non-certification program)

Master of Science in Applied Behavior Analysis (M.S.)

Graduate Certificate in Autism Spectrum Disorders (does not lead to an ALSDE teaching certificate)

Mission

The College of Education at The University of Alabama in Huntsville is a member of a diverse academic community of teacher scholars that challenges teacher candidates to strive for excellence in all aspects of their lives. The professional environment affords the College of Education unique opportunities to make a difference in the lives of elementary, middle, and high school students regardless of socio-economic backgrounds. In addition, the College educates teacher candidates who will live and work effectively in increasingly complex societies. Consistent with the mission of the university, the College of Education defines its mission through three focal elements:

1. To prepare teachers and other school personnel who are academically strong, competent in both theory and practice and prepared to contribute to the needs of a dynamic, complex world.
2. To provide an environment that encourages the department faculty to model sound pedagogy, engage in research and scholarly activities, and become leaders in their area of expertise.
3. To make our teaching, research, and service available to the entire community in order to meet the changing needs of schools, organizations, and professional communities in our region, state, nation, and international community.

The mission of the College of Education is communicated through our shared vision and articulated in our theme, ***Through Teaching, We Lead***. The establishment of this theme codifies the major purpose of our College: to graduate teachers who are exceptionally well-prepared in disciplinary, pedagogical, and professional knowledge, who understand and are prepared to address the needs of all learners, and who are committed to serving as leaders in the educational community to ensure that all students receive a high-quality public or private education.

Master of Science in Kinesiology (M.S.)

The Master of Science in Kinesiology (MSK) program furthers the education and practical experiences of individuals in health- and human performance-related fields. The Sports Science concentration provides students with advanced classroom content and an immersive practical experience to prepare them for careers in player performance assessment and enhancement. The curriculum exposes students to advanced laboratory measurements, enhances performance assessment skills with cutting-edge technology, and develops expert research skills. MSK Sports Science students will participate in a two-semester Practicum to serve as a Sports Scientist for a team affiliated with UAH Kinesiology. The MSK in Sports Science offers a thesis track option for students looking for advanced opportunities to further their careers. Students will work with a thesis committee to plan, execute, and defend a robust research study.

Master of Education (M.Ed.)

The Department of Curriculum and Instruction provides the Master of Education (M.Ed.) in Differentiated Instruction for teachers already certified at the baccalaureate level and seeking advanced level (Alabama Class A) certification and one non-certification program. The M.Ed. has seven **concentration** areas that include:

- Differentiated Instruction in Elementary Education (K-6)
- Special Education/Collaborative Teaching: Autism Spectrum Disorder (K-6 or 6-12)
- Reading Education (Reading Specialist; P-12)
- English Speakers of Other Languages (ESOL; P-12)
- Differentiated Instruction in Secondary Education (6-12) (biology, chemistry, English language arts, history, mathematics, and physics)
- Visual Impairments (P-12)
- Orientation and Mobility (O&M) (does not lead to ALSDE certification, but students are eligible to sit for ACVREP COMS exam)

Master of Arts in Teaching (M.A.T.) Alternative Fifth Year

The Master of Arts in Teaching (M.A.T.) (or Alternative A program) is available to individuals who have completed a baccalaureate degree from a regionally accredited institution in a field other than teacher education. Students eligible for this program do not have a Class B (baccalaureate level) teaching certificate. Students should contact the Teacher Certification Officer and the advisor in the chosen teaching field for an individual evaluation concerning undergraduate deficiencies prior to initial registration in this program. The Alabama State Department of Education requires all applicants for the secondary education alternative fifth year programs to have an academic major in the teaching field or if an academic major is not on the official transcript, 32 semester hours appropriate to the teaching field, including at least 19 semester hours of upper-division credit.

Certification for alternative fifth-year programs is available in the following areas:

- Elementary (K-6)
- Secondary Biology (6-12)
- Secondary Chemistry (6-12)
- Secondary English Language Arts (6-12)
- Secondary History (6-12)
- Secondary Mathematics (6-12)
- Secondary Physics (6-12)
- English Speakers of Other Languages (P-12)
- Physical Education (P-12) (JUMP option available (http://uah.edu/jump/))
- Music Education - Instrumental (P-12) (JUMP option available (http://uah.edu/jump/))
- Music Education - Choral (P-12) (JUMP option available (http://uah.edu/jump/))
- Collaborative Teaching (K-12) (awaiting ALSDE final approval)

Students interested in pursuing the JUMP programs should reach out to the Department for more details.

Master of Science in Applied Behavior Analysis (M.S. in ABA)

The Master of Science in Applied Behavior Analysis will provide a unique opportunity to support the education of individuals with unique behavior needs by applying rigorous scientific methods to develop programs and services for these individuals. This program will provide a unique opportunity to supply the state with more behavioral analysts. The M.S. in ABA runs on a "cohort model" and only allows students to begin courses every Fall semester.

Graduate Certificate in Autism Spectrum Disorders

The Graduate Certificate in Autism Spectrum Disorders is a professional development opportunity for individuals who want to gain expertise in working with students with autism spectrum disorders. Students enrolled in this program will complete the "ASD" courses provided by UAH. However, this program does NOT lead to an Alabama State Department of Education (ALSDE) teaching certificate. Educators who want to earn a Class A teaching certificate should apply for the M.Ed. program instead. This program is also a "non-degree" program which means that it is not eligible for financial aid.

Accreditation

Teacher education programs in the College of Education at The University of Alabama in Huntsville are accredited by the Council for the Accreditation of Educator Preparation (CAEP) and approved by the Alabama State Board of Education, according to standards of the National Association of the State Directors of Teacher Education and Certification (NASDTEC), for the issuance of appropriate professional certificates for service in public schools. The music education programs are accredited by the National Association of Schools of Music (NASM). The Master of Science in Applied Behavior Analysis is approved as a "Verified Course Sequence" through ABAI.

Master of Arts in Teaching (M.A.T.) Degree Program

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable).
2. GPA of 2.5 or higher in undergraduate courses; no grade lower than C.
3. Degree within the content field (32 hours total, 19 upper division) or a passing score on the required Praxis II Content Area Exam (if degree is outside of content field).
4. Program of Study (POS) on file.

Master of Education (M.Ed.) Degree Program

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable).
2. Valid Alabama Class B or higher Teaching Certificate in same or broader field in which advanced certification is sought. (Students completing the O&M concentration are not required to have a valid teaching certificate nor a degree in education).
3. GPA of 3.0 or higher in undergraduate teaching field courses and education courses.
4. Program of Study (POS) on file.

Additional Requirements for Reading Specialist (P-12) Candidates

1. A valid bachelor's level professional educator certificate in early childhood education, elementary education, or collaborative special education (K-6) and two full years of full-time classroom teaching experience OR a valid bachelor's level professional educator certificate in any area of education, two full years of full-time classroom teaching experience, and a passing score on the current ALSDE-approved "Reading" exam used for certification.

Mid-Point Review (After Completion of 19-21 Semester Hours)

1. Maintain 3.0 or higher GPA in Education and in teaching field courses with no grade lower than C
2. Interview with College of Education advisor and/or faculty to determine pacing in program of study

Completion Requirements

1. Completion of all education and teaching field courses with GPA of 3.25 or higher, no grade lower than C
2. Pass Praxis II exams (as applicable)
3. Satisfactory Completion of Capstone Action Research Project (if applicable)

Certification Requirements for All Master's Degree Programs

Alabama teaching certificates are the legal responsibility of the Alabama State Department of Education. Colleges and universities cannot issue professional teaching certificates. In order to be recommended for certification, candidates must complete a state approved program. Approved graduate

certification programs offered by the UAH College of Education are designed to prepare candidates for professional Class A certification with a master's degree.

It is the candidate's responsibility to initiate the application for the teaching certificate by meeting with the Certification Officer. Candidates must provide official transcripts of all undergraduate and graduate coursework, complete all forms required by the Alabama State Department of Education, and pay appropriate fees. Candidates who expect to teach in states other than Alabama are responsible for knowledge of the licensure requirements of those states. Such candidates should inform the certification officer of their intentions.

Certificate Renewal

1. The Class A certificate is valid for five years. This certification may be renewed upon verification of successful teaching for three years and completion of an approved professional development program or additional graduate level credits in the certification area.
2. Individuals who allow their certificates to lapse for more than 6 months will also be required to renew their certificates and to obtain another background clearance for the issuance of a renewed certificate or license. The UAH College of Education in accordance with the Alabama State Board of Education provides courses for persons who hold expired certificates and wish to reinstate them.

Master of Science in Applied Behavior Analysis (M.S.) Degree Program

Admission Requirements

To be admitted unconditionally, applicants must complete the following:

1. Have a minimum grade-point average of 3.0 on the undergraduate record,
2. Submit a high-quality writing sample with the prompt provided by the Department,
3. Successfully complete an interview with program faculty
4. TOEFL or IELTS (for non-native English speakers):
    a. TOEFL (iBT): all sub-scores greater than or equal to 18 OR
    b. IELTS: all sub-scores greater than or equal to 6.0
5. Program of Study (POS) on file in Education based upon placement assessment

The M.S. in ABA runs on a "cohort model" and only begins every FALL semester.

Professional Licensure

If you are interested in obtaining professional licensure, please check with the appropriate licensing body in the state where you intend to practice. Additional information can be found at https://www.uah.edu/academic-affairs/offices/oirea/state-authorizations/professional-licensures. (https://www.uah.edu/academic-affairs/offices/oirea/state-authorizations/professional-licensures/)

Master of Science in Kinesiology **(**p. 83**)**

Master of Science in Applied Behavior Analysis **(**p. 81**)**

Master of Arts in Teaching Elementary (initial teaching license, Alt-A, for grades K-6)

Master of Arts in Teaching Collaborative (Special Education) (initial teaching license, Alt-A, K-12)

Master of Arts in Teaching (initial teaching license, Alt-A, for grades 6-12)

- Biology (p. 72)
- Chemistry (p. 73)
- English Language Arts (p. 73)
- English Speakers of Other Languages (p. 74)
- History (p. 75)
- Mathematics (p. 75)
- Physics (p. 76)

Master of Arts in Teaching (initial teaching license, Alt-A, for grades P-12)

- Music - Choral Education (p. 77)
- Music - Instrumental Education (p. 77)
- Physical Education (P.E.) (p. 78)

Master of Education (leads to Class A licensure)

- Autism Spectrum Disorders (Collaborative K-6 or 6-12) (p. 68)
- Elementary Education - Differentiated Instruction (Elementary K-6) (p. 69)
- English Speakers of Other Languages (P-12) (p. 70)
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Master of Education (non-licensure or teaching certification)

- Orientation and Mobility (p. 81)

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Teaching English as a Second Language (TESOL) (p. 82)

ED 500 - SPECIAL TOPICS IN EDUCATION
Semester Hours: 1-3

Independent study, special projects, and special in-service programs.

ED 501 - INTRODUCTION TO EDUCATION PRACTICUM
Semester Hours: 0

Initial practicum experience designed to provide the opportunity to explore the role of the classroom teacher in today's diverse school settings. Required for graduate students receiving their initial certification.

ED 510 - FOUNDATIONS OF LITERACY
Semester Hours: 3

This course includes a study of methods, materials, and strategies for reading instruction. Components of the course will include but not be limited to the five pillars of reading instruction identified by the National Reading Panel (2000): phonemic awareness, phonics, fluency, vocabulary, and comprehension. Emphasis is placed on the various stages of and approaches to literacy development, knowledge of which is required for the Alabama Reading Specialist licensure.

ED 513 - LITERATURE FOR CHILDREN AND ADOLESCENTS
Semester Hours: 3

Course content will include the study of various genres of children's and adolescent literature and their relationship to beginning reading, enhancement of reading comprehension, and intervention instruction in the various content areas. (Same as EH 613) Must be admitted to the Teacher Education Program.

ED 520 - COMPUTER BASED INSTRUCTIONAL TECHNOLOGY
Semester Hours: 3

Introduces prospective teachers to current state of the art in educational technology. Extensive hands-on experiences with microcomputers and other emerging technology. Emphasis on effectively integrating technology into instructional setting for both special and regular students.

ED 521 - SECONDARY ELA INSTRUCTION WRITING TO READ
Semester Hours: 2-3

Candidates explore the ways they can use specific writing-to-learn activities to enhance their students' capacity to understand a variety of complex texts. Candidates will learn techniques for engaging students in the questioning, inference-making, syntactical pattern recognition, and meaning-making of both fiction and nonfiction works.

ED 522 - MIDDLE AND SECONDARY SCHOOL MATHEMATICS METHODS
Semester Hours: 2-3

This course is part one in a series of two courses that are designed for teacher candidates who are pursuing teaching certification who are pursuing teaching certification in middle and/or secondary mathematics. This methods course provides background for middle school and secondary teaching from the perspective of theory, research, and practice.

ED 523 - TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS I
Semester Hours: 2-3

This course will focus on how secondary students learn science. Candidates will learn how to develop and design developmentally appropriate lessons in which their students are able to make observations, examine relationships, notice patterns, and make inferences, while confronting naive misconceptions. Candidates will discuss the nature of science (NOS).

ED 524 - TEACHING SOCIAL STUDIES IN MIDDLE AND SECONDARY SCHOOLS I
Semester Hours: 2-3

This course teaches research-based techniques and strategies employed by social science teachers at the secondary levels. As well as learning theoretical foundations and the goal of social science instruction (citizenship skills), students will learn pedagogic skills, instructional strategies, and modes of reasoning unique to the social studies classroom.

ED 530 - APPLIED MULTICULTURALISM
Semester Hours: 3

Through an examination of constructs such as race, ethnicity, social class, gender, sexual orientation, and religious affiliation, students will develop an understanding of the connections between identity, difference, power, and privilege and the role(s) school (could/should) play in perpetuating or ending discriminatory practices. Furthermore and more importantly, students will develop an understanding of the ways research in both the humanities and social sciences can be used to interpret, analyze, and critique multiculturalism. Students will leave the course with research-based pedagogical practices designed to help all students learn to the best of their abilities.

ED 531 - SECONDARY ELA INSTRUCTION READING TO WRITE
Semester Hours: 2-3

In this course, candidates will explore the ways they can use specific reading activities to enhance their students' ability to express themselves in multiple registers and forms of discourse. Candidates will learn techniques for engaging students in the process of developing and expressing their ideas while demonstrating and improved command of the grammatical, syntactical, and discursive elements of language.

ED 532 - SPACE ORIENTATION FOR TEACHERS
Semester Hours: 3

A weeklong course at the U.S. Space and Rocket Center in Huntsville, Alabama for pre-service and in-service teachers. The inquiry based workshops are taught around the theme of space exploration include activities to be done across the curriculum. All activities are correlated to National Math, Science, Technology, Social Studies, and Reading Standards. Activities based on curriculum developed by NASA, CAP, NSATA, and the USSRC. Topics include moon, mars, rocketry, propulsion, hydroponics, math, biology, history and literature.

ED 533 - TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS II
Semester Hours: 2-3

Students will discuss the status of science education in our nation's schools, and the need for implementing research-based strategies in the classroom using the 5E learning cycle as framework.

ED 534 - TEACHING SOCIAL STUDIES IN MIDDLE AND SECONDARY SCHOOLS II
Semester Hours: 2-3

This methods course is designed to study effective techniques and strategies employed by social science teachers at the middle and secondary levels. As well as learning theoretical foundations in social studies education, students will learn pedagogic skills, instructional strategies, and modes of reasoning unique to the social studies classroom.

ED 535 - INTRODUCTION TO APPLIED EDUCATIONAL RESEARCH
Semester Hours: 3

Introduction to the nature of research and its relationship to educational thought and practice. Primary focus will be on planning and executing research activities (i.e. action research, thesis development) in the diverse classroom and analyzing the collected data to improve instruction, educational performance, and adding to the body of knowledge in educational practices.

ED 539 - TEACHING REASONING AND PROOF IN SECONDARY MATHEMATICS
Semester Hours: 2-3

This methods course provides background for middle school and secondary teaching from the perspective of theory, research, and practice. It is designed to provide an introduction to and practice in ways in which to encourage students in mathematical reasoning and proof.

ED 540 - COGNITIVE DEVELOPMENT THEORIES OF LEARNING
Semester Hours: 3

The course is designed to inform students about recent developments in Cognitive Psychology and their implications for teaching and learning. Students will leave the course with a variety of "cognitive understandings" for use in differentiated classrooms.

ED 545 - CURRICULUM AND INSTRUCTION IN SECONDARY SCHOOLS
Semester Hours: 3

This course is designed to address various contemporary teaching and learning strategies, as well as related issues, assessments strategies, and applicable theories related to secondary teaching and learning.

ED 560 - CURRICULUM AND EMERGING INSTRUCTIONAL TECHNOLOGY
Semester Hours: 3

Designed to build competency in computer technologies appropriate to instructional use. Concepts of authoring and scripting will be used to unify course materials. (Same as CS 560.).

ED 565 - INTRODUCTION TO DIFFERENTIATED INSTRUCTION
Semester Hours: 3

The course provides an introduction to the philosophy and practice of differentiation. Students will examine the elements, content, process, product, affect and environment by which instruction can be differentiated to address the complex challenges of meeting the diverse learning needs of all students.

ED 570 - DIFFERENTIATED INSTRUCTION FOR SPECIAL POPULATIONS
Semester Hours: 3

The course provides practical strategies to maximize learning for all students, particularly those with disabilities, gifted/talented, and English language learners (ELL).

ED 575 - READING IN THE PRIMARY GRADES
Semester Hours: 3

An introduction to the basic principles of literary instruction in culturally and linguistically diverse primary grade classrooms, including theoretical bases for instruction, methods of instruction and organization, developmentally appropriate strategies and materials, and assessment of children's literacy. Class activities include mini-lessons, discussions, group activities, and presentations. An intensive school-based practicum in grades preK-2 is required.

ED 580 - PROJECT BASED LEARNING
Semester Hours: 3

Develop a robust understanding of Project Based Learning (PBL) through critiquing, evaluating, and synthesizing PBL's core theoretical concepts.

ED 593 - EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS
Semester Hours: 3

Introduction to the field of exceptional children and youth, including observations. This course, or equivalent, is a prerequisite to certification. Intensive field experience required.

ED 600 - SPECIAL PROBLEMS IN EDUCATION
Semester Hours: 1-3

Independent study, special projects, and in-service programs.

ED 604 - CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION
Semester Hours: 3

Principles, theory, and practice of psychology for teaching and administrative service in educational institutions. Factors that determine learning and conditions of effective teaching. Administrator and supervisor as organizer of the milieu wherein teaching, learning, and growth occur. Intensive field required.

ED 605 - REACHING RESEARCH AND INSTRUCTION
Semester Hours: 3

Elements of effective reading instruction for beginning readers as supported by current research and practice. Topics include balance, language-rich/print-rich environment, language development, phonemic awareness, print awareness, phonics, writing, spelling, and comprehension. Intensive field experience required.

ED 607 - EDUCATIONAL LEADER AS THE EVALUATOR
Semester Hours: 3

Procedures and techniques of evaluation and research approaches. Emphasis on teachers as evaluators; based on action research in the classroom. Intensive field experience required.

ED 608 - EXPANDING READING ABILITY IN THE CONTENT AREA
Semester Hours: 3

Strategies to enhance reading comprehension when using materials in all subject areas. Teacher directed, integrated instruction; extensive use of authentic printed materials; discussion at literal and higher levels of understanding, motivation, vocabulary, and writing. Intensive field experience required.

ED 609 - CLASSROOM AND BEHAVIOR MANAGEMENT
Semester Hours: 3

A focus on the variety of instructional management options to meet classroom and individual student needs to ensure success in school is integrated throughout all course activities. A range of management practices, including strategies for diverse and special populations is offered. Theoretical and reflective practices are incorporated during classroom meetings. Students will observe, research, and discuss current classroom approaches. After reflections, effectiveness of observed practices will be assessed. Student will discuss and develop alternative activities that promote successful management techniques. Intensive field experience required. Admission to the Teacher Education program or permission of chair is required for this class.

ED 610 - TEACHING FINE ARTS IN THE ELEMENTARY SCHOOL
Semester Hours: 2-3

This course covers multiple aspects of fine arts education including the use of content, functions, and achievements of the performing arts (dance, music, theatre) and visual arts as primary media for communication, inquiry, and engagement among elementary students.

ED 612 - DIAGNOSIS AND ASSESSMENT OF READING
Semester Hours: 3

Focuses on ways to address the needs of students who do not read at grade level. Intervention strategies such as on-going assessment and evaluation, explicit instruction in phonemic awareness and phonics, extensive practice, comprehension strategies, and writing, along with careful examination of standardized state assessment measures. Intensive field experience required.

ED 615 - READING IN THE INTERMEDIATE GRADES
Semester Hours: 3

This course provides an in-depth study in and application of the process of reading and reading instruction, theoretical approaches, instructional strategies, classroom organization, and the formal/informal assessment of reading in intermediate grades. This course is required of all elementary education majors and secondary education candidates who are pursuing a middle school endorsement. Intensive field experience required. Prerequisites: Admission to the Teacher Education Program.

ED 620 - USING TECHNOLOGY FOR SPECIAL POPULATIONS
Semester Hours: 3

Prepares teachers to plan curriculum integration by using computer technology and software in various curriculum areas for both regular and special students. Students will develop competency in instructional design and production skill techniques and implement instructional events using long-distance technologies.

ED 635 - USING ASSESSMENT TO GUIDE DIFFERENTIATED INSTRUCTION
Semester Hours: 3

The focus of this course would be to use a variety of norm-referenced, criterion-referenced and other assessment data to inform instruction for a diverse classroom within the RTi model. Students would learn to use formative and summative assessments to determine the type of strategies needed to teach content.

ED 650 - DIFFERENTIATING ELEMENTARY MATHEMATICS AND SCIENCE INSTRUCTION
Semester Hours: 3

This course will focus on guiding the learner to apply the concepts of differentiated instruction within mathematics and science contexts. Participants will learn how to implement effective strategies for managing flexible groups, acquire ideas for providing students with a variety of options to successfully target mathematics and science standards and understand how to plan strategically in order to reach the needs of diverse learners within the classroom through inquiry-based learning.

ED 665 - DIFFERENTIATING ELEMENTARY LITERACY (READING AND WRITING INSTRUCTION)
Semester Hours: 3

This course will focus on guiding the learner to apply the concepts of differentiated instruction to elementary literacy concepts. Advanced teacher candidates will develop and implement differentiated instructional plans that utilize individual and flexible grouping strategies and resources to support the growth of strategic, independent readers and writers.

ED 671 - TEACHING ELEMENTARY LANGUAGE ARTS
Semester Hours: 3

Introduction to current practices in language arts instruction with emphasis on the development of an integrated curriculum using children's literature as a foundation. Includes appropriate techniques for teaching of grammar, spelling, and handwriting. Intensive field experience required. Prerequisites: Admission to the Teacher Education Program.

ED 672 - TEACHING ELEMENTARY SOCIAL STUDIES
Semester Hours: 3

Teaching social studies in grades K-6. Helping beginning teachers acquire background skills in organizing and teaching units of work. Intensive field experience required. Prerequisites: Admission to the Teacher Education Program.

ED 673 - TEACHING NATURAL AND HEALTH SCIENCE
Semester Hours: 3

Integrates concepts from reflective practice with elementary science teaching. Opportunity to refine teaching skills in the planning, implementation, and evaluation of science lessons and units of instruction. Intensive field experience required. Prerequisites: Admission to the Teacher Education Program.

ED 674 - TEACHING ELEMENTARY MATHEMATICS
Semester Hours: 3

Overview of the mathematics concepts and skills taught in grades K-6 with an emphasis on the principles, methods, and materials used in the teaching and evaluation of elementary school mathematics. Focuses on the attitudes and behaviors of students and teachers in the actual planning and implementation of mathematics instruction for an elementary school classroom. Intensive field experience required. Prerequisite: Admission to the Teacher Education Program.

ED 690 - MASTER'S ACTION RESEARCH PROJECT
Semester Hours: 3

The capstone course will serve as a mechanism to support the research, methodology, development, and experimental stages of the required action research. The student's work will be approved and supervised by a selected faculty advisor with direct connections to the research area. A symposium in which students present their research report will be culminating activity.

ED 691 - PORTFOLIO SEMINAR & SYMPOSIUM
Semester Hour: 1

The seminar will provide a forum in which the student's culminating portfolio is refined and submitted for faculty review. The seminar will also serve as a mechanism to support the final writing stages of the required action research project or case study report. The student's work will be approved and supervised by the faculty advisor(s). A symposium in which students present their research will be the culminating activity.

ED 692 - ADVANCED P-12 INTERNSHIP
Semester Hours: 3

This internship is for students in advanced programs. The internship is completed throughout the program with a culminating portfolio of all internship assignments.

ED 693 - ELEMENTARY INTERNSHIP
Semester Hours: 3-6

Observation, participation and teaching in elementary school (full time, 15 week semesters). Students will also attend campus-based seminars designed to meet specific needs of the interns.

ED 696 - P-12 INTERNSHIP
Semester Hours: 3-6

ED 698 - HIGH SCHOOL INTERNSHIP
Semester Hours: 3-6

Observation, participation, and teaching in middle/high school (full-time, 15 week semester). Students will also attend campus based seminars designed to meet specific needs of interns.

EDC 511 - INSTRUCTIONAL STRATEGIES IN INCLUSIVE CLASSROOMS
Semester Hours: 3

This course provides foundational, in-depth pedagogical strategies for assisting learners in constructing their own understanding of information. This course focuses on multiple instructional options that all learners need in order to be successful. It takes a broad approach to the multiple teaching models that are necessary for working with diverse populations. Prerequisite w/concurrency: ED 501.

EDC 551 - FOUNDATIONS OF VISUAL IMPAIRMENTS
Semester Hours: 3

Introduction to academic language found within the profession of special education of students with visual impairments. Examines standards, organizations, programs, and services for students with visual impairments. Studies the basic anatomy, diseases, and disorders of the visual system and explores how to conduct a Functional Vision Assessment.

EDC 560 - INTERMEDIATE ORIENTATION AND MOBILITY SKILLS
Semester Hours: 3

Development of orientation and mobility skills for individuals who are blind and visually impaired. Topics include human guide, indoor travel, and residential travel.

EDC 561 - ADVANCED ORIENTATION AND MOBILITY SKILLS
Semester Hours: 3

Development of advanced orientation and mobility skills for individuals who are blind or visually impaired. Topics include business travel, rural travel, and specialized travel.

EDC 610 - BEHAVIORAL ASSESSMENT
Semester Hours: 3

This course will provide an introduction to the strategies, methods, and ethics associated with behavioral assessment. The defining characteristics, strengths, and weaknesses of indirect assessments, descriptive assessments, and functional analysis will be reviewed. Students will learn to differentiate between and implement each type of assessment method. Assessment data collection, analysis, and interpretation will be discussed in the context of identifying appropriate behavioral interventions and goals. Prerequisites: EDC 612, EDC 613 adn EDC 614.

EDC 611 - ETHICS AND PROFESSIONALISM IN APPLIED BEHAVIOR ANALYSIS
Semester Hours: 3

This course will familiarize the student with ethical and professional responsibilities for Board Certified Behavior Analysts. Ethical decision-making processes will be emphasized with respect to the ethical guidelines set forth by the BACB (C), and the relationship between ethics, policy, and law will be explored.

EDC 612 - FUNDAMENTALS OF APPLIED BEHAVIOR ANALYSIS I
Semester Hours: 3

This course will introduce students to the goals, philosophical assumptions, and dimensions of applied behavior analysis. Students will also be introduced to the basic concepts and principles of behavior analysis including, but not limited to, respondent and operant conditioning, reinforcement and punishment contingencies, schedules of reinforcement, extinction, motivating operations, and automatically and socially mediated consequences. The concepts and principles will be discussed with respect to how they are relevant to socially significant behavior.

EDC 613 - FUNDAMENTALS OF APPLIED BEHAVIOR ANALYSIS II
Semester Hours: 3

Students will describe and explain behavior from the perspective of radical behaviorism and distinguish among behaviorism, the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. Students will be able to define and provide examples of more complex concepts and principles such as stimulus control, discrimination, generalization, verbal operants, and derived stimulus relations. Prerequisites: EDC 612.

EDC 614 - RESEARCH METHODS OF APPLIED BEHAVIOR ANALYSIS
Semester Hours: 3

The purpose of this course is to introduce students to the fundamentals of behavior analytic research methods. The course will examine the strategies and tactics used in single-subject research to implement socially important behavior change. Prerequisite: EDC 612.

EDC 615 - INTERVENTIONS IN APPLIED BEHAVIOR ANALYSIS
Semester Hours: 3

This course will prepare students to identify and implement effective, data-based behavior-change procedures and interventions in applied settings. Elements of behavior change and procedures to accomplish behavior increases, decreases, generalization, and maintenance will be examined. Emphasis will be placed on reinforcement, schedules of reinforcement, extinction, and alternate treatment procedures. This course will also examine strategies, teaching self-management, group-oriented contingencies, shaping techniques, behavior chains, motivational systems, punishment, and other topics. Students will learn how to select and implement function-based interventions for the reduction of problem behaviors and skills-based prevention strategies. Prerequisites: EDC 612, EDC 613 and EDC 614.

EDC 616 - SUPERVISION AND MANAGEMENT IN APPLIED BEHAVIOR ANALYSIS
Semester Hours: 3

This course will prepare students to conduct supervision using the principles of behavior analysis. Students will develop performance expectations based on the context, select individualized, assessment-based goals to develop supervisee skills, develop function-based strategies to improve supervisee performance, and design staff training procedures based on behavior analytic research. Prerequisites: EDC 610, EDC 612, EDC 613, EDC 614 and EDC 615.

EDC 617 - INTRODUCTION TO SUPERVISED FIELDWORK IN APPLIED BEHAVIOR ANALYSIS
Semester Hours: 1-3

This course will introduce students to supervised experience through the practice of applied behavior analysis in clinical and academic settings, such as an outpatient clinic and a child development center. This course may be repeated.

EDC 625 - ASSISTIVE TECHNOLOGY FOR EDUCATING INDIVIDUALS WITH ASD
Semester Hours: 3

This course provides an overview of assistive technology devices and services that are used in the instruction of students with autism spectrum disorders (ASD) and other communication disabilities.

EDC 636 - INTRODUCTION TO STUDENTS WITH AUTISM SPECTRUM DISORDERS
Semester Hours: 3

This course will provide advanced teacher candidates with an introduction to working with students diagnosed with autism spectrum disorders. Candidates will develop an understanding of the range of characteristics and behaviors associated with ASD, the effectives of early intervention on behaviors, and the theories regarding the etiology of the disorder.

EDC 645 - ASSESSMENT AND BEHAVIORAL APPLICATIONS IN ASD
Semester Hours: 3

This course focuses on assessment and intervention planning for children with ASD. Candidates will enhance their knowledge of various assessments appropriate to the ASD population and develop skills to administer and interpret assessments. The course will provide candidates with an overview of the Applied Behavioral Analysis approach to assessing and teaching students with ASD.

EDC 652 - INTRODUCTION TO ORIENTATION AND MOBILITY
Semester Hours: 3

Examines the psychosocial implications of blindness, with a particular focus on independence. Exploration of basic orientation mobility concepts including human guide and basic independent travel through the use of verbal description and tactile graphics.

EDC 653 - PRACTICUM FOR TEACHING STUDENTS WITH VISUAL IMPAIRMENTS
Semester Hours: 3

Examines the strategies used to make education accessible to students with visual impairments through the creation of high-quality accommodations and/or modifications. Topics include organization, assessment, early intervention, and the expanded core curriculum. This course is a practicum for visual impairments.

EDC 654 - INTRODUCTION TO BRAILLE LITERACY
Semester Hours: 3

Focused exploration of braille, braille literacy, and braille assessment.

EDC 655 - COLLABORATION AND TRANSITION PLANNING
Semester Hours: 3

Using case-based instructional strategies, this course is designed to assist advanced teacher candidates in learning to build supportive relationships with families, paraprofessionals, and related service providers, including community agencies, as a foundation for designing differentiated learning experiences for students with disabilities.

EDC 656 - PROGRAMS FOR STUDENTS WITH VISUAL IMPAIRMENTS AND MULTIPLE DISABILITIES/DEAFBLIND
Semester Hours: 3

Intensive examination of curricular adaptations, assessment, and intervention for students with multiple disabilities and visual impairments or deafblindness.

EDC 657 - ADVANCED BRAILLE AND ASSISTIVE TECHNOLOGY
Semester Hours: 3

Focused exploration of the braille for use in various contexts (STEM, music, foreign language), assistive technology and STEM education for students with visual impairments.

EDC 660 - PRACTICAL APPLICATIONS OF VISUAL INSTRUCTIONAL STRATEGIES
Semester Hours: 3

Advanced candidates will participate in an extensive summer clinic for children with ASD. Candidates learn how to create an appropriate learning environment, organize schedules for individual students, develop materials, engage in instruction, respond to behavioral issues, and document student progress.

EDC 662 - INTERMEDIATE ORIENTATION AND MOBILITY SEMINAR
Semester Hours: 3

Focuses on research practices and problem areas in intermediate orientation and mobility services for students with visual impairments and additional disabilities.

EDC 663 - ADVANCED ORIENTATION AND MOBILITY SEMINAR
Semester Hours: 3

Focuses on research practices and problem areas in advanced orientation and mobility services for students with visual impairments and additional disabilities.

EDC 682 - O&M AND STUDENTS WITH MULTIPLE DISABILITIES
Semester Hours: 3

Focuses on orientation and mobility planning and instruction for students with visual impairments and other disabilities.

EDC 692 - ORIENTATION AND MOBILITY INTERNSHIP
Semester Hours: 1-3

This variable hour course is the cumulative internship course where students complete the internship required to become a Certified Orientation and Mobility Specialist (COMS). The internship is composed of 350 hours working directly with a COMS.

Autism Spectrum Disorders (Collaborative K-6 or 6-12), M.Ed.

Description of the Program

A focus on how to plan, instruct, conduct assessments and collaborate to maximize learning opportunities for students with Autism Spectrum Disorders.

Admission Requirements

- Student must hold a minimum of a bachelor's degree.
- Student must hold a teaching certificate in education (any content area).

Program Requirements

Code	Title	Semester Hours
Core Courses		
ED 530	APPLIED MULTICULTURALISM	3
ED 535	INTRODUCTION TO APPLIED EDUCATIONAL RESEARCH	3
ED 540	COGNITIVE DEVELOPMENT THEORIES OF LEARNING	3
ED 565	INTRODUCTION TO DIFFERENTIATED INSTRUCTION	3
Concentration Courses		
Any graduate courses (500+) with ED or EDC prefix with Department Approval		18
Recommended Courses:		
ED 570	DIFFERENTIATED INSTRUCTION FOR SPECIAL POPULATIONS	
EDC 625	ASSISTIVE TECHNOLOGY FOR EDUCATING INDIVIDUALS WITH ASD	
EDC 636	INTRODUCTION TO STUDENTS WITH AUTISM SPECTRUM DISORDERS	
EDC 645	ASSESSMENT AND BEHAVIORAL APPLICATIONS IN ASD	
EDC 655	COLLABORATION AND TRANSITION PLANNING	
EDC 660	PRACTICAL APPLICATIONS OF VISUAL INSTRUCTIONAL STRATEGIES	
Action Research Project		
ED 690	MASTER'S ACTION RESEARCH PROJECT	3
Total Semester Hours		**33**

Autism Spectrum Disorders Certificate

Program Description

This graduate certificate prepares students to meet the educational needs of learners with autism spectrum disorder (ASD). Students will be taught the characteristics of ASD, how to assess ASD learner needs, and how to identify social and communication profiles of ASD learners. The certificate will equip students to teach educational strategies which benefit ASD learners.

Increasing numbers of those identified with ASD require the skills and expertise of trained professionals. UAH's online/hybrid ASD Graduate Certificate is **a non-licensure program** designed for teachers and human service agency staff to acquire these skills and expertise. This Graduate Certificate meets the Professional Content Standards of the Council for Exceptional Children (CEC) and, offers students the opportunity to pursue graduate-level education through the flexibility of online/hybrid learning from UAH faculty and ASD professionals.

The ASD Graduate Certificate is ideal for educators, interventionists, psychologists, pathologists, behavior analysts, and family members who want to enhance their preparation for working with children and adults who have ASD. Teacher certification is not a requirement for admission to this program.

This program does NOT lead to a ALSDE Teaching Certificate.

Program completers will be prepared to:

- Work as public school teachers in a broad range of educational settings, including the general education classroom and special education programs
- Work as human service agency personnel implementing research-validated intervention strategies for children, youth and adults in community agencies
- Implement research-validated instruction/intervention strategies for children, youth and young adults with autism spectrum disorders
- Assess the effectiveness of individualized instruction/intervention programs for individuals with autism spectrum disorders

This 15-credit graduate certificate program consists of five classes. The graduate certificate can be completed as a stand-alone certificate, or a maximum of 12 semester hours (four credits) can be applied toward the degree requirements for a Master of Education (M.Ed.).

Admission Requirements

The items listed below are required for admission to this program; only complete files are reviewed.

1. Baccalaureate degree from a regionally accredited institution
2. GPA of 3.000, or at least 3.000 for the last 30 semester credits of graded course work
3. Complete a Graduate School Application indicating Graduate Certificate for ASD

Requirements

Code	Title	Semester Hours
EDC 636	INTRODUCTION TO STUDENTS WITH AUTISM SPECTRUM DISORDERS	3
EDC 645	ASSESSMENT AND BEHAVIORAL APPLICATIONS IN ASD	3
EDC 655	COLLABORATION AND TRANSITION PLANNING	3
EDC 625	ASSISTIVE TECHNOLOGY FOR EDUCATING INDIVIDUALS WITH ASD	3
EDC 660	PRACTICAL APPLICATIONS OF VISUAL INSTRUCTIONAL STRATEGIES	3
Total Hours		**15**

Elementary Education - Differentiated Instruction (Elementary K-6), M.Ed.

Description of the Program

This master's program focuses on how to adjust instruction and assessment to maximize learning opportunities for all students in the K-6 classroom.

Admission Requirements

To be admitted to this program, a student must

- hold a minimum of a bachelor's degree, and
- hold a teaching certificate in education (any content area).

Program Requirements

Code	Title	Semester Hours
Core Courses		
ED 530	APPLIED MULTICULTURALISM	3
ED 535	INTRODUCTION TO APPLIED EDUCATIONAL RESEARCH	3
ED 540	COGNITIVE DEVELOPMENT THEORIES OF LEARNING	3
ED 565	INTRODUCTION TO DIFFERENTIATED INSTRUCTION	3
Concentration Courses		
ED 570	DIFFERENTIATED INSTRUCTION FOR SPECIAL POPULATIONS	3
ED 620	USING TECHNOLOGY FOR SPECIAL POPULATIONS	3
ED 635	USING ASSESSMENT TO GUIDE DIFFERENTIATED INSTRUCTION	3
ED 650	DIFFERENTIATING ELEMENTARY MATHEMATICS AND SCIENCE INSTRUCTION	3
ED 665	DIFFERENTIATING ELEMENTARY LITERACY (READING AND WRITING INSTRUCTION)	3
ESL 640	INSTRUCTIONAL AND EVALUATION OF LANGUAGE USAGE	3
Action Research Project		
ED 690	MASTER'S ACTION RESEARCH PROJECT	3
Total Semester Hours		**33**

English Speakers of Other Languages (P-12), M.Ed.

Description of the Program

This master's program focuses on how to best support the needs of students whose native language is not English, facilitates professional development and offers resources to teachers, students and families, and differentiates instruction and assessment for English language learners.

Admission Requirements

To be admitted to the program, a student must

- hold a minimum of a bachelor's degree, and
- hold a teaching certificate in education (any content area).

Program Requirements

Code	Title	Semester Hours
Core Courses		
ED 530	APPLIED MULTICULTURALISM	3
ED 535	INTRODUCTION TO APPLIED EDUCATIONAL RESEARCH	3
ED 540	COGNITIVE DEVELOPMENT THEORIES OF LEARNING	3
ED 565	INTRODUCTION TO DIFFERENTIATED INSTRUCTION	3
Concentration Courses		
ESL 500	POLICY AND PRACTICE IN EDUCATIONAL LINGUISTICS	3
ESL 510	INTRODUCTION TO LANGUAGE SYSTEMS	3
ESL 520	INSTRUCTIONAL AND ACADEMIC LANGUAGE ACROSS CONTENT DOMAINS	3
ESL 640	INSTRUCTIONAL AND EVALUATION OF LANGUAGE USAGE	3
ED 635	USING ASSESSMENT TO GUIDE DIFFERENTIATED INSTRUCTION	3
ED 692	ADVANCED P-12 INTERNSHIP	3
Action Research Project		
ED 690	MASTER'S ACTION RESEARCH PROJECT	3
Total Semester Hours		**33**

Master of Arts in Teaching - Elementary Education

Description of the Program

This program is intended for students with at least a bachelor's degree in a non-education field who intend to become elementary educators (K-6). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Elementary Education (K-6).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. GPA of 2.500 or higher from an accredited undergraduate program
3. Passing score on required Praxis II Content Area Exam (Multiple Subjects)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
Curriculum		
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
Methods of Teaching		
EDC 511	INSTRUCTIONAL STRATEGIES IN INCLUSIVE CLASSROOMS (Taken concurrently with ED 501)	3
Diverse Populations		
ED 530	APPLIED MULTICULTURALISM	3
Literacy		
ED 575	READING IN THE PRIMARY GRADES	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
Professionalism		
ED 501	INTRODUCTION TO EDUCATION PRACTICUM (Taken concurrently with EDC 511)	0
Using Assessment Data to Improve Student Learning		
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
Survey of Special Education Coursework		
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
Internship		
ED 693	ELEMENTARY INTERNSHIP	3
Teaching Field		
ED 615	READING IN THE INTERMEDIATE GRADES	3
ED 671	TEACHING ELEMENTARY LANGUAGE ARTS	3
ED 672	TEACHING ELEMENTARY SOCIAL STUDIES	3
ED 673	TEACHING NATURAL AND HEALTH SCIENCE	3
ED 674	TEACHING ELEMENTARY MATHEMATICS	3
ED 610	TEACHING FINE ARTS IN THE ELEMENTARY SCHOOL	2
KIN 564	HEALTH AND PE FOR THE ELEMENTARY TEACHER	2
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**46**

Master of Arts in Teaching - P-12 Collaborative K-12

Description of the Program

This program is intended for individuals with at least a bachelor's degree in a non-education field who intend to become collaborative teachers (special education) (K-6 and 6-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificates in Collaborative Teaching, K-6 and 6-12.

***This program is awaiting approval by the Alabama State Department of Education with an anticipated start in Spring 2024.**

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. GPA of 2.500 or higher from an accredited undergraduate program
3. Passing score on required Praxis II Content Area Exam (multiple subjects)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
EDC 511	INSTRUCTIONAL STRATEGIES IN INCLUSIVE CLASSROOMS	3
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 575	READING IN THE PRIMARY GRADES	3
ED 615	READING IN THE INTERMEDIATE GRADES	3
ED 665	DIFFERENTIATING ELEMENTARY LITERACY (READING AND WRITING INSTRUCTION)	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
or ED 530	APPLIED MULTICULTURALISM	
EDC 636	INTRODUCTION TO STUDENTS WITH AUTISM SPECTRUM DISORDERS	3
Teaching Field (courses to be developed)		15
EDC 602: Differentiated Instruction Across the Age-Span		
EDC 521: Collaborative Consultations		
EDC 502: Low Incidence Populations		
EDC 651: Behavioral, Analytical, and Interventions		
EDC 631: Critical Issues in Special Education		
ED 696	P-12 INTERNSHIP	3-6
Total Semester Hours		**42-45**

Teaching, MA - Biology

Description of the Program

This program is intended for individuals with at least a bachelor's degree in a biology or a biology-related field who intend to become a secondary biology educator (6-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Secondary Biology (6-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.500 or higher
3. Passing score on required Praxis II Content Area Exam OR a degree in BIOLOGY (32 hours, 19 upper division)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 523	TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS I	2
ED 533	TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS II	2
ED 530	APPLIED MULTICULTURALISM	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3

ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 698	HIGH SCHOOL INTERNSHIP	3
Biology Content Courses 500+		15
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**43**

Teaching, MA - Chemistry

Description of the Program

This program is intended for students with at least a bachelor's degree in a chemistry or a chemistry-related field who intend to become secondary chemistry educators (6-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Secondary Chemistry (6-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.500 or higher
3. Passing score on required Praxis II Content Area Exam OR a degree in CHEMISTRY (32 hours, 19 upper division)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 523	TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS I	2
ED 533	TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS II	2
ED 530	APPLIED MULTICULTURALISM	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 698	HIGH SCHOOL INTERNSHIP	3
Chemistry Content Courses 500+		15
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**43**

Teaching, MA - English Language Arts

Description of the Program

This program is intended for individuals with at least a bachelor's degree in an English or an English-related field who intend to become a secondary English educator (6-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Secondary English (6-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.750 or higher
3. Passing score on required Praxis II Content Area Exam
4. Program of Study on file in Education

5. Students must have undergraduate or graduate courses in two areas: Journalism, Media, and/or Theater. If not completed during their undergraduate program, students may be required to take extra courses within these areas.

Program Requirements

Code	Title	Semester Hours
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 521	SECONDARY ELA INSTRUCTION WRITING TO READ	2
ED 531	SECONDARY ELA INSTRUCTION READING TO WRITE	2
ED 530	APPLIED MULTICULTURALISM	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 698	HIGH SCHOOL INTERNSHIP	3
English Content Courses		
EH 500	COMPOSITION STUDIES FOR TEACHERS	3
or EH 601	ACTION RESEARCH IN WRITING STUDIES	
English 500+		9
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
ESL 510	INTRODUCTION TO LANGUAGE SYSTEMS	3
or ESL 520	INSTRUCTIONAL AND ACADEMIC LANGUAGE ACROSS CONTENT DOMAINS	
Total Semester Hours		**43**

Teaching, MA - English Speakers of Other Languages

Description of the Program

The English Speakers of Other Languages (ESOL) program is intended for students with at least a bachelor's degree who intend to become ESOL teachers (P-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in ESOL (P-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.500 or higher
3. Passing score on required Praxis II Content Area Exam OR a degree in FOREIGN LANGUAGES or ENGLISH or LINGUISTICS (32 hours, 19 upper division) (other degrees will be reviewed by the Department)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
EDC 511	INSTRUCTIONAL STRATEGIES IN INCLUSIVE CLASSROOMS	3
ED 575	READING IN THE PRIMARY GRADES	3
ED 672	TEACHING ELEMENTARY SOCIAL STUDIES	3
ED 673	TEACHING NATURAL AND HEALTH SCIENCE	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 530	APPLIED MULTICULTURALISM	3

ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ESL 640	INSTRUCTIONAL AND EVALUATION OF LANGUAGE USAGE	3
ESL 500	POLICY AND PRACTICE IN EDUCATIONAL LINGUISTICS	3
ESL 520	INSTRUCTIONAL AND ACADEMIC LANGUAGE ACROSS CONTENT DOMAINS	3
ESL 510	INTRODUCTION TO LANGUAGE SYSTEMS	3
ED 696	P-12 INTERNSHIP	3-6
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**45-48**

Teaching, MA - History

Description of the Program

This program is intended for students with at least a bachelor's degree in a history or a history-related field who intend to become secondary history educators (6-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Secondary History (6-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.5 or higher
3. Passing score on required Praxis II Content Area Exam OR a degree in HISTORY or SOCIAL SCIENCE (32 hours, 19 upper division)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 524	TEACHING SOCIAL STUDIES IN MIDDLE AND SECONDARY SCHOOLS I	2
ED 534	TEACHING SOCIAL STUDIES IN MIDDLE AND SECONDARY SCHOOLS II	2
ED 530	APPLIED MULTICULTURALISM	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 698	HIGH SCHOOL INTERNSHIP	3
History Content Courses 500+		15
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**43**

Teaching, MA - Mathematics

Description of the Program

This program is intended for students with at least a bachelor's degree in a mathematics or a mathematics-related field who intend to become secondary mathematics educators (6-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Secondary Mathematics (6-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.500 or higher
3. Passing score on required Praxis II Content Area Exam OR a degree in MATH or STATISTICS (32 hours, 19 upper division)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 522	MIDDLE AND SECONDARY SCHOOL MATHEMATICS METHODS	2
ED 539	TEACHING REASONING AND PROOF IN SECONDARY MATHEMATICS	2
ED 530	APPLIED MULTICULTURALISM	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 698	HIGH SCHOOL INTERNSHIP	3
Mathematics Content Courses 500+		15
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**43**

Teaching, MA - Physics

Description of the Program

This program is intended for students with at least a bachelor's degree in a physics or a physics-related field who intend to become secondary physics educators (6-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Secondary Physics (6-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.500 or higher
3. Passing score on required Praxis II Content Area Exam OR a degree in PHYSICS or SPACE SCIENCE (32 hours, 19 upper division)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 523	TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS I	2
ED 533	TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS II	2
ED 530	APPLIED MULTICULTURALISM	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 698	HIGH SCHOOL INTERNSHIP	3
Physics Content Courses 500+		15
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**43**

Teaching (P-12), MA - Music Education: Choral

Description of the Program

This program is intended for individuals with at least a bachelor's degree in a music-related area who intends to become a music - choral education (P-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Music: Choral Education (P-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.750 or higher
3. Passing score on required Praxis II Content Area Exam OR a degree in MUSIC (32 hours, 19 upper division)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
Professional Studies		
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 530	APPLIED MULTICULTURALISM	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
MUE 527	TEACHING GENERAL MUSIC	3
MUE 528	VOCAL/CHORAL METH SEC SCH	3
Teaching Field		
MU 501	FORM AND ANALYSIS	3
MU 516	ORCHESTRATION	3
MU 525	ADVANCED CONDUCTING	2
MU 611	SEMINAR IN MUSIC HISTORY & LIT	3
MUX 590	UAH CONCERT CHOIR	1
or MUX 591	UAH CHAMBER CHOIR	
Principal Instrument (MUA 500+)		3
Internship		
ED 696	P-12 INTERNSHIP	3
Required Proficiencies		
Piano Proficiency		
Performance Proficiency		
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**45**

Teaching (P-12), MA - Music Education: Instrumental

Description of the Program

This program is intended for individuals with at least a bachelor's degree in a music-related area who intends to become a music - instrumental education (P-12). The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Music: Instrumental Education (P-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.500 or higher

3. Passing score on required Praxis II Content Area Exam OR a degree in MUSIC (32 hours, 19 upper division)
4. Program of Study (POS) on file in Education

Program Requirements

Code	Title	Semester Hours
Professional Studies		
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
ED 530	APPLIED MULTICULTURALISM	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
MUE 527	TEACHING GENERAL MUSIC	3
MUE 529		3
Teaching Field		
MU 501	FORM AND ANALYSIS	3
MU 516	ORCHESTRATION	3
MU 525	ADVANCED CONDUCTING	2
MU 611	SEMINAR IN MUSIC HISTORY & LIT	3
MUX 599	UAH WIND ENSEMBLE	1
Principal Instrument (MUA 500+)		3
Internship		
ED 696	P-12 INTERNSHIP	3
Required Proficiencies		
Piano Proficiency		
Performance Proficiency		
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**45**

Teaching (P-12), MA - Physical Education

Description of the Program

This program is intended for students with at least a bachelor's degree who intend to become physical education (P-12) teachers. The program leads to the completion of the graduate degree but also fulfills the requirements for an Alabama State Department of Education (ALSDE) Alternative-A Teaching Certificate in Physical Education (P-12).

Admission Requirements

1. Unconditional admission to UAH and major department (if applicable)
2. Undergraduate GPA of 2.500 or higher
3. Passing score on required Praxis II Content Area Exam OR a degree in Kinesiology or Exercise Science (32 hours, 19 upper division)
4. Program of Study on file in Education

Program Requirements

Code	Title	Semester Hours
Professional Studies		
ED 501	INTRODUCTION TO EDUCATION PRACTICUM	0
ED 607	EDUCATIONAL LEADER AS THE EVALUATOR	3
ED 593	EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS	3
ED 604	CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION	3

ED 609	CLASSROOM AND BEHAVIOR MANAGEMENT	3
ED 530	APPLIED MULTICULTURALISM	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 520	COMPUTER BASED INSTRUCTIONAL TECHNOLOGY	3
Teaching Field		
KIN 540	SCHOOL AND COMMUNITY HEALTH (Teaching Field)	3
KIN 570	ADAPTED PHYSICAL EDUCATION	3
KIN 621	INSTRUCTIONAL APPROACHES TO SPORT PEDAGOGY	3
KIN 655	MOTOR LEARNING AND DEVELOPMENT	3
KIN 662	ELEMENTARY PHYSICAL EDUCATION METHODS	3
KIN 665	METHODS OF TEACHING PHYSICAL EDUCATION IN SECONDARY SCHOOLS	3
Internship		
ED 696	P-12 INTERNSHIP	3-6
Students are required to complete 200 hours of field experiences throughout the program before their internship.		
Total Semester Hours		**42-45**

Reading Specialist (P-12), M.Ed.

This program focuses on how to support literacy learning, teach struggling readers, facilitate professional development of reading teachers, and diagnose and respond to literacy challenges encountered by students.

Admission Requirements

To be admitted to this program, a student must

- hold a minimum of a bachelor's degree, and
- hold a valid bachelor's-level professional educator certificate in early childhood education, elementary education (K-6), or collaborative special education (K-6) **OR** a valid bachelor's-level professional educator certificate in any are of education along with a passing score on the Praxis Teaching Reading test validated for use in Alabama.

Program Requirements

Code	Title	Semester Hours
Core Courses		
ED 530	APPLIED MULTICULTURALISM	3
ED 535	INTRODUCTION TO APPLIED EDUCATIONAL RESEARCH	3
ED 540	COGNITIVE DEVELOPMENT THEORIES OF LEARNING	3
ED 565	INTRODUCTION TO DIFFERENTIATED INSTRUCTION	3
Concentration Courses		
ED 510	FOUNDATIONS OF LITERACY	3
ED 605	REACHING RESEARCH AND INSTRUCTION	3
ED 608	EXPANDING READING ABILITY IN THE CONTENT AREA	3
ED 612	DIAGNOSIS AND ASSESSMENT OF READING	3
ED 665	DIFFERENTIATING ELEMENTARY LITERACY (READING AND WRITING INSTRUCTION)	3
ED 692	ADVANCED P-12 INTERNSHIP	3
Action Research Project		
ED 690	MASTER'S ACTION RESEARCH PROJECT	3
Total Semester Hours		**33**

Secondary Education - Differentiated Instruction (6-12), M.Ed.

This program focuses on how to adjust instruction and assessment to maximize learning opportunities for all students in the 6-12 classroom.

Admission Requirements

To be admitted to this program, a student must:

- hold a minimum of a bachelor's degree, and
- hold a teaching certificate in education (any content area).

Program Requirements

Code	Title	Semester Hours
Core Courses		
ED 530	APPLIED MULTICULTURALISM	3
ED 535	INTRODUCTION TO APPLIED EDUCATIONAL RESEARCH	3
ED 540	COGNITIVE DEVELOPMENT THEORIES OF LEARNING	3
ED 565	INTRODUCTION TO DIFFERENTIATED INSTRUCTION	3
Concentration Courses		
ED 580	PROJECT BASED LEARNING	3
ED 620	USING TECHNOLOGY FOR SPECIAL POPULATIONS (Action Research Course (based upon content area))	3
ED 545	CURRICULUM AND INSTRUCTION IN SECONDARY SCHOOLS	3
Content Courses		
Graduate courses (500+) in the Secondary Content Courses		9
Action Research Project Course (select one based upon content area)		**3**
Courses by Content Areas:		
BYS 691	SPECIAL TOPICS (Biology)	
CH 735	SELECTED TOPICS IN ORGANIC CHEMISTRY (Chemistry)	
PH 679	EDUCATION CAPSTONE COURSE (Physics)	
MA 590	SELECTED TOPICS IN MATHEMATICS (Math)	
EH 601	ACTION RESEARCH IN WRITING STUDIES (English)	
HY 598	STUDIES IN HISTORY (History)	
Total Semester Hours		**33**

Visual Impairments (P-12), M.Ed.

This master's program focuses on how to plan, instruct, conduct assessments and collaborate to maximize learning opportunities for students with visual impairments, blindness, and deafblindness.

Admission Requirements

Te be admitted to the program, a student must

- hold a minimum of a bachelor's degree, and
- hold a teaching certificate in education (any content area).

Program Requirements

Code	Title	Semester Hours
Core Courses		
Any graduate courses (500+) with ED or EDC prefix with Department Approval		12
Recommended Courses:		
ED 565	INTRODUCTION TO DIFFERENTIATED INSTRUCTION	
ED 530	APPLIED MULTICULTURALISM	
ED 570	DIFFERENTIATED INSTRUCTION FOR SPECIAL POPULATIONS	
ED 535	INTRODUCTION TO APPLIED EDUCATIONAL RESEARCH (Core Courses)	
Concentration Courses (Teaching Field)		
EDC 551	FOUNDATIONS OF VISUAL IMPAIRMENTS	3
EDC 652	INTRODUCTION TO ORIENTATION AND MOBILITY	3
EDC 653	PRACTICUM FOR TEACHING STUDENTS WITH VISUAL IMPAIRMENTS	3
EDC 654	INTRODUCTION TO BRAILLE LITERACY	3

EDC 656	PROGRAMS FOR STUDENTS WITH VISUAL IMPAIRMENTS AND MULTIPLE DISABILITIES/ DEAFBLIND	3
EDC 657	ADVANCED BRAILLE AND ASSISTIVE TECHNOLOGY	3
Action Research Project		
ED 690	MASTER'S ACTION RESEARCH PROJECT	3
Total Semester Hours		**33**

The Orientation and Mobility Concentration, M.Ed.

Description of the Program

The Orientation and Mobility concentration focuses on training professionals to work with students with visual impairments and deafblindness how to independently travel. The coursework combines theoretical, research, and practical skills that prepare individuals to become professionals in this field. The program is mapped to the Academy for Certification of Vision Rehabilitation and Education Professionals (ACVREP) Orientation and Mobility Body of Knowledge and Clinical Practice Competencies. Completion of the program along with the internship should allow students to sit for the Certified Orientation and Mobility (COMS) examination.

Admission Requirements

To be admitted to the program, a student must

- hold a minimum of a bachelor's degree, and
- hold a teaching certificate in education (any content area).

Program Requirements

Code	Title	Semester Hours
EDC 551	FOUNDATIONS OF VISUAL IMPAIRMENTS	3
EDC 654	INTRODUCTION TO BRAILLE LITERACY	3
Six (6) hours of education electives.		6
These two courses must be graduate coursework with an ED or EDC prefix unless granted special permission by the Department of Curriculum and Instruction. The two electives should be selected in coordination with the program's coordinator. However, these are recommended: EDC 656, EDC 657, EDC 653, ED 535, ED 565, ED 530, ED 540, ED 570, EDC 636, EDC 625		
EDC 652	INTRODUCTION TO ORIENTATION AND MOBILITY	3
EDC 560	INTERMEDIATE ORIENTATION AND MOBILITY SKILLS	3
EDC 561	ADVANCED ORIENTATION AND MOBILITY SKILLS	3
EDC 662	INTERMEDIATE ORIENTATION AND MOBILITY SEMINAR	3
EDC 663	ADVANCED ORIENTATION AND MOBILITY SEMINAR	3
EDC 682	O&M AND STUDENTS WITH MULTIPLE DISABILITIES	3
EDC 692	ORIENTATION AND MOBILITY INTERNSHIP (May be completed in 1 hour increments throughout the program.)	3
Total Semester Hours		**33**

Master of Science in Applied Behavior Analysis

Description of the Program

The Master of Science in Applied Behavior Analysis provides a unique opportunity to support the education of individuals with unique behavior needs by applying rigorous, scientific methods to develop programs and services for these individuals. This program will supply the state with more behavioral analysts.

Admission Requirements

To be admitted unconditionally, applicants must:

1. have a minimum undergraduate grade-point average of 3.000,
2. submit a high-quality writing sample as per a prompt provided by the Department,
3. successfully complete an interview with the program faculty,

4. meet minimum Graduate School requirements for English language proficiency (non-native English speakers), and
5. develop program of study with the Department based upon placement exam.

Requirements

Code	Title	Semester Hours
ABA Core		
EDC 610	BEHAVIORAL ASSESSMENT	3
EDC 611	ETHICS AND PROFESSIONALISM IN APPLIED BEHAVIOR ANALYSIS	3
EDC 612	FUNDAMENTALS OF APPLIED BEHAVIOR ANALYSIS I	3
EDC 613	FUNDAMENTALS OF APPLIED BEHAVIOR ANALYSIS II	3
EDC 614	RESEARCH METHODS OF APPLIED BEHAVIOR ANALYSIS	3
EDC 615	INTERVENTIONS IN APPLIED BEHAVIOR ANALYSIS	3
EDC 616	SUPERVISION AND MANAGEMENT IN APPLIED BEHAVIOR ANALYSIS	3
Free Electives (select 4)		**6**
EDC 617	INTRODUCTION TO SUPERVISED FIELDWORK IN APPLIED BEHAVIOR ANALYSIS	1-3
EDC 625	ASSISTIVE TECHNOLOGY FOR EDUCATING INDIVIDUALS WITH ASD	3
EDC 655	COLLABORATION AND TRANSITION PLANNING	3
EDC 645	ASSESSMENT AND BEHAVIORAL APPLICATIONS IN ASD	3
EDC 636	INTRODUCTION TO STUDENTS WITH AUTISM SPECTRUM DISORDERS	3
ED 570	DIFFERENTIATED INSTRUCTION FOR SPECIAL POPULATIONS	3
ESL 640	INSTRUCTIONAL AND EVALUATION OF LANGUAGE USAGE	3
EDC 511	INSTRUCTIONAL STRATEGIES IN INCLUSIVE CLASSROOMS	3
EDC 551	FOUNDATIONS OF VISUAL IMPAIRMENTS	3
EDC 652	INTRODUCTION TO ORIENTATION AND MOBILITY	3
EDC 653	PRACTICUM FOR TEACHING STUDENTS WITH VISUAL IMPAIRMENTS	3
EDC 654	INTRODUCTION TO BRAILLE LITERACY	3
EDC 656	PROGRAMS FOR STUDENTS WITH VISUAL IMPAIRMENTS AND MULTIPLE DISABILITIES/ DEAFBLIND	3
PY 505	PSYCHOPHARMACOLOGY	3
PY 530	PSYCHOMETRICS	3
PY 537	PSYCHOBIOLOGY OF STRESS AND ILLNESS	3
PY 615	GRADUATE SEMINAR	3
PY 520	SPECIAL TOPICS	3
Other Related Courses with Departmental Approval		
Total Semester Hours		**33**

TESOL Certificate

This fully online program leads to an 18-hour graduate certificate in Teaching English as a Second Language (TESOL) and prepares students to work worldwide. The program prepares students for multiple opportunities, whether working with children or adults, teaching online or on-ground, or delivering training in corporate and non-profit settings globally.

Program Snapshot

- Format: Online
- Credit hours: 18 hours
- Time to degree: 12 - 18 months
- Start dates: Spring, Summer, Fall
- Application deadlines: May 15 (Summer), July 15 (Fall), December 1 (Spring)

Program Overview

- Two core courses (510 and 520) focus on the components, structures, and analysis of language, including an in-depth assessment of form and meaning across human languages.

- Two core courses (640 and 650) focus on the design and delivery of instruction across a range of settings that include real-world teaching opportunities.
- Two allied field courses, often chosen from Communication Arts, Curriculum and Instruction, or English, focus on tailoring the program to the students' unique goals.

Code	Title	Semester Hours
ESL 510	INTRODUCTION TO LANGUAGE SYSTEMS	3
ESL 520	INSTRUCTIONAL AND ACADEMIC LANGUAGE ACROSS CONTENT DOMAINS	3
ESL 640	INSTRUCTIONAL AND EVALUATION OF LANGUAGE USAGE	3
ESL 650	PRACTICUM, TESOL	3
Allied Field Electives		6
Total Semester Hours		**18**

Getting Started

- Contact the Director of TESOL (andrea.word@uah.edu). Subject Line: TESOL Certificate Program
- Prepare your application for admission to the program. Follow this link to the admissions website (https://www.uah.edu/admissions/graduate/apply-for-admission/).
- Upon admission, register for course(s) outlined in your Program of Study.

Kinesiology, MS

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http://www.uah.edu/education/departments/kinesiology (http://www.uah.edu/education/departments/kinesiology/)
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329 Wilson Hall
Telephone: 256.824.6007
Email: kin@uah.edu

Program Overview

The Master of Science in Kinesiology (MSK) program is aimed at furthering the education and practical experiences of students in health- and human performance-related fields. The purpose of the MSK Sports Science concentration is to equip students with advanced classroom content and an immersive practical experience to prepare them for careers in the next evolution of player performance assessment and enhancement. The curriculum consists of classes that expose students to advanced laboratory measurements, promote enhancement of performance assessment skills with cutting-edge technology, and help further expert research skills. Additionally, all students in the MSK Sports Science concentration will be assigned a two-semester Practicum to serve as a Sports Scientist for a team affiliated with UAH Kinesiology. The MSK in Sports Science offers a thesis track option for students looking for advanced opportunities to further their careers. Students will work with a thesis committee to plan, execute, and defend a robust research study.

Admission Requirements

- Applicants must have earned a bachelor's degree from a regionally accredited institution.
- Applicants must have earned a bachelor’s degree with a minimum overall grade point average (GPA) of 3.000 or a master’s or higher degree with a GPA of at least 3.000. This GPA must be documented on the official transcript of the degree-granting institution and must be the GPA that was used as the basis for granting the degree, not a GPA that includes post-degree courses.
- Applicants must have taken the GRE within the past five years and have a score submitted as part of their application.
- Applicants must send the following materials to UAH Graduate Admissions:
  - Official transcripts from all degree-granting institutions attended
  - GRE Score(s)
  - Current Curriculum Vitae/Resume
  - Two Letters of Recommendation - Letters should ideally be from a former professor or by others who can accurately address the applicant's academic performance and/or ability to successfully complete graduate school
  - Personal Statement - Provide a brief statement (maximum one page, single-spaced) describing their:

1. interest in pursuing graduate work at UAH (e.g., how the MSK program will benefit you; please specify your particular area(s) of research interest
2. professional/occupational goals

3. suitability of academic preparation for graduate study in Sports Science
4. prior professional experience

- Once the applicant has been formally accepted to UAH, they should meet with an advisor, who will complete a Program of Study and inform the student of any prerequisites that may be required. The student must complete all undergraduate prerequisites prior to beginning any courses in the MSK program.

Program Continuation

To continue in the MSK program, students must maintain:

- a minimum 3.000 GPA in MSK coursework with no grade lower than "C". GPA reports are obtained at the end of each academic semester from the UAH Graduate School and Registrar's Office and are used to monitor students' performance,
- satisfactory completion of a minimum of 240 credit hours of Practicum experience as a team Sports Scientist in each of the final two semesters, and
- a passing score on a written comprehensive exam in MSK coursework and field work.

If the above requirements are not met, a Personalized Professional Development Plan (PDP) will be developed; failure to meet criteria in the PDP may result in dismissal from the MSK program

MS in Kinesiology, Sports Science Concentration

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This program includes 37 total credit hours, as outlined below.
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Sports Science

Year 1		
Fall		**Semester Hours**
KIN 510	RESEARCH METHODS IN KINESIOLOGY	3
KIN 520	LABORATORY TECHNIQUES FOR SPORTS SCIENCE	3
PY 611	STATISTICS FOR EXPERIMENTAL METHODS	4
	Term Semester Hours:	**10**
Spring		
KIN 515	MASTER SEMINAR IN KINESIOLOGY	3
KIN 518	ADVANCED HUMAN PERFORMANCE AND TESTING	3
KIN 527	ADVANCED EXERCISE PHYSIOLOGY	3
	Term Semester Hours:	**9**
Year 2		
Fall		
KIN 630	SPORTS SCIENCE PRACTICUM I	3
BYS 531	BIOLOGICAL DATA SKILLS	3
KIN 699	SPORTS SCIENCE MASTER'S THESIS (or Elective for non-thesis track)	3
	Term Semester Hours:	**9**
Spring		
KIN 631	SPORTS SCIENCE PRACTICUM II	3
Elective: see Advisor		3
KIN 699	SPORTS SCIENCE MASTER'S THESIS (or Elective for non-thesis track)	3
	Term Semester Hours:	**9**
	Total Semester Hours:	**37**

KIN 510 - RESEARCH METHODS IN KINESIOLOGY
Semester Hours: 3

This course establishes an understanding of key principles related to kinesiology-related research and methodology. Key principles will be to address applicable research techniques and designs while emphasizing the planning and preparation necessary for conducting and reporting kinesiological research.

KIN 515 - MASTER SEMINAR IN KINESIOLOGY
Semester Hours: 3

This course will provide a format for the further understanding of pertinent, valuable, and meaningful research in the field of kinesiology and human performance assessment. Students will also be prepared for the professional certifications associated with their field of study.

KIN 518 - ADVANCED HUMAN PERFORMANCE AND TESTING
Semester Hours: 3

This course will provide students with advanced knowledge in the field of human performance training and evaluation through classroom lectures and laboratory/field experiences. Topics include developing and testing in strength, speed, power, agility, endurance, stability, and flexibility.

KIN 519 - EXERCISE AND SPORT BIOMECHANICS
Semester Hours: 3

This course is designed to expose students to an understanding of biomechanics in human performance. Biomechanics is the study of forces and their effects on living systems. Sport and exercise biomechanics is specifically the study of forces and their effects on humans in sport and exercise.

KIN 520 - LABORATORY TECHNIQUES FOR SPORTS SCIENCE
Semester Hours: 3

This course expands on the prerequisite knowledge of basic biomechanics and neuromuscular control and apply it to investigate human movements and characteristics. Topics covered include: kinematics, kinetics, electromyography, isokinetics, physiological, and body composition testing.

KIN 527 - ADVANCED EXERCISE PHYSIOLOGY
Semester Hours: 3

A more in-depth review of exercise physiology, with a particular focus on musculoskeletal performance, metabolic demands, and cardiovascular function. Students should have successfully completed an undergraduate course in exercise physiology or obtain permission of the instructor prior to taking the course for credit.

KIN 540 - SCHOOL AND COMMUNITY HEALTH
Semester Hours: 3

Obtain information and skills related to school and community health programs with an emphasis on health instruction, strategies, and resources. Survey the components of a school health program: school health services, healthful school environment, principles of physical and movement education, nutrition services, counseling and social services, parent/community involvement, health promotion for staff. Examine the core functions of public health, prevention of diseases and injuries, health needs of special populations, and functions of various organizations.

KIN 564 - HEALTH AND PE FOR THE ELEMENTARY TEACHER
Semester Hours: 2

The purpose of this course is to help the future elementary classroom teacher learn to appreciate, plan, organize and conduct (if called upon to do so) a quality physical education program for children in grades pre-K-5. The pre-service teacher (PT) will be provided background knowledge about physical education content, skill themes and movement concepts, how to teach skill themes and movement concepts, and fitness concepts.

KIN 570 - ADAPTED PHYSICAL EDUCATION
Semester Hours: 3

Develop knowledge of current concepts and trends in adapted physical education as well as the ability to plan and implement a physical education program designed to meet the unique needs of individuals. Students will understand how to design and implement an Individualized Educational Program for use in an activity-based setting.

KIN 621 - INSTRUCTIONAL APPROACHES TO SPORT PEDAGOGY
Semester Hours: 3

This class is designed to expand and enrich the teaching repertoire. Special emphasis will be given to how selected models of teaching can be used to achieve multiple outcomes of teaching in physical education and other contexts (e.g., physical activity programs & youth sport). Additionally, the course will increase awareness in other instructional areas related to the profession (teaching undersevered youth, youth sports programs, etc.,) Prerequisite: ED 501.

KIN 630 - SPORTS SCIENCE PRACTICUM I
Semester Hours: 3

This course is the first of a two-semester placement with a sports team/program affiliated with UAH Kinesiology. The student will operate/assist the team's Sport Scientist and report to coaches, training staff, and athletes. The course includes monthly seminars with a faculty member. Prerequisites: KIN 510, KIN 518.

KIN 631 - SPORTS SCIENCE PRACTICUM II
Semester Hours: 3

This course is the second of a two-semester placement with a sports team/program affiliated with UAH Kinesiology. The student will operate as/ assist the team's Sport Scientist and report to coaches, training staff, and athletes. The course includes monthly seminars with a faculty member. Prerequisites: KIN 510, KIN 518.

KIN 655 - MOTOR LEARNING AND DEVELOPMENT
Semester Hours: 3

Study the principles and practices that affect the learning and development of motor skills; theories of motor learning, motor control, and development; lifespan motor development perspective related to performing motor and sport skills; and professional applications of motor learning and development in exercise science, athletic training and physical education.

KIN 662 - ELEMENTARY PHYSICAL EDUCATION METHODS
Semester Hours: 3

Physical education teacher certification will acquire the ability to understand, recognize, analyze and demonstrate the range of teaching skills employed by successful physical educators in the preschool and elementary setting. Emphasis is placed on understanding the theoretical implications of different teaching skills and the contexts in which they are effective. Teacher candidates will design lessons that allow for maximum student participation while remaining aligned with Alabama Consent Standards. Field experience is required. Candidates will observe, participate in, and teach lessons in physical education classrooms.

KIN 665 - METHODS OF TEACHING PHYSICAL EDUCATION IN SECONDARY SCHOOLS
Semester Hours: 3

Physical education teacher candidates will acquire the ability to understand, recognize, analyze, and demonstrate the range of teaching skills employed by successful educators in the secondary setting. Teacher candidates will design lessons that allow for maximum student participation while remaining aligned with Alabama Consent Standards Field Experience is required. Candidates will observe, participate in, and teach lesson in physical education classrooms.

KIN 699 - SPORTS SCIENCE MASTER'S THESIS
Semester Hours: 3

Thesis credit hours are required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours requires for MSK students. A maximum of 9 hours of credit is awarded upon successful completion of a master's thesis. Requires thesis advisor permission.

College of Engineering

102 Engineering Building
Telephone: 256.824.6474
Email: eng_grad@uah.edu

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Dean: Shankar Mahalingam, Ph.D.
Associate Dean for Graduate Education and Research: Michael D. Anderson, Ph.D.
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Mission

The mission of the College of Engineering is to advance knowledge through research and education of students in core engineering disciplines. The college promotes ethical, innovative, and multidisciplinary approaches in an environment of collaboration with local and global partners to address society's technological problems.

Departments and Degree Programs

The College of Engineering has five academic departments: Chemical and Materials Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Industrial and Systems Engineering and Engineering Management, and Mechanical and Aerospace Engineering. The academic departments offer several graduate degree programs including:

- Master of Science in Engineering (Options in Civil, Chemical, Computer, Electrical, Industrial, and Mechanical)
- Master of Science in Aerospace Systems Engineering
- Master of Science in Operations Research
- Master of Science in Software Engineering
- Doctor of Philosophy (Aerospace Systems, Civil, Computer, Electrical, Industrial, and Mechanical)

The College of Engineering also supports several interdisciplinary graduate degree programs including:

- Master of Science in Cybersecurity
- Master of Science in Material Science
- Doctor of Philosophy in Biotechnology Science and Engineering
- Doctor of Philosophy in Material Science
- Doctor of Philosophy in Optical Science and Engineering

Engineering Graduate Study

The College of Engineering comprises five academic departments that offer programs of study (POS) and research leading to master's and doctoral degrees. Some departments also offer programs in one or more subdisciplines as well as joint programs with other UAH colleges/departments or other universities in the University of Alabama system.

The College of Engineering graduate programs are designed to provide a balance of strong academics and graduate-level research. Engineering faculty members provide broad and vigorous research programs with excellent opportunities for thesis and dissertation work.

Admissions

Applicants for graduate study in the College of Engineering must apply for admission to the Graduate School. General admissions criteria are determined by the UAH Graduate School and may be found on the Graduate School Admission webpage (https://www.uah.edu/admissions/graduate/). Additional admissions criteria may be specified by an engineering department or program. Students should consult their major engineering department for the additional requirements.

Graduate Assistantships

Financial aid, in the form of teaching and research assistantships, is available for qualified students. Admission to an Engineering graduate degree program **does not guarantee financial aid**. Students should consult their major department for information on applying for assistantships.

Initial Advisement

Applicants who are granted admission to graduate study in the College of Engineering will be referred to the major department.

Master's Degree General Requirements

The College of Engineering master’s degree programs include a thesis option (Plan I), or a non-thesis option (Plan II). Students who choose the Plan I option must complete and defend a thesis based on research performed under a faculty advisor. Students who choose the Plan II option must complete a capstone experience or a comprehensive exam. Each engineering master’s degree program requires a minimum of 30 semester hours. Students should consult with their major department for additional requirements.

A minimum overall grade point average of 3.0/4.0 is required for all graduate courses at UAH, whether or not the course is required to satisfy the master’s degree requirements. Further, a minimum overall grade point average of 3.000/4.000 is required for all courses taken at the 600-level or above. With prior approval, up to 12 hours of courses numbered 500-599 may be taken in fulfillment of the basic POS. A minimum grade of B must be attained in each engineering course in the student's program of study designated by a number less than 600. If a lower grade is attained, a substitution of another approved course is required. With permission of the major department, students may transfer up to 12 semester hours of acceptable graduate credit earned at an approved institution to satisfy master’s degree requirements. Transfer coursework may not be older than 10 years at the time of graduation. All requirements for the master’s degree must be completed in six years.

Doctoral Degree General Requirements

The College of Engineering doctoral degree programs require a minimum of 48 hours of graduate-level coursework and a minimum of 18 hours of dissertation. All programs require a qualifying examination, which is administered by the supervisory committee within a year after the student has completed their graduate coursework. All programs also require the completion and defense of a dissertation based on research performed under a faculty advisor. Some programs may also require a preliminary examination or other subject examination as well as a research proposal presentation. For those students who have already earned a Master's degree, a minimum of 18 semester hours of approved coursework beyond the Master's degree, with an average grade no lower than a B.

A minimum overall grade point average of 3.000/4.000 is required for all graduate courses at UAH, whether or not the course is required to satisfy the doctoral degree requirements. Further, a minimum overall grade point average of 3.000/4.000 is required for all courses taken at the 600-level or above. With prior approval, up to 12 hours of courses numbered 500-599 may be taken in fulfillment of the basic program of study. A minimum grade of B must be attained in each engineering course in the student's POS designated by a number less than 600. If a lower grade is attained, a substitution of another approved course is required. With permission of the major department, students may transfer acceptable graduate credit earned at an approved institution to satisfy Ph.D. degree requirements. Transfer coursework may not be older than 10 years at the time of graduation.

Newly admitted Ph.D. students will be required to complete their degree within 10 calendar years. If a student does not complete the degree within the 10-year limit, the student will automatically be withdrawn from the Ph.D. program and from the College of Engineering. Students may reapply to UAH after the 10-year limit.

Programs leading to the degree of Doctor of Philosophy are offered in the College of Engineering and are granted on the basis of general demonstrated ability to perform independent, original investigation. These attributes are tested in a comprehensive examination and in a dissertation that must clearly and effectively present the substantial results of research. These accomplishments, rather than mere accumulation of residence and course credits, are essential considerations in awarding the Ph.D. degree.

Residency Requirements

A majority of semester hours (including thesis/dissertation hours) must be earned at UAH or in the case of joint/shared program, at the participating institution. Residence may be established through either (1) being enrolled as a full-time student (at least nine graduate semester hours) either for one continuous academic year, or for Spring and Fall semesters in the same calendar year, or (2) being enrolled in at least six hours of graduate course work in at least three of the four consecutive semesters.

All research effort presented for residence credit toward the Ph.D. degree must be performed under the direction of a member of the graduate faculty who holds full membership status.

Master's Programs in Engineering

- Aerospace Systems Engineering, MSASE (p. 137)
- Chemical Engineering, MSE (p. 92)
- Civil Engineering, MSE (p. 99)
- Computer Engineering, MSE (p. 116)
- Cybersecurity, MS Interdisciplinary - Computer Engineering Track (p. 148)
- Cybersecurity, MS Interdisciplinary - Computer Science Track (p. 150)
- Cybersecurity, MS Interdisciplinary - Management Track (p. 49)
- Electrical Engineering, MSE (p. 117)
- Industrial and Systems Engineering, MSE (p. 126)
- Industrial and Systems Engineering, MSOR (p. 127)
- Materials Science, MS (p. 151)
- Mechanical Engineering, MSE (p. 139)
- Software Engineering, MSSE (p. 117)

Doctoral Programs in Engineering

- Aerospace Systems Engineering, PhD (p. 137)
- Biotechnology Science and Engineering, PhD (p. 140)
- Civil Engineering, PhD (Joint with UAB) (p. 100)
- Computer Engineering, PhD (Shared with UAB) (p. 114)
- Electrical Engineering, PhD (p. 115)
- Industrial and Systems Engineering, PhD (p. 124)
- Materials Science, PhD (p. 142)
- Mechanical Engineering, PhD (p. 138)
- Optical Science and Engineering, PhD (p. 144)

Chemical and Materials Engineering

117 Engineering Building
Telephone: 256.824.6810
Email: chegrad@uah.edu

Chair: Yu Lei, PhD

Mission

The Department of Chemical and Materials Engineering is dedicated to developing and maintaining undergraduate and graduate programs that educate students in the safe control and manipulation of matter in industrially important chemical and materials systems. The faculty will continue to educate students and maintain its programs by providing intellectual leadership, innovative teaching, university and community service, while conducting internationally recognized research. Undergraduate and graduate programs within the department are continuously refined based on national standards

and are designed to encourage interdisciplinary education. Research objectives focus on technology important to the further development of the University, the community, the State of Alabama, and the nation.

Degree Programs

The Department of Chemical and Materials Engineering offers coursework and research leading to the Master of Science degree in Engineering (M.S.E.). The Doctor of Philosophy degree is available through the Materials Science Ph.D. program, the Biotechnology Science and Engineering Program, or the Chemical Engineering Option of the Mechanical Engineering Ph.D. program.

The range of research interests in the chemical engineering faculty is broad. It affords graduate students opportunities for advanced work in processes, reaction engineering, electrochemical systems, material processing and biotechnology and energy. The M.S.E. degree granted in these areas of concentration is equivalent to those available in a traditional chemical engineering program. Please contact The University of Alabama in Huntsville (UAH) Department of Chemical and Materials Engineering (CHE) at 256.824.6810 or visit the CHE homepage at http://www.uah.edu/eng/departments/cme (http://www.uah.edu/eng/departments/cme/) for further details.

Chemical Engineering, MSE

The M.S.E. in CHE requires a total of 30 semester hours. The basic program of study contains a minimum of 18 semester hours of graduate-level coursework that must include 12 semester hours in graduate chemical engineering courses and six semester hours of courses in Graduate Engineering Analysis. There are two options: Plan One includes 24 semester hours of coursework and six semester hour of thesis work, and the non-thesis Plan Two option contains 30 hours of coursework.

Chemical Engineering, PhD options

The College of Engineering does not offer a Ph.D. in Chemical Engineering. However, students with a background in chemical engineering may pursue one the following interdisciplinary options:

- Ph.D. in Mechanical Engineering with a Chemical Engineering option. The Chemical Engineering Option of the Mechanical Engineering Ph.D. program requires 48 credit hours of graduate coursework. Students should consult the requirements for the Mechanical Engineering Ph.D.
- Ph.D. in Materials Science. This program is innovative joint-program involving all three campuses of the University of Alabama System (UAB, UAH, and UA) and multiple departments from the UAH College of Science and College of Engineering. The requirements include a three-part program examination, 48 credit hours of graduate coursework, 18 credit hours of dissertation (MTS 799) and successful defense of a doctoral dissertation.
- Ph.D. in Biotechnology Science and Engineering. This is a joint program between the UAH College of Science and College of Engineering. The requirements include 48 credit hours of graduate coursework, 18 credit hours of dissertation (BSE 799) and successful completion of a preliminary examination and a doctoral dissertation.

Students who wish to pursue one of these options should consult the catalog entries for these programs for more information, or visit the CME Department office.

Graduate Programs in Chemical & Materials Engineering

CHE 540 - PHYSICAL PROP OF FLUIDS
Semester Hours: 3

Theoretical, experimental, and correlation methods for determining and predicting the thermodynamic and transport properties of various fluids. Critical properties, equations of state, vapor pressure and latent heat, heat capacity. Viscosity, thermal conductivity, diffusion coefficient, phase equilibrium, heat and free energy for formation.

CHE 541 - CHEMICAL KINETICS & REACTOR DE
Semester Hours: 3

Fundamental principles of chemical kinetics and chemical reactor engineering along with the design of both thermal and catalytic reactors.

CHE 549 - INTRO ENVIRONMENTAL ENGR
Semester Hours: 3

Engineering aspects of air, water, and thermal pollution. Hydrologic cycle, water sources and uses;industrial and other sources of primary and secondary pollutants. Transport process in environmental problems and in their control.

CHE 552 - EXPER TECH IN FLUID MECH
Semester Hours: 3

CHE 559 - SELECTED TOPICS/CHE
Semester Hours: 1-6

Discussion of biocompatible polymers and their application in drug delivery systems. Polymers of natural and synthetic origin will be studied, special emphasis will be placed upon the synthesis of biocompatible polymers. The formation of polymeric micelles, hydrogels, and liposomes will be studied. The process of extravasation as an uptake mechanism for polymeric delivery systems will be discussed. Reading material will be based on the latest publications in the field.

CHE 560 - INTRO TO BIOPROCESS ENGR
Semester Hours: 3

Application of engineering principles to the analysis of and the development and design of processes using biological catalysts including enzymes, plant and animal cells, and genetically engineered cells. Other topics include fermentation and biological mass transport processes.

CHE 561 - BIOSEPARATIONS RECOMBI TECH/PR
Semester Hours: 3

General characteristics of separation processes used in the biotechnology industry, including removal of insolubles, isolation and purification of thermally sensitive products for final use by the customer. Application of unit operation principles for biological separations, recombinant DNA techniques, protein engineering. Prerequisite: CHE 560.

CHE 594 - APPLIED MATERIALS PROCESSING
Semester Hours: 3

Synthesis and processing methods of materials for engineering applications. Selection and use of materials performance factors for design of structural and functional components. Use of computational methods in solving open-ended design problems that depend on an understanding of the nature and properties of materials will be emphasized. All classes of materials are covered.

CHE 595 - POLYMER ENGINEERING
Semester Hours: 3

Engineering principles of polymers and their role in manufacturing processes. Aspects of polymer phenomena and their relationship to processing of structural and functional components.

CHE 641 - ADV THERMODYNAMICS
Semester Hours: 3

Application of classical thermodynamics. Treatment of problems involving nonideal gases and liquids, phase equilibrium, and chemical equilibrium.

CHE 642 - PHYSICOCHEMICAL HYDRODYNAMICS
Semester Hours: 3

Treatment of electrokinetic phenomena, axial dispersion, convective diffusion in liquids, Brownian motion, flows driven by surface tensions, capillary motion.

CHE 644 - INTRO ELECTROCHEM SYSTEM
Semester Hours: 3

Thermodynamics, transport, and kinetics of electrodes and cells. Systems analysis of batteries, fuel cells, porous electrodes, electroplating, electrowinning, and corrosion processes. Convective diffusion at high Schmidt numbers.

CHE 646 - THERMODYNAMICS OF MATRLS
Semester Hours: 3

Fundamental thermodynamic review, phase equilibrium, chemical reaction equilibrium, free energy, binary and ternary phase transformations, solution models and selected topics.

CHE 648 - TRANSPORT PHENOMENA I
Semester Hours: 3

Introduction to transport phenomena, fluid and continuum mechanics. Exact solutions of the Navier-Stokes equation. Introduction to boundary-layer. Multiphase flows. Capillary flows.

CHE 649 - TRANSPORT PHENOMENA II
Semester Hours: 3

Introduction to transport phenomena with emphasis on energy and mass transport. Equations of energy change. Free and forced convection. Equations of mass change. Ficks Law. The Stephan-Maxwell equations. Mass transport in multiphase systems. Prerequisite: CHE 648.

CHE 650 - PRINC LIQUID/SOLID INTER
Semester Hours: 3

Applies basic principles in thermodynamics and kinetics to characterize surfaces and surface phenomena. Reviews fundamental properties of gas-liquid, liquid-liquid, solid-liquid, and solid-gas interfaces and phenomena occurring at these interfaces.

CHE 652 - INTRO TO AIR POLLU CONTROL
Semester Hours: 3

Technology of air pollution dealing with air pollutants, effects, sources, combustion processes, and abatement and control technology. Engineering contributions to both the problems and their solutions. Nature of air pollution problem and fundamental technological approaches to its solution.

CHE 657 - ADVANCED PROCESS CONTROL
Semester Hours: 3

Application of modern control theory to chemical processes; multivariable control; estimation and adaptive control, optimal control.

CHE 658 - CATALYSIS/REACTOR DESIGN
Semester Hours: 3

Treatment of homogeneous and heterogeneous reaction kinetics, transport in fluid-solid reactions, catalyst deactivation and their effects on the analysis and design of chemical reactors. Prerequisite: CHE 541.

CHE 659 - SELECTED TOPICS/CHE
Semester Hours: 1-6

CHE 696 - GRAD INTERNSHIP CHE ENGR
Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization, or government agency that has particular interest and relevance to the graduate student. Permission of CHE faculty member required.

CHE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of nine hours of credit is awarded upon successful completion of master's thesis. The 1 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 1 hour option once in their career.

CHE 724 - INSTR METH/BIO-MTLS CHARACTERI
Semester Hours: 3

CHE 725 - INSTR METH/BIO-MTLS CHARACTERI
Semester Hours: 4

CHE 747 - ADV TOP/BIOENGINEERING
Semester Hours: 3

Engineering aspects of microbial processes and the processing of biological materials. Integrating knowledge of governing biological properties and principles with chemical engineering methodology. Emphasis on current literature in the areas of purification and separation technology, bioprocess development, and biomaterials.

CHE 749 - MASS TRANSPORT
Semester Hours: 3

Mass transfer in solid and fluid systems under steady and transient conditions. Integration of momentum, heat and mass transfer equations with application to reactive, rheological and multicomponent systems.

CHE 757 - OPT TECH/FLUID MECHANICS
Semester Hours: 3

Laser courses, molecular interactions with light and diatomic spectroscopy needed fluorescence, Brillouin scattering, four wave mixing, CARS and other applications in optical fluid diagnostics.

CHE 759 - ADV SELECTED TOPICS IN CHE
Semester Hours: 1-3

CHE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation.

Chemical Engineering, MSE

The CME Department offers two plans leading to the M.S.E. degree for the Chemical Engineering option. These are designated:

- Plan I (Thesis)
- Plan II (Non-thesis)

The following sections describe the requirements for each of these options. Additional requirements, policies, and required forms may be found in the CME Department office.

Basic Program of Study

The Basic Program of Study, common to both the Plan I and Plan II (Non-thesis) M.S.E. options, contains a minimum of 24 semester hours of graduate-level coursework that must include:

Code	Title	Semester Hours
Engineering Major		
Select an engineering major consisting of 12 semester hours of graduate courses including supporting engineering courses		12
First Minor [1]		
Select a first minor of 6 semester hours of graduate courses in an approved engineering area of specialization		6
Second Minor		
MAE 692	GRAD ENGR ANALYSIS I	3
MAE 693	GRAD ENGR ANALYSIS II	3
Total Semester Hours		**24**

1 Additional CHE courses and/or other five/six-hundred level courses listed in the graduate catalog can be used as elective courses. Students are required to select an academic advisor and set up the MSE Program of Study early on to identify these elective courses.

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Master's Thesis		
CHE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense		
Total Semester Hours		**30**

Plan II, Non-Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Select 6 semester hours of graduate courses to complete an approved extended program of study		6
Total Semester Hours		**30**

Civil and Environmental Engineering

S201 Technology Hall
Telephone: 256.824.6854

Email: ceegrad@uah.edu

Chair: Michael Anderson, Ph.D., Associate Dean and Professor

Mission

The mission of the Civil Engineering program is to educate students with the fundamental knowledge and analytical skills necessary for successful careers in civil and environmental engineering. Through rigorous scholarship, innovative instruction, and service, we advance knowledge to improve our global community.

Degrees

- Master of Science in Engineering (Civil Engineering) (p. 99)
- Doctor of Philosophy in Civil Engineering (p. 100)

The Civil and Environmental Engineering (CEE) Department offers coursework and research leading to the M.S.E. and Ph.D. degrees. The Ph.D. program is offered jointly with the Department of Civil and Environmental Engineering at the University of Alabama at Birmingham (UAB).

Research performed by the civil engineering faculty emphasizes state-of-the-art technology and is geared largely toward space-based applications. The philosophy and unique qualifications of the faculty afford graduate students opportunities for advanced work in structural engineering and structural materials, geotechnical engineering, engineering mechanics, environmental engineering, hydraulics and hydrologic processes, transportation planning, intelligent transportation systems, experimental mechanics/applied optics and natural hazard mitigation.

Under a cooperative agreement, several courses are co-listed and jointly taught by civil and mechanical engineering faculty so that a variety of courses can be offered on a regular basis. Courses are also available through the Intercampus Interactive Telecommunications System (IITS) from faculty at the University of Alabama (UA), UAB, and the University of South Alabama (USA). Financial support is available at attractive levels for qualified students in the form of assistantships. Graduate Co-op positions are also available with many local research and industrial organizations. The University of Alabama in Huntsville (UAH) has the intellectual and social environment to provide a well-rounded, high technology-oriented degree. The M.S.E. degree granted by the department is equivalent to those available in traditional civil and environmental engineering programs.

Civil Engineering, MSE

Students wishing to pursue the M.S.E. in Civil Engineering must meet the admission requirements of the UAH Graduate School as well as the College of Engineering. A beginning student files a Program of Study in consultation with the faculty advisor. The M.S.E. in Civil Engineering requires a minimum of 30 semester hours and consists of two options. The thesis option requires 24 hours of graduate coursework and six hours of thesis. Under this option, students must complete a written thesis and an oral defense. The non-thesis option requires 30 hours of graduate coursework.

Civil Engineering, PhD

The CEE Department offers a program (jointly with UAB) leading to a Ph.D. in Civil Engineering. Courses are offered jointly by CEE faculty from both universities and are available in real-time via IITS. The doctoral work is supervised by an experienced researcher and recognized authority in the field and the supervisory committee is composed of faculty from both UAH and UAB and a minimum number of course semester hours must be taken from each campus. Coursework, written and oral examinations, and the dissertation are all essential components of the doctorate degree. The doctoral program requires 48 semester hours of coursework beyond the B.S. degree, plus 24 semester hours of dissertation. However, for students entering with an M.S.E. degree with thesis, the dissertation requirement is 18 semester hours. Ph.D. students must meet the minimum requirements set by the Graduate School, the College of Engineering, and the CEE Department.

In addition to the graduate coursework, students must pass a preliminary exam that ascertains their academic, technical, and intellectual preparedness to pursue doctoral-level work. For doctoral students with a master's degree, the preliminary exam must be administered within the first two semesters of study, and for doctoral students with a baccalaureate degree, it must be administered after the completion of 24 semester hours of graduate coursework. More information about this exam is available in the CEE Department office.

Students must also pass a qualifying exam, which is administered after all coursework is completed by the student's supervisory committee. The qualifying exam is given in conjunction with the presentation of the dissertation proposal to the supervisory committee and is designed to determine the student's research competence. This exam process includes both written questions related to the coursework and an oral presentation of the proposal to the committee. The exam should be completed at least two semesters (one academic year) before the Ph.D. is awarded. Students are allowed two attempts to pass the qualifying exam.

Finally, students must write a dissertation on their research work. When the dissertation has been completed, the supervisory committee will give the candidate a final oral examination as a part of a public dissertation defense. More information about the dissertation process is available in the CEE Department office.

Master's Program in Civil and Environmental Engineering

- Civil Engineering, MSE (p. 99)

Doctoral Program in Civil and Environmental Engineering

- Civil Engineering, PhD (Joint with UAB) (p. 100)

CE 511 - INTRO GEOGRAPHICAL INFO SYS
Semester Hours: 3

Introduces vector, raster and tabular concepts, emphasizing the vector approach. Topics include: spatial relationships, map features, attributes, relational database, layers of data, data ingesting, digitizing from maps, projections, output, applications, and availability of public data sets.

CE 520 - URBAN TRANSPORTATION PLANNING
Semester Hours: 3

Planning of highway systems and terminals as part of a complete planning approach; public transportation system planning; transportation planning studies, projection analysis, plan formulation, and programming.

CE 541 - OPEN CHANNEL HYDRAULICS
Semester Hours: 3

Design and analysis of erodible and non-erodible channels. Uniform flow, channel roughness, gradually and spatially varied flow, rapidly varied flow, hydraulic jumps, gradually varied unsteady flow, flood routing, flow measurements, channel models, channel and culvert design.

CE 549 - INTRO ENVIRONMENTAL ENGR
Semester Hours: 3

Engineering aspects of air, water, and thermal pollution. Hydrologic cycle, water sources and uses; industrial and other sources of primary and secondary pollutants. Transport process in environmental problems and in their control.

CE 550 - ENVIRONMENTAL CONTROL
Semester Hours: 3

Engineering design and synthesis of environmental control systems. Control of multiphase systems with application to air and water pollution control.

CE 552 - INDUSTRIAL WASTE TREATMENT
Semester Hours: 3

Advanced topics in the area of hazardous waste management and water quality control. Emphasis on industrial waste, including hazardous waste management. Topics include: generation, storage, collection, transfer, disposal, recycling, economic, environmental, and regulatory considerations.

CE 554 - SOLID & HAZARDOUS WASTE MGMT
Semester Hours: 3

Waste characterization, minimization, collection, treatment, transport, and disposal. Landfill design and incineration options. Leachate characteristics and potential groundwater contamination. Prerequisite: CE 549.

CE 555 - WATER QUALITY LABORATORY
Semester Hours: 3

Properties of natural water sources and laboratory methods associated with water and wastewater treatment systems. Students design and demonstrate a water treatment system to bring a water sample into compliance with drinking water standards.

CE 556 - WATER QUALITY CONTROL PROC
Semester Hours: 3

Principles of public water supply design. Source selection, collection, purification, and distribution for municipal use. Collection of waste waters, their treatment, and disposal. Prerequisite: CE 549.

CE 557 - HYDROLOGY
Semester Hours: 3

Occurrence and movement of water over the earth's surface for engineering planning and design. Relationship of precipitation to streamflow with frequency analysis, flood routing, and unit hydrograph theory.

CE 558 - ENVIRONMENTAL ENGR DSGN
Semester Hours: 3

Engineering design and project management of environmental quality/restoration systems. Students will complete a design project focusing on one of the following systems: sanitary landfill, municipal incinerator, or groundwater/site remediation. Lectures will address skills for technical presentations and proposal writing, as well as process design and decision making.

CE 559 - SEL TOPICS CIVIL ENGINEERING
Semester Hours: 1-6

CE 561 - VIBRATIONS ELASTIC SYS
Semester Hours: 3

Formulation of the equations of motion of discrete and continuous systems, analytical and numerical methods of solution, eigenvalue problems, and dynamic response.

CE 571 - ADVANCED SOIL MECHANICS
Semester Hours: 3

Continuum mechanics applied to soil behavior. Theoretical approaches to consolidation, shear strength, slope stability and soil stabilization.

CE 572 - SOIL DYNAMICS
Semester Hours: 3

Behavior of soils under dynamic, earthquake and blast loading. Analysis of foundation vibration and isolation.

CE 573 - EARTH STRUCTURES ENGINEERING
Semester Hours: 3

Principles of earth structure design. Theories of earth pressures and the design of retaining wall systems including gravity, cantilever, mechanically stabilized earth, flexible sheet pile, and anchored wall systems. Methods of stability analyses for retaining walls, earth slopes, and embankment design.

CE 574 - APP MECHANICS OF SOLIDS
Semester Hours: 3

Stresses and strains at a point, theories of failures, stress concentration factors, thick-walled cylinders, torsion of noncircular members, curved beams, unsymmetrical bending, and shear center.

CE 577 - EXP TECH SOLID MECHANICS
Semester Hours: 3

Experimental methods to determine stress, strain, displacement, velocity, and acceleration in various media. Theory and laboratory applications of electrical resistance strain gages, brittle coatings, and photoelasticity. Application of transducers and experimental analysis of engineering systems.

CE 578 - MATRIX METH STRUCT MECH
Semester Hours: 3

Matrix application to formulation and solution of linear problems in structural mechanics. Stresses, vibrations, and stability of engineering structures.

CE 581 - STRUCTURAL ANALYSIS II
Semester Hours: 3

Reactions, shears, moments and deformations in complex structural systems. Statically indeterminate systems, advanced geometric and energy methods.

CE 583 - REINFORCED CONCRETE DESIGN
Semester Hours: 3

Theory and practice of reinforced concrete design. Theory and design of high strength concrete mixtures. Design of reinforced concrete beams, slabs and columns using the ultimate strength design code of the American Concrete Institute.

CE 584 - STEEL DESIGN
Semester Hours: 3

Principles of the design of steel structures using ASD methods. Analysis and design of structural elements including beams, columns, and connection details.

CE 585 - FOUNDATION ENGINEERING
Semester Hours: 3

Design of foundations with emphasis on reinforced concrete, footings, caissons, piles, retaining walls, and mat foundations. Effect of bearing pressure on foundations. Prerequisite: CE 583.

CE 586 - ADV CEMENTITIOUS & COMPOSITE
Semester Hours: 3

Concrete structures, rheology, mechanical properties, environmental durability, dimensional stability, advanced concrete technologies (such as high strength, fiber reinforced, and fracture mechanics), advanced fiber polymer composites, and repair/rehabilitation of concrete structures.

CE 587 - BRIDGE DESIGN
Semester Hours: 3

Structural design of bridge components based on governing design codes, loadings, and structural analysis. Topics may include the introduction to Load and Resistance Factor Design (LRFD) design philosophy, loads and analysis, reinforced concrete girders and deck slabs, steel girders, etc.

CE 603 - ADVANCED CONCRETE DESIGN
Semester Hours: 3

Design of concrete columns; bond, anchorage and reinforcing details; design of two-way slabs; design and analysis of multistory building frames; introduction to prestressed concrete; design of prestressed cross-sections for moment.

CE 611 - GIS IN CIVIL ENGINEERING
Semester Hours: 3

Advanced topics in geographical information systems (GIS) with civil engineering applications. Emphasis will be placed on spatial/temporal data analyses using digitized maps and database information in an area of CE specialization. Research project will be required.

CE 622 - ADVANCED TRAFFIC ENGRG DESIGN
Semester Hours: 3

In depth analysis of traffic engineering concepts related to intersection analysis (signalized and un-signalized) as well as arterial systems.

CE 646 - EROSION & SEDIMENTATION
Semester Hours: 3

River morphology and river response, incipient erosion and its prediction, bed form and roughness, degradation, aggradation, and local scour in alluvial rivers. Design of stable channels, computation of bed load.

CE 650 - ENVIRONMENTAL IMPACT ANAL
Semester Hours: 3

National environmental policy act and its implementation. Environmental impact process. Writing an environmental impact statement.

CE 651 - ENVIRONMENTAL REGULATIONS
Semester Hours: 3

Basic understanding of environmental law with an appreciation for the practical implementation of regulations for environmental engineers. Includes an overview of the major American environmental laws for protection of water and air resources, as well as permitting requirements and health/safety responsibilities. Prerequisite: CE 549.

CE 652 - INTRO TO AIR POLLUTION CONTROL
Semester Hours: 3

Technology of air pollution dealing with air pollutants, effects, sources, combustion processes, and abatement and control technology. Engineering contributions to both the problems and their solutions. Nature of air pollution problem and fundamental technological approaches to its solution.

CE 653 - GROUNDWATER ENGINEERING
Semester Hours: 3

Application of engineering principles to the movement of groundwater. Influence of physical and geological environment on groundwater hydraulics. Water well hydraulics and aquifer evaluation. Emphasis on practical groundwater engineering problems. Prerequisites: MA 526 or MAE 693.

CE 654 - ENVIRONMENTAL TRANSPORT
Semester Hours: 3

Fundamental principles of mass transport, chemical partitioning/transformations in environmental systems. Practical transport examples for surface water, ground water, and atmospheric systems will be presented and mathematical modeling will be utilized for solutions.

CE 655 - HAZARDOUS WASTE MGMT
Semester Hours: 3

Topics include definition of hazardous waste, regulatory considerations, risk assessments, and categories of waste. Current and emerging treatment and disposal technologies will be explored.

CE 656 - ADV. WASTEWATER ENGINEERING
Semester Hours: 3

Advanced topics in wastewater engineering. Theory and modeling of biological wastewater treatment processes. Focus on theory/modeling of biological processes and current research on advanced wastewater treatment processes. Prerequisites: CE 556.

CE 657 - ADVANCED HYDROLOGY
Semester Hours: 3

Hydrologic cycle, including interrelationships between classical and statistical methods of hydrology. Evaluation of governing equations, linearizations, analytical approximations and numerical solution techniques for various boundary conditions. Stochastic hydrologic modeling in both temporal and spatial domains. Prerequisites: ISE 690, MAE 586, MAE 693, and CE 557.

CE 658 - SUSTAINABLE DESIGN
Semester Hours: 3

The built environment has a substantial impact on energy and material resources as well as being a critical determinant of health and productivity. This course covers topics such as site planning and construction variables, energy and water alternatives, and current rating systems. Case studies and field trips of historic and contemporary projects exemplifying various sustainability features will be included.

CE 659 - SEL TOPICS CIVIL ENGINEERING
Semester Hours: 1-6

CE 660 - STRUCTURAL DYNAMICS
Semester Hours: 3

Application of the theory of vibrations to discrete and continuous models of structures. Numerical methods of analysis for both spatial and temporal variables. Model synthesis and step-by-step time integration methods. Finite element applications: substructuring techniques.

CE 662 - GEOTECHNICAL ENGINEERING
Semester Hours: 3

Shallow foundation's immediate and consolidated settlement, advanced deep foundations under lateral and axial loads, design of single and pile groups, soil-pile interaction, introduction to seismology, earthquake characteristics, dynamic soil properties and response, soil profile response spectra, soil liquefaction. Prerequisite: CE 585.

CE 666 - EARTHQUAKE ENGR & STRUCT DYNAM
Semester Hours: 3

This allows structural engineers to consolidate their knowledge on the effect of earthquake ground motions on civil engineering structures. The course will cover the analysis and the theories of structures made of various materials that are located in active seismic zones. Finally, the course will allow structural engineers to acquire new basic knowledge in earthquake engineering that will allow them to communicate better with scientists and engineers of other disciplines in earthquake engineering (e.g. seismologist, geotechnical engineers, etc.).

CE 671 - CONTINUUM MECHANICS
Semester Hours: 3

Kinematics and kinetics, various coordinate systems, constitutive equations for continuous media; governing partial differential equations from first and second laws of thermodynamics; applications to solids, liquids, and gases.

CE 672 - THEORY OF ELASTICITY
Semester Hours: 3

Formulation of boundary-value problems of classical elasticity. Application to plane problems, prismatic members, and axisymmetric problems. Introduction to three-dimensional problems.

CE 673 - PLASTICITY
Semester Hours: 3

Fundamentals of mechanical behavior of metals and nonmetals for stress states greater than the yield stress state. Deformation and flow theories. Stress-strain relations and yield criteria. Solution of boundary value problems with plastic bodies. Limit analysis of structures.

CE 674 - FINITE ELEMENT ANALYS I
Semester Hours: 3

Finite element theory, variational methods, weighted residuals. Applications to linear partial differential equations in continuous media. Solution of boundary value and initial value problems.

CE 675 - ROCK MECHANICS
Semester Hours: 4

Principles of continuum mechanics applied to the design of structures in rock; tunnels, underground structures and foundations. Joint behavior; stresses; analysis of rock slopes; instrumentation.

CE 676 - VISCOELASTICITY
Semester Hours: 3

Mechanical behavior of materials having time-dependent and temperature-dependent material properties. Creep and relaxation phenomena. Elastic-viscoelastic analogies. Formulation of stress-strain laws. Solution of boundary value problems for viscoelastic bodies.

CE 677 - OPTICAL TECH IN SOLID MECH
Semester Hours: 3

Overview of conventional methods for experimental stress analysis. Introduction to applied optics with emphasis on non-destructive, laser-based testing methods, fiber optic recording systems, photoelectronic-numerical data acquisition, and computer aided analysis.

CE 678 - MECHANICS OF COMPOSITE MATRLS
Semester Hours: 3

Introduction to composite materials, micro- and macro-mechanical behavior of laminae; bending, buckling and vibration of laminated plates.

CE 679 - HYPERVELOCITY IMPACT PHENOMENA
Semester Hours: 3

Fundamental principles of penetration mechanics. Analytical and numerical approaches to perforation and penetration problems. Shock jump conditions, hugoniots, and equations of state; low, high, and hypervelocity impacts of finite and thin targets.

CE 681 - ADVANCED STRUCTURAL ANALYSIS
Semester Hours: 3

Explores modern methods of structural analysis, matrix formulation of flexibility and stiffness methods, and analysis of structures with material and geometric nonlinearities. Also introduces energy methods for indeterminate structures. Prerequisite: CE 581.

CE 683 - GRADUATE SEMINAR
Semester Hour: 1

Professional activities designed to promote the skills required to organize and deliver oral technical presentations and to broaden the individual's awareness of technical issues. Required for all students pursuing a graduate degree. Students will be graded "S" (Satisfactory) or "U" (Unsatisfactory) based upon their performance and attendance. Students who do not receive an "S" grade must register for the course until an "S" is obtained.

CE 696 - GRAD INTERNSHIP CE ENGR
Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization or government agency that has particular interest and relevance to the graduate student. Permission of CEE faculty member required.

CE 697 - MASTER'S PLAN II PROJECT
Semester Hours: 3

Application-oriented student project designed to show competence in an area of civil engineering.

CE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of nine hours of credit is awarded upon successful completion of master's thesis. The 1 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 1 hour option once in their career.

CE 722 - SLIDING MODE CONTROL
Semester Hours: 3

CE 756 - HAZARDOUS WASTE REMEDIAT
Semester Hours: 3

Engineering design skills applied to the solution of real world hazardous waste remediation problems. Remedy screening and selection; treatment train development for a Superfund facility.

CE 762 - WAVE MOTION CONT ELASTIC BODIE
Semester Hours: 3

Elements of stress wave propagation in bounded elastic media. Propagation of elastic waves in infinite and semi-infinite bodies, cylinders, rods and beams.

CE 765 - RAND VIBRAT ELASTIC SYSTEM
Semester Hours: 3

Dynamic analysis of elastic systems including the response of complex structures to random excitations. Typical excitations include random wind, thermal, earthquake, aerodynamic, and ocean wave phenomena. Probabilistic mechanics methods. Concepts of reliability. Stationary and ergodic processes.

CE 772 - THEORY STRUCT STABILITY
Semester Hours: 3

Energy criterion for stability of elastic structure under conservative loading. Stability concept for general continuous systems. Rigorous and approximate methods of analysis. Buckling of structural elements under impulsive and nonconservative loading. Postbuckling behavior.

CE 773 - THEORY OF SHELLS
Semester Hours: 3

Analysis of thin plates and shells, including higher approximations theories and transverse-shear deformations; illustration of theories by selected problems.

CE 774 - FINITE ELEMENT ANAL II
Semester Hours: 3

Advanced topics in finite element analysis: application to nonlinear partial differential equations in continuum mechanics: theoretical studies of convergence and stability of solutions.

CE 778 - FRACTURE MECHANICS
Semester Hours: 3

CE 779 - ADV PENETRATION MECHANIC
Semester Hours: 3

Advanced analytical modeling of penetration and perforation phenomena, hydrocode development and applications, and similitude analysis.

CE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

PhD Research.

Civil Engineering, MSE

Civil Engineering, MSE

The CEE Department offers two plans leading to the M.S.E. degree for the Civil Engineering option. These are designated:

- Plan I (Thesis),
- Plan II (Non-thesis)

The following sections describe the requirements for each of these options. For both options, 50 percent of graduate coursework must be at the 600-level or above, and students must earn a grade of B or better in all 600-level or above coursework. Students should consult their faculty advisor when selecting courses for their Program of Study (POS).

Basic Program of Study

The Basic POS, common to both Plan I and Plan II MSE options, contains a minimum of 24 semester hours of graduate-level coursework that must include:

Code	Title	Semester Hours
Engineering Major		
Select 12 semester hours of graduate courses in an engineering major including supporting engineering courses		12
First Minor		
Select a first minor of 6 semester hours in an approved engineering area of specialization		6
Second Minor		
Select a second minor of 6 semester hours in Mathematics, Graduate Engineering Analysis, or Statistics (ISE 690)		6
Total Semester Hours		**24**

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
CE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense		
Total Semester Hours		**30**

Plan II, Non-Thesis Option

Student selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study		24
Select 6 semester hours of graduate coursework to complete an approved extended program of study		6
Total Semester Hours		**30**

Civil Engineering, PhD (Joint with UAB)

The CEE Department offers a Ph.D. program (jointly with UAB) in Civil Engineering.

The following table is an outline of the Program of Study (POS) requirements. Students should consult their dissertation advisor and supervisory committee to develop their POS.

Program of Study

Students entering the joint Ph.D. degree program with a baccalaureate degree and without a master's degree must complete the following graduate coursework:

Code	Title	Semester Hours
Engineering Major [1]		
Select a minimum of 27 semester hours of graduate coursework in a major area		27
First Minor [1]		
Select 9 semester hours of graduate coursework in an approved engineering area of specialization		9
Second Minor [1]		
Select 6 semester hours of graduate coursework in Mathematics, Graduate Engineering Analysis, or Statistics (ISE 690)		6
Additional Courses		
Select 6 additional semester hours of graduate coursework in the major, first or second minors		6
Doctoral Dissertation [2]		
24 hours of CE 799 - Doctoral Dissertation		24
Total Semester Hours		**72**

1. Students entering the joint PhD program after completing their master's degree must complete 24 semester hours of coursework beyond the coursework required for their master's degree. The combined coursework completed in the master's and doctoral programs of study must satisfy the semester hour requirements for the major and minor areas specified above.
2. 24 semester hours of CE 799 must be completed for those who entered the program with a master's degree without a thesis. 18 semester hours of CE 799 must be completed for those who entered the program with a thesis.

Electrical and Computer Engineering

272 Engineering Building
Telephone: 256.824.6316

Email: ecegrad@uah.edu

URL: uah.edu/eng/departments/ece

Interim Chair: Aleksandar Milenkovic, Ph.D.

Associate Chair: Laurie Joiner, Ph.D.

Mission

The mission of the Electrical and Computer Engineering (ECE) Department is to develop and maintain high quality undergraduate and graduate programs in electrical, computer, and cybersecurity engineering to meet the needs of its constituents, and to participate in scholarly and productive research that contributes to the economic well-being and quality of life for the residents of Huntsville, the State of Alabama, and the citizens of the United States of America.

Degree Programs

The ECE Department supports several degree programs that provide a unique academic and research experience for students including:

- Master of Science in Engineering (Computer Engineering)
- Master of Science in Engineering (Electrical Engineering)
- Master of Science in Software Engineering
- Master of Science in Cybersecurity
- Doctor of Philosophy in Computer Engineering (Shared with UAB)
- Doctor of Philosophy in Electrical Engineering (also offered with Optical Sciences and Engineering Interdisciplinary program)

The ECE Department offers opportunities for advanced work in a variety of fields, including radar and radar systems, digital signal processing, digital communications, digital and analog electronics, computer architecture, cybersecurity, parallel processing, software engineering, software safety, optics, and photonics.

Co-located in one of the nation's largest research parks, UAH has the intellectual and social environment to provide a well-rounded, technologically oriented degree. ECE graduate students have outstanding opportunities for research, collaboration, cooperative employment, and future employment with government research centers and high-tech businesses. In addition, a number of UAH research centers collaborate with the ECE Department, including the Center for Rotorcraft Systems Engineering and Simulation, the Center for Modeling, Simulation and Analysis, the Center for Applied Optics, and the Nano and Micro Devices Center.

Prospective and current students are encouraged to visit the ECE Department website at www.uah.edu/eng/departments/ece (http://www.uah.edu/eng/departments/ece/) for information about faculty research interests, ongoing research projects, funding opportunities and course availability. Other information about the ECE graduate programs are available in the department office.

MSE in Computer or Electrical Engineering

The MSE in Computer or Electrical Engineering each require 30 credit hours and consist of two options. The thesis option requires 24 credit hours of graduate coursework and a minimum of six credit hours of thesis coursework. Students under this option must complete a written thesis and an oral defense. The non-thesis option requires 30 credit hours of graduate coursework.

Students wishing to pursue an MSE degree in Computer or Electrical Engineering must meet the admission requirements of the UAH Graduate School as well as the College of Engineering. Students who are admitted to these programs must file a Program of Study made in consultation with their Faculty Advisor.

MS in Software Engineering (MSSE)

The MSSE degree program has two options: Plan I and Plan II. Plan I requires 24 credit hours of graduate coursework and a minimum of six semester hours of thesis. Plan I students must also write and defend a thesis as a final examination. Plan II requires 24 credit hours of coursework as well as a capstone and elective course. Students who are admitted to these programs must file a Program of Study made in consultation with their Faculty Advisor. Students wishing to pursue the MSSE degree must meet the admission requirements of the UAH Graduate School, as well as the College of Engineering.

MS in Cybersecurity (MSCBS)

The MSCBS degree program is an interdisciplinary program with the Colleges of Science and Business with a distinct computer engineering track. The MSCBS has one option: 30 credit hours of graduate coursework with no thesis. Students who are admitted to this program must file a Program of Study made in consultation with their Faculty Advisor. Students wishing to pursue the MSCBS degree must meet the admission requirements of the UAH Graduate School, as well as the College of Engineering.

PhD in Computer or Electrical Engineering

The ECE Department offers a program leading to the degree of Doctor of Philosophy (Ph.D.) in Computer or Electrical Engineering. The Ph.D. is a research-oriented degree awarded upon completion of a defined program of study, demonstration of scholarly competence, distinctive achievement in a special field, and demonstrated ability to do an independent, original investigation. Demonstration of substantial scholarly research accomplishments, rather than mere accumulation of residence and course credits, is an essential consideration in awarding the Ph.D. degree.

The ECE Department doctoral programs require 48 credit hours of approved coursework. Students must register for a minimum of 18 credit hours of dissertation research. Students must meet with their Doctoral Advisors to develop a Program of Study (POS), which lists the approved coursework required for the Ph.D. In addition, students must register for dissertation research every semester after the completion of the POS until the dissertation defense. At the end of the coursework, a student must pass a Qualifying Examination. Finally, a student must write an acceptable dissertation that must be defended in front of the supervisory committee. More details about these examinations are available in the department office. In order for a student's doctoral dissertation to be approved, at least one refereed journal or refereed national conference article must be published or accepted for publication.

Students wishing to pursue a Ph.D. must meet the admission requirements of the UAH Graduate School as well as the College of Engineering. Students who do not have the appropriate bachelor's or master's degree from an ABET-accredited Computer or Electrical Engineering program must complete the foundation courses described below or demonstrate proficiency by completing similar courses or providing evidence based on employment experience.

Foundation Courses

The Computer and Electrical Engineering degree programs described above assume that students have a bachelor's degree and/or master's degree in Computer or Electrical Engineering, respectively.

To pursue the MSE or Ph.D. in Computer Engineering, students who do not have a bachelor's degree in Computer Engineering should complete coursework or demonstrate knowledge in the following CPE foundation areas[1]:

Code	Title	Semester Hours
Programming Languages/Software Engineering		
CPE 211	INTRO COMPUTER PROG FOR ENGR	3
CPE 212	FUNDAMENTALS SOFTWARE ENGRG	3
CS 317	INTRO DESIGN/ANALYSIS OF ALG	3
Digital Logic Design/Electronics		
EE 202	INTRO DIGITAL LOGIC DSGN	3
EE 315	INTRO ELECTRONIC ANAL & DESIGN	3
Computer Organization/Microprocessors		
CPE 221	COMPUTER ORGANIZATION	3
CPE 323	INTRO TO EMBEDDED COMPUTER SYS	3
CPE 431	INTRO COMPUTER ARCHITECTURE	3
Total Semester Hours		**24**

1 An entering student can demonstrate knowledge of the material in one of the following ways: completing the courses at UAH, completing similar courses at another institution, or by providing evidence based on employment experience. A student may be required to successfully pass a placement exam to demonstrate their knowledge of the material.

To pursue the MSE or Ph.D. in Electrical Engineering, students who do not have a bachelor's degree in Electrical Engineering must complete coursework or demonstrate knowledge in the following subjects[1]:

Code	Title	Semester Hours
EE 202	INTRO DIGITAL LOGIC DSGN	3
EE 213	ELECTRICAL CIRCUIT ANALYSIS I	3
EE 307	ELECTRICITY & MAGNETISM	3
EE 315	INTRO ELECTRONIC ANAL & DESIGN	3
EE 382	ANALY METH CONTINUOUS TIME SYS	3
EE 383	ANALY METH MULTIVARIABLE	3
EE 385	RANDOM SIGNALS & NOISE	3
Total Semester Hours		**21**

1 An entering student can demonstrate knowledge of the material in one of the following ways: completing the courses at UAH, completing similar courses at another institution, or by providing evidence based on employment experience. A student may be required to successfully pass a placement exam to demonstrate their knowledge of the material.

To pursue either the MSSE or the MSCBS degrees, students who do not have a Computer Science or Computer Engineering bachelor's degree from an ABET-accredited program must complete the following courses or demonstrate knowledge in these subject areas[1]. Experience in the development of a large scale, industrial strength software system is highly desirable.

Code	Title	Semester Hours
CPE 211	INTRO COMPUTER PROG FOR ENGR (or programming in C, C++ or Java)	3
CPE 212	FUNDAMENTALS SOFTWARE ENGRG (Data Structures)	3
CS 214	INTRO DISCRETE STRUCTURE	3
CS 317	INTRO DESIGN/ANALYSIS OF ALG	3
CPE 348	INTRO TO COMPUTER NETWORKS	3
CPE 431	INTRO COMPUTER ARCHITECTURE	3
CPE 434	OPERATING SYSTEMS	3
Total Semester Hours		**21**

1 An entering student can demonstrate knowledge of the material in one of the following ways: completing the courses at UAH, completing similar courses at another institution, or by providing evidence based on employment experience. A student may be required to successfully pass a placement exam to demonstrate their knowledge of the material.

Master's Programs in Electrical & Computer Engineering

- Computer Engineering, MSE (p. 116)
- Electrical Engineering, MSE (p. 117)
- Master of Science in Cybersecurity (p. 148)
- Master of Science in Software Engineering, MSSE (p. 117)

Doctoral Programs in Electrical & Computer Engineering

- Computer Engineering, PhD (p. 114)
- Electrical Engineering, PhD (p. 115)

CPE 512 - INTRO PARALLEL PROGRAMMING
Semester Hours: 3

Introduction to processing in parallel and distributed computing environments. General concepts of parallel machine models, processes, mutual exclusion, process synchronization, message passing, and programming languages for parallel computing and scheduling. Design and analysis of parallel algorithms. Parallel programming environments: Pthreads for shared memory multiprocessor systems and PVM/MPI for distributed networked computers.

CPE 523 - HARDWARE/SOFTWARE CO-DESIGN
Semester Hours: 3

Study and design of Systems On a Chip (SOC). Emphasis on Field Programmable realizations of SOC systems. Prerequisite: CPE 522 or CPE 526.

CPE 526 - VLSI HARDWARE DESC LANG/MODL/S
Semester Hours: 3

Modern VLSI design techniques and tools, such as silicon compilers, (V)HDL modeling languages, placement and routing tools, synthesis tools, and simulators. Students will design, simulate, and layout using both programmable logic families and ASIC libraries.

CPE 527 - VLSI DESIGN I
Semester Hours: 3

Introduction to VLSI design using CAD tools, CMOS logic, switch level modeling, circuit characterization, logic design in CMOS, systems design methods, test subsystem design, design examples, and student design project. Design project to be fabricated and tested in CPE 528. Students enrolling in CPE 527 must enroll concurrently in CPE 527L.

CPE 527L - LABORATORY
Semester Hours: 0

Students enrolling in CPE 527L must enroll concurrently in CPE 527.

CPE 528 - VLSI DESIGN II
Semester Hours: 3

Advanced experience with CAD tools for VLSI design, IC testing. Design project from CPE 527 will be fabricated and tested. Implementation and verification of test programs, IC testing and troubleshooting, legal, economic, and ethical design issues. Oral presentations and written reports are required. Students enrolling in CPE 528 must enroll concurrently in CPE 528L.

CPE 528L - LABORATORY
Semester Hours: 0

Students enrolling in CPE 528L must enroll concurrently in CPE 528.

CPE 531 - INTRO COMPUTER ARCHITECTURE
Semester Hours: 3

Existing computer structures. Computer organization with emphasis on busing systems, storage systems, and instruction sets. Special purpose architecture, performance models and measures, VLSI influence on architecture.

CPE 534 - OPERATING SYSTEMS
Semester Hours: 3

Study of the fundamentals of operating systems. Emphasis on processes, file management, interprocess communication, input-output, virtual memory, networking and security.

CPE 536 - INTERNALS OF MODERN OPER SYS
Semester Hours: 3

In depth study of the design of modern operating systems such as Unix, NT, and Linux. Emphasis on the internals and implementation details of interrupt processing, real-time clocks, device independent I/O, process management, memory management, and file management.

CPE 538 - REAL TIME & EMBEDED SYSTEMS
Semester Hours: 3

Study of design methodologies for reliable real time systems.

CPE 549 - INTRO TO CYBERSECURITY ENGINRG
Semester Hours: 3

Introduction to cryptography and computer security through hardware and physical security to a knowledge of audit methods, security management, and public law. The course will introduce security engineering skills such as business process analysis, software security, IAE evaluation, and IAE testing.

CPE 555 - SECURE SOFTWARE DEV
Semester Hours: 3

Overview of methodologies for development of high-assurance software. Major topics include analysis of security and safety risks, software certification criteria, the software development lifecycle, risk mitigation, design and coding best practices, verification techniques, and auditing of software for insecure and unsafe coding constructs.

CPE 557 - SOFTWARE REVERSE ENGR
Semester Hours: 3

This course provides fundamental knowledge of software reverse engineering. The course provides the ability (a) to understand software of unknown origin or software for which source code is unavailable, (b) to determine how something works, (c) to discover data used by software, and (d) to aid in the analysis of software. The course introduces tools for reverse engineering, including disassemblers, debuggers, monitors, virtual machines and modern tools for software analysis.

CPE 559 - SYSTEMS SECURITY
Semester Hours: 3

This course (1) introduces cyber physical, industrial control, embedded and Supervisory Control and Data Acquisition (SCADA) control systems, (2) examines common vulnerabilities and threats associated with these systems, and (3) examines techniques to defend these systems from cyber-attacks.

CPE 561 - TRANSLATION SYSTEMS
Semester Hours: 3

Grammars, parsers, and lexical analyzers; implementation of translators via top-down and bottom up techniques; grammar analysis to identify ambiguities. Practical applications of translators including conversion of file formats and compilation of traditional computer languages.

CPE 590 - SPECIAL TOPICS IN COMP ENGR
Semester Hours: 1-3

CPE 590L - SELECTED TOPICS LABORATORY
Semester Hours: 0

CPE 601 - SURVEY INFORMATION ASSURANCE
Semester Hour: 1

CPE 610 - SELECTED TOPICS IN COMPUTER EN
Semester Hours: 1-6

CPE 612 - PARALLEL ALGORITHMS
Semester Hours: 3

Introduction to metrics describing the performance and scalability of parallel algorithms. Performance analysis of parallel algorithms for performing sorting, matrix multiplication, solving linear equations, and FFT.

CPE 613 - GEN PURPOSE GPU COMPUTING
Semester Hours: 3

The focus of this course is to introduce emerging techniques and programming paradigms that can be used to accelerate the processing speed of scientific and other high performance applications using Graphics Processing Units, GPUs. GPUs represent low-cost highly parallel video processing hardware that can be programmed for general purpose applications using UDA/OpenCL software architecture. The course will survey the current state of research and industrial activity and will give student's hands-on experience implementing design applications on real-world GPU facilities for a wide range of scientific applications. Prerequisite: CPE 512.

CPE 619 - MODELING & ANAL COMPU/COMMUN S
Semester Hours: 3

Modeling of single and multiprocessor systems, single and multi-stage interconnection networks, Computer Networks. Analysis using Stochastic processes, Markov and Queuing techniques. Modeling using Petri Nets and Finite State models. Prerequisite: EE 500 or MA 585.

CPE 621 - ADVANCED EMBEDDED SYSTEMS
Semester Hours: 3

Deeply embedded low-power wireless sensors. Low-power microcontroller architectures, sensor platform architecture, wireless intelligent sensors, low power wireless communication standards, battery powered systems, resource constrained operating systems, data aggregation/sensor synergy, and collaborative signal processing.

CPE 625 - CMOS ANALOG CIRCUIT DESIGN
Semester Hours: 3

Analog circuit design in CMOS technology. CMOS processing technology. MOS transistor modeling. Basic current mirrors and single-stage amplifiers. Noise analysis and modeling. Basic OPAMP design and compensation. Advanced current mirrors and OPAMPS. Bandgap references. Oscillators. CMOS technology characterization for radio-frequency (RF) design.

CPE 626 - ADVANCED VLSI DESIGN
Semester Hours: 3

Advanced VLSI Design. Case study of the VLSI design of a modern RISC processor using a Hardware Description Language. Prerequisite: CPE 526.

CPE 628 - TESTING OF HARDWARE SYSTEMS
Semester Hours: 3

Introduction to testing of digital electronic circuits and systems. Topics include: fault modeling, testing problems, testing schemes, test generation for combinational and sequential circuits, the complexity of testing, design for testability, built-in self-testing and boundary scan.

CPE 631 - ADV COMP SYSTEMS ARCHITECTURE
Semester Hours: 3

Study of architectural features of modern processors, including cache memories and memory systems, pipeline designs, branch prediction techniques. Design of superscalar, multithreaded VLIW processors, code optimization for such systems will be studied. Quantitative evaluation of architectural features are emphasized throughout the course. Prerequisite: CPE 512 and CPE 531.

CPE 633 - FAULT-TOLERANT COMPUTING SYS
Semester Hours: 3

Analysis and design of very high reliability and availability systems. Fault types, reliability techniques, and maintenance techniques. Case studies of high-availability long-life, life-critical systems. Both hardware and software techniques for achieving fault-tolerance will be studied.

CPE 635 - SYSTOLIC ARRAY PROCESSING
Semester Hours: 3

Systolic structure of fast algorithms and switchable array realizations.

CPE 643 - OPTICAL COMMUNICATIONS
Semester Hours: 3

CPE 645 - COMPUTER NETWORK SECURITY
Semester Hours: 3

Principles and concepts of computer network security. Introduction to cryptography, confidentiality, authentication, digital signatures, E-mail security, IP security, web security, intruders, malicious software, firewall, and other network security-related issues.

CPE 646 - MOBILE & WIRELESS NETWORKS
Semester Hours: 3

High-level issues in mobile and wireless networks. The main topics are mobile IP, mobile Ad hoc NETworks (MANETS) wireless sensor networks, wireless LAN, Bluetooth, cellular networks, satellite systems and security issues in mobiles and wireless networks.

CPE 647 - UBIQUITOUS COMPUTING
Semester Hours: 3

The course is based on the new "anytime, anywhere" computing paradigm, also known as ubiquitous computing. This course is project oriented, and explores issues of mobile, wireless, and distributed computing in Internet environment, advanced human-computer interfaces, and power efficient computing.

CPE 648 - ADVANCED COMPUTER NETWORKS
Semester Hours: 3

Advanced principles and concepts of general-purpose computer networks, with a special emphasis to internetworking and Internet. Transport and higher level protocols emphasis. Programming issues. High-speed networking, congestion control, data compression, security and distributed processing will be covered.

CPE 649 - ADV CYBERSECURITY ENGINEERING
Semester Hours: 3

Introduction to topics ranging from how to attack computer systems and networks to how to protect and recover from attacks on computer systems and networks. Basic process utilized by computer attackers in order to develop a complete understanding and appreciation of the threat to information assurance. Process of detecting, preventing, and recovering from information assurance attacks. Intrusion Detection and Prevention Systems, Auditing, Security Vulnerability Assessments, and the Incident Response process. Prerequisite: CPE 549.

CPE 649L - ADV CYBERSECURITY ENG LAB
Semester Hours: 0

Students enrolling CPE 649 must enroll concurrently in CPE 649L.

CPE 656 - SOFTWARE ENGRG STUDIO I
Semester Hours: 3

This is the first course in a two course studio series required for the MSSE degree in the College of Engineering. Students will work in small design teams on medium sized software projects. Activities include developing requirements, designing and constructing system prototypes, developing and implementing test and verification plans, and presenting the project for evaluation. The practice of software design and evaluation will be conducted in an iterative cycle using best software engineering practices, so that design and execution can be refined over the lifecycle of the project. Prerequisite: CS 650.

CPE 657 - SOFTWARE STUDIO
Semester Hours: 3

Graduate software studio is a capstone course in the MSSE program which requires students to present mastery of software development through completion of an extensive software project which follows a defined process. Students work in collaborative teams which will require extensive collaboration outside of class through meetings, teleconferencing, and documentation. Prerequisites: CS 650 plus 9 graduate credits or approval of instructor.

CPE 658 - SOFTWARE ENGRG STUDIO II
Semester Hours: 3

This is the second course in a two course studio series required for the MSSE degree in the College of Engineering. Students will work in small design teams on medium sized software projects. Activities include developing requirements, designing and constructing system prototypes, developing and implementing test and verification plans, and presenting the project for evaluation. The practice of software design and evaluation will be conducted in an iterative cycle using best software engineering practices, so that design and execution can be refined over the lifecycle of the project. Prerequisite: CPE 656.

CPE 690 - SELECTED TOPICS COMPUTER ENGRG
Semester Hours: 1-6

CPE 692 - CYBERSECURITY CAPSTONE
Semester Hours: 3

A capstone course emphasizing the integration of various principles, theories, and techniques for developing, implementing and using cybersecurity strategies and applications in organizations. Includes readings, lectures, tours, situation analysis, cases, and the completion of a major practical project. Normally taken in the last semester of a student's program. Minimum grade B required. Prerequisites: CS 585, CPE 549, IS 660, IS 663.

CPE 695 - PROJECTS IN COMPUTER ENGRG
Semester Hours: 3

CPE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours credit is awarded upon successful completion of master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

CPE 710 - SEL TOPICS IN PARALLEL PROC
Semester Hours: 3

CPE 715 - SELECTED TOPICS IN COMPUTAT TH
Semester Hours: 3

CPE 720 - SELECTED TOPICS IN VLSI DESIGN
Semester Hours: 3

Prerequisite: CPE 626.

CPE 726 - ALGORITHMS FOR VLSI DESIGN TOO
Semester Hours: 3

Tools for VLSI Design. This course is concerned with the algorithms found in VLSI design tools.

CPE 730 - SELECTED TOPICS IN COMPUTER SY
Semester Hours: 3

Prerequisite: CPE 631.

CPE 731 - DISTRIBUTED SHARED MEMORY SYS
Semester Hours: 3

Study issues related to performance, granularity of sharing, multithreading, cache coherence, memory consistency models, pull vs push caching, false sharing, thread migration. Case studies systems, including DASH, FLASH ThreadMarks, SHRIMP, Calypso, Alewife to understand these issues.

CPE 735 - SELECTED TOPICS IN OPERATING S
Semester Hours: 3

CPE 740 - SPEC TOPICS COMPUTER NETWORKS
Semester Hours: 3

Prerequisite: CPE 648.

CPE 742 - PARALLEL PROCESS DESIGN
Semester Hours: 3

CPE 748 - MOBILE & WIRELESS NETWORKS
Semester Hours: 3

High-level issues in mobile and wireless networks. The main topics are mobile IP, Mobile Ad hoc NETworks (MANETs), wireless sensor networks, wireless LAN, Bluetooth, cellular networks, satellite systems, and security issues in mobiles and wireless networks. Prerequisite: CPE 648 or CS 670.

CPE 760 - SEL TOPICS COMPILER/TRANSLAT S
Semester Hours: 3

CPE 790 - SEL TOPICS COMPUTER ENGRG
Semester Hours: 1-6

CPE 795 - RESEARCH IN COMPUTER ENGRG
Semester Hours: 1-6

CPE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

EE 501 - DIGITAL SIGNAL PROC ARCHITECTU
Semester Hours: 3

Introduction to digital signal processor architecture, applications, assembly language programming, and development tools for designing and implementing DSP systems.

EE 504 - INTRO DATA COMMUNICA NETWORKS
Semester Hours: 3

Overview of historic development of modern telephone and data communication system, system architecture, standards, broadband switching systems, modems, protocols, personal and mobile communications, digital modulation techniques.

EE 506 - COMMUNICATION THEORY
Semester Hours: 3

Review of elementary signals and systems including the Hilbert transform, cross and auto correlation, power density spectrum, and the Wiener-Khintchine theorem. Butterworth and Chebyshev lowpass filters. Bandpass signals and systems. The lowpass equivalent of a bandpass signal/system. Commonly used forms of linear and nonlinear modulation. Demodulation methods and circuits. Phase lock and frequency feedback techniques.

EE 510 - SELECTED TOPICS/ECE
Semester Hours: 1-6

EE 514 - ANALOG & DIGITAL FILTER DESIGN
Semester Hours: 3

Analog filter design via Butterworth, Chebyshev, and elliptical approximation. Active filter design using operational amplifiers. Digital filter design methods.

EE 516 - DIGITAL ELECTRONICS
Semester Hours: 3

Introduction to digital electronics. The Metal-Oxide-Semiconductor (MOS) transistor. MOS inverters and gate circuits. Bipolar junction transistors, ECL inverters, and bipolar digital gates. Semiconductor memories. Circuit design for VLSI.

EE 518 - NONLINEAR DYNAMICS & CHAOS
Semester Hours: 3

Topics: system stability, linearization, equilibrium/steady-state solutions, bifurcations, periodic solutions, limit cycles, oscillators, chaos, iterated maps and chaos control/synchronization. Various tools and methods used for analysis and design of nonlinear circuits and systems will be covered. Students should have prerequisite knowledge of electronics and signals and systems such as covered in EE 315 and EE 382.

EE 521 - ANTENNA DESIGN & ANALYSIS
Semester Hours: 3

Covers analytical methods and mathematical foundations for solving antenna radiation problems, based on Maxwell's equations. Different types of antennas will be studied, including wire, phased array, aperture, microstrip, and reflector antennas. Students should have prerequisite knowledge of electromagnetics, such as that covered in EE 308.

EE 525 - FUNDAMENTALS OF RADAR SYSTEMS
Semester Hours: 3

An introduction to radar systems and basic radar analysis. Topics include common radar topologies and construction methods, transmission, reception and processing of radar signals that are embedded in noise. Particular focus on analysis of the radar range equation and its various terms. Students are expected to have prerequisite knowledge of signals and systems and random signals such as covered in EE 382 and EE 385.

EE 532 - OPTICAL SYSTEMS DESIGN
Semester Hours: 3

Introduction to the geometrical design and analysis of optical systems, and to the design principles of lens systems.

EE 534 - OPTICAL FIBER COMMUNICATIONS
Semester Hours: 3

Introduction to optical fibers and their transmission characteristics, optical fiber measurements, sources and detectors, noise considerations for digital and analog communications, optical fiber systems.

EE 541 - OPTICS I
Semester Hours: 3

Foundations and physics of geometrical optics, Fermat's principles and Huygen wavelets, refraction and reflection. The many forms of Snell's Law. Optical path lengths, geometrical wavefronts and rays. Ray tracing, ynu-chart and matrix methods. Gaussian imagery and paraxial optics, conjugate elements, cardinal points, and image-object relations. Stops and pupils, chief and marginal rays, vignetting, and the optical or Lagrange invariant. The y-ybar diagram, design of common systems: objectives, magnifiers, microscopes, collimators and detectors. Optical glasses and chromatic aberrations, wavefront and transverse aberrations, spot diagrams and ray fan plots.

EE 542 - PHYSICAL OPTICS
Semester Hours: 3

Scalar and electromagnetic waves, polarization, coherence, reflection and refraction; two beam and multiple beam interference, interferometers, Fabry-Perots, thin films, diffraction, and absorption and dispersion.

EE 543 - OPTICAL COMM SYS & NETWORKS
Semester Hours: 3

EE 553 - LASER SYSTEMS
Semester Hours: 3

Spontaneous and stimulated emission, population inversion, optical resonators, three- and four-level systems, Q-switching and modelocking, semiconductor lasers, integrated optic waveguides and couplers, scanning systems, high power industrial applications. Includes a research project and oral presentation.

EE 570 - OPT & PHOTONIC SYSTEMS DESIGN
Semester Hours: 3

EE 586 - INTRO MODERN CONTROL SYSTEMS
Semester Hours: 3

The basic ideas and techniques of modern control theory. Analytical techniques for modeling, analysis and control of MIMO dynamic systems. State variable description of dynamic systems. State variable feedback control design and state observers. Kalman-filtering. Fundamentals of nonlinear systems analysis. Introduction to discrete time system modeling, analysis and control. Basics of adaptive and optimal control. Applications to aerospace and electric power systems.

EE 603 - RANDOM SIGNALS IN COMMUNICATIO
Semester Hours: 3

Random processes applied to communication and control. Concepts covered include stationarity, correlation, power spectrum, Brownian motion, thermal noise, Markov processes, and queuing theory. Emphasis on systems with noisy excitation.

EE 604 - DIGITAL IMAGE PROCESSING
Semester Hours: 3

Review of digital filters. Spatial filters and realizations. Edge and wedge detectors. Derivative matrices and u-notch, r-notch filters. Periodic images, their transformation and scanning, their two-dimensional Fourier transforms. Rational vectors and image filtering.

EE 605 - CLASSICAL CONTROL DESIGN
Semester Hours: 3

Design of feedback, feedforward, and minor-loop controllers/compensators using classical control engineering techniques and classical performance criteria. Frequency domain synthesis of lead, lag, lead-lag, etc. compensators; tuning of PD and PID controllers; error budgets; use of commercial CAD software for classical control design and performance evaluation; digital simulation techniques. CAD laboratory sessions.

EE 607 - ROBOTIC SYSTEMS CONTROL
Semester Hours: 3

In-depth study of information, decision and control problems associated with robotic system design. Sensor systems, recognition and decision algorithms, kinematics and dynamics, trajectory planning, analog and digital controllers, adaptive and optimal control.

EE 609 - ELECTROMAGNETIC FIELD THEORY
Semester Hours: 3

Mathematical approach to electromagnetic phenomena. Basic field concepts. Radiation and propagation. Waveguides and simple radiating and scattering systems. Perturbational and variational techniques.

EE 610 - SELECTED TOPICS/ECE
Semester Hours: 1-6

EE 612 - GRADUATE DESIGN PROJECT
Semester Hours: 3

Graduate design project in support of an M.S.E. program.

EE 613 - LASER ELECTRONICS
Semester Hours: 3

Resonant optical cavities. Atomic radiation. Laser oscillation and amplification. General characteristics of lasers. Laser excitation. Semiconductor lasers. Gas discharge phenomenon. Transition rates. Spectroscopy of common lasers. Detection of optical radiation.

EE 614 - DATA COMPRESSION
Semester Hours: 3

Introduction to the fundamental theories and techniques of lossless and lossy data compression. Topics include Huffman codes, arithmetic codes, Golomb-Rice code, dictionary techniques, context-based compression, scalar quantization, vector quantization, transform coding, subband coding, wavelets, compression standards, and selected advanced topics of data compression.

EE 615 - ANALOG CIRCUIT DESIGN
Semester Hours: 3

Use of operational amplifiers to synthesize special-purpose filters and circuits for analog signal processing and conditioning; linear and switching power supplies; high-frequency effects; circuits for transmitters and receivers; digital circuits from an analog viewpoint; A/D and D/A converters; selected topics.

EE 616 - MICROELECT DEV/INTE CIRC
Semester Hours: 3

Analysis and design of microelectronic devices for integrated circuits. Properties of semiconductors important to microelectronic device operation. Analysis and modeling of MOS devices and circuits. Analysis and modeling of metal semiconductor devices, junction diodes, bipolar transistors. Device fabrication technology. Prerequisite: EE 516.

EE 617 - VLS INTEGRATION DEVICES
Semester Hours: 3

Operation and modeling of the MOS transistor. Second-order considerations for a MOSFET, VLSI device fundamentals and scaling laws. Micron-length and submicron-length semiconductor devices. Basic technology and applications of VLSI. Impact of VLSI on computer architecture. VLSI computer aided design.

EE 618 - VLSI CIRCUITS
Semester Hours: 3

MOS device electronics. MOS processing and design rules. Circuit design with MOSFETS. MOS circuit technique. Combinational logic gate in CMOS. Pseudo-NMOS logic gates. Very high performance digital circuits. Sequential logic circuits. Designing semiconductor memories. Low power CMOS VLSI circuit design.

EE 619 - RADAR SYSTEMS
Semester Hours: 3

Radar range equation, noise & noise figure, radar losses, false alarm and detection probability, detection probability improvement techniques, matched filter theory, ambiguity function. Prereq: EE 525.

EE 620 - CMOS ANALOG CIRCUIT DESIGN
Semester Hours: 3

Analog circuit design in CMOS technology. CMOS processing technology. MOS transistor modeling. Basic current mirrors and single-stage amplifiers. Noise analysis and modeling. Basic OpAmp design and compensation. Advanced current mirrors and OpAmps. Bandgap references. Oscillators. CMOS technology characterization for radio-frequency (RF) design. Same as CPE 625.

EE 622 - HARDWARE RELIABILITY
Semester Hours: 3

The objective for this course is to provide students with an understanding of the essential reliability physics of electronic devices as well as some of the practical technological considerations.

EE 629 - ANAL & COMP METH IN ELEC ENG I
Semester Hours: 3

Analytic and numerical solution techniques applicable to problems arising in engineering, utilizing complex variable theory, linear algebra, matrix theory, and transform methods.

EE 630 - ANAL & COMP METHODS ELEC EG II
Semester Hours: 3

Analytical and numerical solution techniques applicable to problems arising in electrical engineering. Partial differential equations, vector differential and integral calculus, special functions, Fourier analysis with applications and integral equations.

EE 632 - FOURIER OPTICS
Semester Hours: 3

Introducing the optical system as an invariant linear system, convolution, Sommerfield's diffraction integral, Fourier Transform, angular spectrum, coherent and incoherent imaging, optical transfer function.

EE 633 - ELECTRO-OPTICAL ENGINEER
Semester Hours: 3

Propagation of optical beams in homogeneous and guiding media, optical resonators, and spectrum analyzers, theory of laser oscillation, some specific laser systems, parametric oscillators, electro-optical and acousto-optical modulators.

EE 634 - OPTICAL COMMUNICATIONS
Semester Hours: 3

Optical communication systems; counting statistics; the optical detector response process; direct detection; heterodyne detection parameter estimation in optical communications; pointing, spatial acquisition and tracking.

EE 642 - DATA & DIGITAL COMMUNICATION
Semester Hours: 3

Introduction to digital and data communications; transmission channels; modulation and coding; telephone networks; data communication standards; noise and distortion; computer interfacing; protocols. Prerequisite: EE 603.

EE 648 - DIGITAL SIGNAL PROCESSING
Semester Hours: 3

Theory and applications of signal processing by digital techniques. Difference equations, Z-transform theory, digital-filter design, fast Fourier transform, quantization effects, and discrete estimation. Applications in digital filtering, signal processing, data analysis and smoothing, and image processing. Students should have prerequisite knowledge of signals and systems such as covered in EE 383.

EE 654 - OPTICAL TESTING
Semester Hours: 3

EE 672 - DIGITAL PROC RANDOM SIGNALS I
Semester Hours: 3

Discrete signals, linear systems, spectral analysis and probability; and random discrete-time signals. Introduction to statistical interference, time-series analysis and spectral estimation of random discrete-time signals. Cross correlation and cross spectra, multitaper spectrum estimation and multivariable spectral analysis.

EE 673 - DIGITAL PROC RANDOM SIGNALS II
Semester Hours: 3

Parametric models for random signal processing; AR (autoregressive), MA (moving average), ARMA(autoregressive moving average), and Prony method. Two-dimensional spectral estimation; higher-order spectral analysis and multiresolution signal analysis.

EE 690 - UNIFORM GEOM THY DIFFRAC
Semester Hours: 3

Geometrical optics fields, geometrical optics reflected fields, two-dimensional wedge diffraction (GTD and UTD), three-dimensional wedge diffraction and corner diffraction, equivalent currents, diffraction at a smooth convex conducting surface, radar cross section.

EE 696 - GRAD INTERN EE ENGR
Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization or government agency that has particular interest and relevance to the graduate student. Permission of EE faculty member is required.

EE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of nine hours of credit is awarded upon successful completion of master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

EE 700 - SAMPLED DATA CONT SYS
Semester Hours: 3

Classical and modern methods for analysis and design of sampled data-control systems; Ztransforms, transport lags, z and w plane analysis, state variables, and the transition matrix.

EE 701 - ADV LINEAR CONTROL THRY
Semester Hours: 3

Modern techniques for analysis and design of linear control systems. Matrix formulation, multivariable control systems, state variable concepts. Linear transformation, controllability, observability, discrete-time systems. Prerequisite: EE 586.

EE 703 - MODERN CONTROL DESIGN
Semester Hours: 3

Use of modern (state-variable) control concepts and theories to design high-performance controllers for multi-input/multi-output set-point regulation and servo-tracking/pointing problems. Modeling of uncertain disturbances; design of disturbance-accommodating controllers; introduction to adaptive and stochastic control. Use of commercial CAD software for modern control design and performance evaluation. CAD laboratory sessions. Prerequisite: EE 701.

EE 704 - NONLINEAR CONTROL SYSTEM
Semester Hours: 3

Classical and modern methods for analysis and design of nonlinear automatic control systems. State variables, phase plane, limit cycles, stability, describing functions, relay control, stabilization theory. Prerequisite: EE 701.

EE 705 - THEORY OPTIMAL CONTROL
Semester Hours: 3

General theory of optimal control of dynamic processes. Calculus of variations. Hamilton-Jacobi theory. Pontryagain's maximum principle, dynamic programming.

EE 706 - KALMAN FILTERS
Semester Hours: 3

Review of continuous and discrete time systems, random variables and processes; matrix random processes; derivation of the first order, linear Kalman filter; derivation of the linear vector Kalman filter; derivation of the extended Kalman filter; design and implementation of specific Kalman filters. Prerequisite: EE 525 or EE 586.

EE 707 - INFORMATION THEORY
Semester Hours: 3

Self-information, entropy, mutual information, and channel capacity, encoding, error detecting and correcting codes. Sampling theorem. Discrete and continuous channels.

EE 710 - SELECTED TOPICS/ECE
Semester Hours: 1-6

EE 711 - ANTENNA THEORY
Semester Hours: 3

Antennas and antenna arrays. Radiation patterns and impedance characteristics. Spheres, cylinders, horns, slots, microwave lenses, traveling-wave, and frequency independent antennas.

EE 716 - DEVICE MOD INTEG CIR DSG
Semester Hours: 3

Fundamental limits in integrated circuits. Advanced and detailed development of the theory of MOS and bipolar transistors. MOS and bipolar transistor models for IC design. Numerical algorithms for modeling microelectronic devices. Device modeling and simulation for radio frequency (RF) application. Computer-aided design and VLSI device development.

EE 717 - SPACE APPLI/ELECTROMAGNE
Semester Hours: 3

Plasma as a dielectric; dielectric functions for cold, warm, isotropic and anisotropic plasmas, body-plasma interaction; space craft electrodynamics, antennas in plasmas; mode of radiation, input impedance and radiation pattern, scattering problems involving plasmas.

EE 718 - MICROWAVE TECHNIQUES
Semester Hours: 3

Network representations and analysis of microwave devices. Discontinuities from a circuit point of view. Symmetry consideration. Scattering matrices in circuit design. Cavity resonators.

EE 721 - ROBUST AND ADAPTIVE CONTROL
Semester Hours: 3

Introduction to fundamental ideas of robust and adaptive control. Effects of parameter and disturbance uncertainties, H-infinity and mu-synthesis ideas; parameter estimation techniques; adaptive control algorithms; stability considerations; model-reference and linear adaptive control techniques.

EE 722 - SLIDING MODE CONTROL
Semester Hours: 3

The basic and advanced theories and analytical techniques for modeling and analysis of systems dynamics in sliding manifolds. Traditional and High Order Sliding mode controller design. Discontinuous and equivalent control, robustness. Applications to control of electro-mechanical systems, reusable launch vehicle, air craft, spacecraft, and DC-to-DC power converters. Prerequisite: EE 701.

EE 723 - RADAR TRACKING
Semester Hours: 3

Alpha-Beta and Alpha-Beta-Gamma track filters, range, angle, Doppler frequency measurement and discriminators; implementation of range, angle, Doppler, and combined range/angle/Doppler trackers; tracking the presence of multipath, multiple target effects. Prerequisite: EE 619.

EE 724 - RADAR WAVEFORMS & SIGNAL PROCE
Semester Hours: 3

Stretch Processing. Synthetic Aperture Radar and SAR signal processing, Space-time adaptive processing (STAP). Phase coded waveforms and processing. Frequency hop waveforms Prerequisite: EE 619.

EE 725 - ADVANCED RADAR TECHNIQUE
Semester Hours: 3

Modern radar systems for search and tracking are analyzed with emphasis on signal processing. Modeling and simulation of system and environment. Advanced techniques include CFAR, binary modulation, frequency agility, polarization agility, and synthetic aperture. Prerequisite: EE 619.

EE 726 - DECIS/ESTIMATION THEORY
Semester Hours: 3

Classical detection theory, including maximum likelihood, Neyman-Pearson, Bayes and minimax criteria. Estimation theory concepts and criteria, linear estimators, Kalman filters, maximum likelihood and least-squares estimator, matched filters, Cramer-Rao lower bound. Introduction to pattern recognition.

EE 727 - NUMER METH ELECTROMAGNET
Semester Hours: 3

Review of concepts in electromagnetics, antennas and scattering problems, method of moments and applications, finite difference and finite element methods, numerical solutions of transient problems associated with broadband systems, impulse response, direct solution of field equations in time domain.

EE 733 - NONLINEAR OPTICS APPLICATIONS
Semester Hours: 3

Modeling of optical nonlinearities; Kerr, thermal and photorefractive effects; nonlinearity-induced beam distortion; applications of nonlinearities in crystals and fibers; quantum well and SEED devices; soliton-based communication system; nonlinear optical switches, deflectors and limiters; measurements of nonlinearities.

EE 734 - FIBER OPTICS
Semester Hours: 3

Propagation in dielectric slab and fibers with step and graded index of refraction; electromagnetic and ray optical methods; eikonal equations; ray trajectory; WKB method; paraxial approximation; weakly guiding structures.

EE 735 - STATISTICAL OPTICS
Semester Hours: 3

Introduction to random variables and random processes; first-order properties of light waves; coherence of optical waves, partial coherence and imaging systems, imaging in randomly inhomogeneous media, fundamental limits in photoelectric detection of light.

EE 738 - OPT TRANSF/PATTN RECOGNI
Semester Hours: 3

Systems and transforms in diffraction theory; two-dimensional Fourier transform; Hankel transforms; generalized Hankel transforms; optical signals, correlation coherence; filtering; apodization; applications to optical pattern recognition.

EE 742 - WIRELESS COMMUNICATIONS
Semester Hours: 3

Design and analysis of wireless transmission systems. Prerequisite: EE 642.

EE 744 - ERROR CONTROL CODING
Semester Hours: 3

Linear block coding techniques, convolutional codes and the Viterbi decoding algorithm, iterative decoding algorithms and the codes to which they are applied, including Turbo Codes, Low-Density Parity-Check Codes, and Serially-Concatenated Codes. Prerequisite: EE 504.

EE 745 - MOD/PHASE LOCK TECH COMM
Semester Hours: 3

Treatment of analog and digital phase locked loops. Applications in carrier regeneration, demodulation, and synthesis discussed. Linear and nonlinear PLL models and analysis. Noise analysis via Volterra Series and Fokker-Planck equation. False lock phenomenon.

EE 747 - PATTERN RECOGNITION ALGORITHMS
Semester Hours: 3

EE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

Computer Engineering, PhD (shared program with UAB)

The UAH Electrical and Computer Engineering Department offers, jointly with the University of Alabama in Birmingham, a Ph.D. program in Computer Engineering.

The following table is an outline of the program of study requirements. Students should consult their dissertation advisor and supervisory committee to develop their Program of Study. At least 42 credit hours applied towards degree requirements must have the CPE prefix and be taken at UAH.

Program of Study

Code	Title	Semester Hours
CPE Major		
Select a major consisting of a minimum of 18 semester hours of approved related coursework in Computer Engineering		18
Math Minor		
Select one of the following options:		12
Option 1: Select 12 semester hours in approved graduate level mathematics courses		
Option 2: Select 6 semester hours in approved graduate level mathematics courses and select one of the following approved two-course sequences		
MA 585 & CPE 619	PROBABILITY and MODELING & ANAL COMPU/COMMUN S	
MA 540 & MA 640	COMBINATORIAL ENUMERATION and GRAPH THEORY	
MA 640 & MA 740	GRAPH THEORY and COMBINATORIAL ALGORITHMS	
EE 629 & EE 630	ANAL & COMP METH IN ELEC ENG I and ANAL & COMP METHODS ELEC EG II	
MA 542 & CPE 645	ALGEBRA and COMPUTER NETWORK SECURITY	
Engineering or Computer Science Area of Specialization Minor		
Select a minor consisting of 12 semester hours of approved coursework in engineering or computer science		12
Supporting Coursework and Dissertation Hours		
Select 6 semester hours of approved ECE graduate coursework		6
Complete a dissertation		18
Total Semester Hours		**66**

Electrical Engineering, PhD

The UAH Department of Electrical and Computer Engineering offers a Ph.D. in Electrical Engineering.

The following table is an outline of the program of study requirements. Students should consult their dissertation advisor and supervisory committee to develop their programs of study.

Program of Study

Code	Title	Semester Hours
EE Major		
Select a minimum of 18 semester hours of approved related coursework in Electrical Engineering		18
Math Minor		
Select one of the following options:		12
Option 1: Select 12 semester hours in approved graduate level mathematics courses		
Option 2: Select 6 or 9 semester hours in approved graduate level mathematics courses and one of the following approved two-course sequences		
Select one of the following approved two course sequences:		
EE 629 & EE 630	ANAL & COMP METH IN ELEC ENG I and ANAL & COMP METHODS ELEC EG II	
PH 607 & PH 609	MATHEMATICAL METHODS I and MATHEMATICAL METHODS II	
Engineering or Computer Science Area of Specialization Minor		
Select a minor consisting of 12 semester hours of approved coursework in engineering or computer science		12
Supporting Coursework and Dissertation Semester Hours		
Select 6 additional semester hours of approved graduate level ECE coursework		6
Complete a dissertation		

Dissertation research	18
Total Semester Hours	**66**

Computer Engineering, MSE

The Computer Engineering (CPE) program offers two plans leading to the MSE with a Computer Engineering option. These are designated:

- Plan I (Thesis)
- Plan II (Non-thesis)

The following sections describe the requirements for each of these options. With prior approval, up to 12 credit hours of 500-level courses may be taken in fulfillment of the MSE requirements. At least 15 credit hours counted toward the degree must be courses with a CPE prefix taken at UAH.

Basic Program of Study

The Basic Program of Study, common to both the Plan I and Plan II MSE options, contains a minimum of 24 credit hours of graduate-level coursework that must include:

Code	Title	Semester Hours
CPE Core [1]		
CPE 512	INTRO PARALLEL PROGRAMMING	3
CPE 526	VLSI HARDWARE DESC LANG/MODL/S	3
CPE 631	ADV COMP SYSTEMS ARCHITECTURE	3
3 semester hour graduate course in computer engineering or a related field		3
Math Minor		
6 hours of coursework with mathematical or theoretical foundation. The courses must be approved by the student’s academic advisor.		6
Engineering Area of Specialization Minor		
Select a 2-course sequence from engineering, or computer science [2]		6
Total Semester Hours		**24**

1. Students who have completed these or similar courses elsewhere may request course substitutions. All substitutions must be approved by the student’s academic advisor.
2. At least one of those courses should be at the 600 level. The selected courses must be approved by the student’s academic advisor or Supervisory Committee.

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete the Basic Program of Study as described above		24
CPE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense		
Total Semester Hours		**30**

Plan II, Non-Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete the Basic Program of Study as described above		24
Select 6 semester hours of graduate coursework to complete an approved extended program of study [1]		6
Total Semester Hours		**30**

1. At least 3 semester hours must be at the 600-level or above

Electrical Engineering, MSE

The Electrical Engineering (EE) program offers two plans leading to the MSE with an Electrical Engineering option. These are designated:

- Plan I (Thesis)
- Plan II (Non-thesis)

The following sections describe the requirements for each of these options. No more than 12 credit hours of 500-level courses may be applied to the MSE degree. Students make take up to six credit hours of 500-level courses may be taken in fulfillment of the requirements for the EE Major or the Engineering Area of Specialization Minor. Students may also take up to six credit hours of 500-level mathematics course in fulfillment of the Math Minor. All courses in the Program of Study (POS) must be approved by a Faculty Advisor.

Basic Program of Study

The Basic POS, common to both the Plan I and Plan II MSE options, contains a minimum of 24 credit hours of graduate-level coursework that must include:

Code	Title	Semester Hours
EE Major		**12**
Select 12 semester hours of related graduate-level courses in an EE subject area		
Math Minor [1]		
6 hours of coursework with mathematical or theoretical foundation.		6
Engineering Area of Specialization Minor		
Select a 2-course sequence from engineering, or computer science [2]		6
Total Semester Hours		**24**

1. Students may take two graduate level mathematics courses or EE 629 and EE 630
2. At least one of those courses should be at the 600 level.
3. Concentration in Optoelectronics: Under the EE Major students must take EE 617, EE 618, and EE 553. Under the engineering area of specialization, students must take PH 541 and PH 542.
4. Concentration in Optics and Photonics Technology: Under the EE Major students must take EE 632, EE 633, and EE 634. Under the engineering area of specialization, students must take PH 451 and PH 452.

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete the Basic Program of Study as described above		24
EE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense		
Total Semester Hours		**30**

Plan II, Non-Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete the Basic Program of Study as described above		24
Select 6 semester hours of graduate coursework to complete an approved extended program of study		6
Total Semester Hours		**30**

Software Engineering, MSSE

The CPE program offers two plans leading to the MSSE. These are designated:

- Plan I (Thesis)
- Plan II (Non-thesis)

The following sections describe the requirements for each of these options. Students must consult their Faculty Advisor when constructing their Program of Study (POS).

Basic Program of Study

The Basic POS, common to both Plan I and Plan II MSSE options, contains a minimum of 24 credit hours of graduate-level coursework that must include:

Code	Title	Semester Hours
Computer Science Core		
CS 650	SOFT'W ENGINEERING PROC	3
CS 617	DES & ANALY OF ALGORITHM	3
CS 656	SOFTWARE TESTING	3
Select one of the following (CS 690, CS 613, CPE 536, CPE 631)		
Cybersecurity (Choose one)		
CPE 549	INTRO TO CYBERSECURITY ENGINRG	3
CS 585	INTRO CYBERSECURITY ENGR	3
or CS 685	APPLIED CRYPTOGRAPHY	
Select 6 hours from one concentraion		**6**
Area 1: Big Data/Data Mining (CS 554, CS 637, CS 640, or CS 641)		
Area 2: Project Management (ISE 690-required and EM 660, MGT 601 or MKT 604)		
Area 3: Parallel Programming (CPE 512, CPE 612, CPE 613)		
Area 4: Embedded Systems (CPE 538, CPE 523, CPE 621)		
Area 5: Advanced Cybersecurity (CPE 649, CPE 645, IS 663)		
Elective (approved by advisor)		**3**
Total Semester Hours		**24**

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete the Basic Program of Study as described above		24
CPE 699	MASTER'S THESIS	6
Total Semester Hours		**30**

Plan II, Non-thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete the Basic Program of Study described above		24
Select 3 hour elective approved by advisor		3
Capstone CPE 657		3
Total Semester Hours		**30**

Industrial and Systems Engineering and Engineering Management

N143 Technology Hall
Telephone: 256.824.6256
Email: isegrad@uah.edu

Interim Chair: Sampson Gholston, Ph.D.

Mission

The mission of the Industrial & Systems Engineering and Engineering Management (ISEEM) program is to provide integrated, applications-oriented education and research programs in the areas of Industrial Engineering, Systems Engineering, and Engineering Management to support the needs of students and organizations in the Huntsville, Alabama, area and beyond.

Degrees

Master of Science in Engineering (Engineering Management, Industrial Engineering, Systems Engineering concentrations)
Master of Science in Operations Research
Doctor of Philosophy in Industrial Engineering (with Engineering Management, Industrial Engineering, Operations Research, and Systems Engineering majors)

The ISEEM Department offers major options and associated minors in the subject areas of Operations Research, Industrial Engineering, Systems Engineering, and Engineering Management. All students are encouraged to tailor their graduate programs with a blend of theory and applications. ISEEM faculty are actively involved in research programs, which affords graduate students opportunities for coursework and research inquiry in the areas described above. Please contact the ISEEM Department (256.824.6256) or visit the ISEEM home page at http://www.uah.edu/iseem (http://www.uah.edu/iseem/) for further details.

Industrial and Systems Engineering, MSE & MSOR

Additional Admission Requirements

The requirements for admission for graduate study in an ISEEM program conform to the policies of the UAH Graduate School and the College of Engineering. In addition, ISEEM requires the following:

1. ABET-accredited B.S. degree in engineering
2. GPA of 3.000 or better, GPA of 3.500 or better at the graduate level
3. Minimum GRE scores of 150 Verbal, 155 Quantitative, and 4.0 Analytical Writing (old scores: 400 or better Verbal, 500 or better Quantitative, and a combined score of 1000 or better, Analytical Writing score of 4.0 or better). ISEEM requires the GRE, however candidates can petition the department for a waiver if their experience and/or academic achievement merits a waiver.

Additionally, the Ph.D. Engineering Management and Systems Engineering options have a preference of five years of work experience in an engineering position beyond the B.S. degree **or** current full-time employment as an engineer.

General Requirements

Students pursuing an MSE option or the MSOR under ISEEM must follow the requirements for either Plan I (Thesis Option) or Plan II (Non-Thesis Option). Both plans require 24 credit hours of approved graduate coursework. Plan I requires a minimum of six credit hours of thesis work and the successful completion of the thesis as approved by the supervisory committee. Plan II requires an additional six credit hours of approved graduate coursework.

MSE Concentrations

The **MSE-Engineering Management Concentration** was developed to meet the needs of practicing engineers who find themselves performing engineering management functions without the benefit of a formal management education. The Engineering Management Concentration is designed to build upon the mathematical and analytical expertise gained from both a formal engineering education and professional experience. The Engineering Management curriculum emphasizes the application of the management function in the technological setting, while recognizing the basic and applied sciences in engineering systems. To learn more or request additional information, please visit the Engineering Management web page (https://www.uah.edu/admissions/learn-more-mseem/).

The **MSE-Industrial Engineering Concentration** is offered to engineers who possess a bachelor’s degree in a traditional engineering discipline and who have the desire to broaden their engineering problem-solving skills. This is accomplished by providing them with a better understanding of traditional and contemporary problem-solving skills in the areas of operation research, quality control, computer integrated manufacturing, and simulation. The program is applications oriented and can be tailored to fit the individual needs of the student.

The **MSE-Systems Engineering Concentration** offered for engineers who possess a bachelor's degree in a field other than Industrial & Systems Engineering and who have the desire to broaden their background into systems-oriented aspects of engineering, or for those students who have an Industrial & Systems Engineering bachelor’s degree and wish to further their systems skills. With a curriculum focused on needs identification, cost-benefit analysis, the system life cycle, quality control, multi-disciplinary optimization, model-based systems engineering and digital engineering, the program provides students with the analysis and design tools to supplement those learned in their undergraduate engineering program.

MS Operations Research

The M.S. in Operations Research option is for students who wish to broaden their background into operations research. Courses in the curriculum include linear programming, optimization, queueing, Markov processes, and systems modeling.

Industrial and Systems Engineering, PhD.

The Ph.D. in Industrial Engineering offers majors in Engineering Management, Industrial Engineering, or Systems Engineering. The content of these programs can vary to suit the needs and goals of the student.

Additional Admission Requirements

The requirements for admission for graduate study in an ISEEM program conform to the policies of the UAH Graduate School and the College of Engineering and are listed as follows:

1. ABET-accredited B.S. degree in engineering
2. GPA of 3.000 or better
3. Minimum GRE scores of 150 Verbal, 155 Quantitative, and 4.0 Analytical Writing (old scores: 400 or better Verbal, 500 or better Quantitative, and a combined score of 1,000 or better, Analytical Writing score of 4.0 or better). ISEEM requires the GRE, however, candidates can petition the department for a waiver if their experience and/or academic achievement merits a waiver.

Additionally, the MSE Engineering Management and Systems Engineering options prefer two years of work experience in an engineering position beyond the B.S. degree or current full-time employment as an engineer.

General Requirements and Exams

Students pursuing a Ph.D. option under ISEEM must complete 48 credit hours of approved graduate coursework beyond the bachelor's degree. A maximum of six hours of master's thesis credit may be included in the 48 credit-hour requirement. A Program of Study (POS) must be submitted to the student's supervisory committee for review and approval.

The Ph.D. program in the ISEEM Department has a Preliminary Examination requirement under which students must achieve a 4.000 GPA in their core courses. If courses fail to meet the GPA requirement, they may be retaken until the requirement is met.

After completing the coursework on the POS, students will complete a Comprehensive Exam that either contains both written and oral portions, or, at the option of the student's committee, is based on writing a journal article.

After passing the Comprehensive Exam, students will prepare a dissertation proposal to satisfy the Qualifying Examination requirement. All newly admitted Ph.D. students will be required to complete their degree within 10 calendar years after admission. If a student does not complete the degree within the 10-year limit, the student will automatically be withdrawn from the Ph.D. program and from the College of Engineering. Students may reapply to UAH after the 10-year limit.

Foundation Courses

Outstanding students (3.500 GPA) from other technical fields may gain admittance to the College of Engineering MSE and Ph.D. graduate programs by completing the following courses, or equivalents, as approved by ISEEM faculty. Applicants who have passed the Fundamental of Engineering Exam (FE) may substitute the exam for the courses.

Code	Title	Semester Hours
Mathematics		
MA 171	CALCULUS A	4
MA 172	CALCULUS B	4
MA 201	CALCULUS C	4
MA 238	APPLIED DIFFERENTIAL EQUATIONS	3
MA 244	INTRODUCTION TO LINEAR ALGEBRA	3
Science		
PH 111	GENERAL PHYSICS WITH CALCULUS I	3
PH 112	GENERAL PHYSICS WITH CALCULUS II	3
CH 121	GENERAL CHEMISTRY I	3
Engineering		
EE 213	ELECTRICAL CIRCUIT ANALYSIS I	3
MAE 271	STATICS	3
MAE 341	THERMODYNAMICS I	3

MAE 370	MECHANICS OF MATERIALS	3
Total Semester Hours		**39**

Master's Programs in Industrial and Systems Engineering and Engineering Management

- Industrial and Systems Engineering, MSE (p. 126)
- Industrial and Systems Engineering, MSOR (p. 127)
- Engineering Management (p. 129)

Doctoral Program in Industrial Engineering

- Industrial and Systems Engineering, PhD (p. 124)

ISE 502 - INDUSTRIAL & ORGANIZA PSY
Semester Hours: 3

Application of basic principles of learning, motivation, and perception to typical industrial and organizational problems.

ISE 503 - HUMAN FACTORS PSYCHOLOGY
Semester Hours: 3

Study of human performance in human-technology-environment systems. Consideration of human capabilities and limitations as related to controls and displays, and the role of human cognition in decision-making and training effectiveness.

ISE 521 - IMPROVING HEALTHCARE SYSTEMS
Semester Hours: 3

Overview of healthcare systems with emphasis on departments, functions, and improving operational performance. Lean concepts and techniques are introduced as they specifically apply in a healthcare environment. Topics include workplace organization, patient and material flow, pull systems, value stream mapping, problem solving, and root cause analysis. Hands on simulations will be utilized.

ISE 522 - HEALTHCARE SYSTEMS ENGINEERING
Semester Hours: 3

This course introduces students to systematic and quantitative analysis of healthcare systems. The purpose of this class is to increase the student's understanding of how to apply proven industrial and systems engineering methods to healthcare related problems. Potential topics include: healthcare financing, health analytics, six sigma as they relate to healthcare, reliability and patient safety, capacity management, and healthcare logistics.

ISE 523 - INTR STATISTICAL QUALITY CONTR
Semester Hours: 3

This course introduces statistical theory and techniques to control quality of manufacturing products. This course will provide a solid foundation in Statistical Quality Control (SQC). The Six Sigma methodology is also introduced in this course. Students can take the certification exam to earn a Green Belt in Six Sigma. Prerequisites: ISE 690.

ISE 526 - DESIGN/ANALY OF EXPERIMENT
Semester Hours: 3

Advanced topics in statistical experiments with emphasis on design aspect. Confounding, fractional replication, factorial and nested design.

ISE 530 - MANUF SYS & FACILITIES DESIGN
Semester Hours: 3

Overview of modern manufacturing systems design with emphasis on facility location and plant layout. Includes classical systems, just-in-time systems, basic principles of integrated manufacturing systems design, as well as analysis of process flow, process productivity, and available space to determine plant layout. Includes laboratory exercises.

ISE 533 - PRODUCTION/INVENTORY CONTR SYS
Semester Hours: 3

Inventory models including classical optimal economic order quantity models, manufacturing resource planning (MRP) systems, master production scheduling, material requirements planning, and purchase order control. Emphasis on manufacturing system revision, continuous process improvement, and the implementation of lean principles. Prerequisite: ISE 690.

ISE 539 - SELECTED TOPICS/ISE
Semester Hours: 1-3

ISE 547 - INTRO TO SYSTEMS SIMULATION
Semester Hours: 3

Philosophy and elements of digital discrete-event simulation. Emphasis on modeling and analysis of stochastic systems, including probabilistic models, output analysis, and use of simulation software. Prerequisite: ISE 690.

ISE 580 - SYSTEMS ENGINEERING MODELING
Semester Hours: 3

The main goal of this course is to teach the student Model Based Systems Engineering (MBSE) fundamentals with application to real-world systems engineering problems. Students will learn (1) core systems engineering concepts and processes; (2) System Modeling Language (SysML) fundamentals and its use to develop and execute system models on a SysML based tool and (3) Architecture and physical model execution, simulation and integration.

ISE 623 - ENGR ECON ANALYSIS
Semester Hours: 3

This course is designed for graduate students in industrial engineering, systems engineering and engineering management. This course involves mathematical models for expenditure analysis under uncertainty; investment decision criteria; capital planning and budgeting; and decisions involving expansion, acquisitions, replacement, and disinvestment. Prerequisite: ISE 690.

ISE 626 - INTRO OPERATIONS RESEARCH
Semester Hours: 3

Philosophy and methodology of operations research. Includes linear programming, game theory, sequencing, and networks.

ISE 627 - ENGINEERING SYSTEMS
Semester Hours: 3

Development of a systems-scientific framework for the integration of systems theory, systems thinking, systems engineering, and systems management. Emphasis is on the conception, design, and management of systems to accommodate complex environments.

ISE 629 - OPTIMIZ AEROSPACE SYST DSGN
Semester Hours: 3

in this project course, students will learn to model an aerospace system they aer designing and optimize the system using the model. Linear, nonlinear, and discrete optimization are addressed. This course is targeted to students in systems engineering and aerospace systems engineering. Prerequisite with concurrency: ISE 627.

ISE 638 - ENGINEERING RELIABILITY
Semester Hours: 3

Methodology of reliability prediction including application of discrete and continuous distribution models. Reliability estimation, reliability logic diagrams, life testing, and reliability demonstrations.

ISE 639 - SELECTED TOPICS/ISE
Semester Hours: 1-6

ISE 641 - ADVANCED QUALITY CONTROL
Semester Hours: 3

This capstone course uses advanced statistical quality tools such as autocorrelated data, multi-variate quality controls charts, response surface methodology, ridge analysis, and evolutionary operations (EVOP). Advanced Six Sigma concepts will be taught and students will have the opportunity to earn a Black Belt in Six Sigma upon successful completion of the certification exam and an acceptable project.

ISE 690 - STATISTICAL METHODS FOR ENGR
Semester Hours: 3

Application of statistics for estimation and inference using parametric and nonparametric methods. Descriptive statistics, sampling distributions, point and interval estimates, tests of hypotheses, ANOVA, and linear regression.

ISE 696 - GRAD INTERN ISE ENGR
Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization, or government agency that has particular interest and relevance to the graduate student. Permission of ISE faculty member required.

ISE 697 - INDUS & SYSTEMS ENGR PROJECT I
Semester Hours: 3-9

Application oriented student project designed to show competence in Industrial and Systems Engineering.

ISE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours of credit is awarded upon successful completion of master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

ISE 726 - SYSTEMS MODELING
Semester Hours: 3

The capstone course for the operations research option studies the philosophy and methodology for modeling probabilistic systems. Includes Markov processes, queueing theory, and inventory theory. Team project required. Prerequisite: ISE 690 and (ISE 626 or ISE 627).

ISE 734 - DECISION ANALYSIS
Semester Hours: 3

Decision making for systems engineering and engineering management, with an emphasis on applications to complex systems. Builds a rigorous foundation in decision making under uncertainty using expected utility theory. Topics include decision trees, value models, predictive models, preferences and bias. Prerequisite: ISE 690.

ISE 739 - SELECTED TOPICS/ISE
Semester Hours: 1-6

ISE 761 - EVOL THRY ENG MGMT/IND SYS ENG
Semester Hours: 3

Development of applicable engineering management or industrial and systems engineering theory using classical concepts, contemporary studies and practices at successful technology-based organizations.

ISE 790 - ADV STATISTICAL APPLICATIONS
Semester Hours: 3

Continuation of ISE 690 with extension to regression models and nonparametric methods. Prerequisite: ISE 690.

ISE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is working and receiving direction on a doctoral dissertation. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

EM 660 - ENGR MGMT THEORY
Semester Hours: 3

Comparison of classical management principles and theory with the current systems in high technology, research and development, and other scientific-engineering organizations. Use of people systems to accomplish goals in high technology organizations. Cases used to illustrate contemporary problems and environments.

EM 666 - ENGR PROJECT MANAGEMENT
Semester Hours: 3

Management and control of multifaceted engineering and technological projects. Coordination and interactions between client and various service organizations. Project manager selection. Typical problems associated with various phases of project life cycle. Case studies illustrate theories and concepts.

EM 679 - SELECTED TOPICS IN ENGR MGMT
Semester Hours: 3-9

EM 697 - ENGR MANAGEMENT PROJECT I
Semester Hours: 3-9

Application-oriented student project designed to show competence in engineering management.

EM 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours of credit is awarded upon successful completion of master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

EM 747 - STRATEGIC ENGINEERING MGT
Semester Hours: 3

Analysis of creating an organizational strategy for engineering and technology-based enterprises; identifying critical value streams and creating supplier and customer partnerships. Development of skills for leadership and management of innovation. Prerequisite: EM 660.

EM 760 - ENGR MGMT STRUCTURES & SYSTEMS
Semester Hours: 3

The course studies the impact of various organization structures in relation to the goals of high technology enterprises. Use and effectiveness of contemporary organizational systems as related to the knowledge worker. Cases used to illustrate contemporary problems and environments. Prerequisite: EM 660.

EM 761 - EVOL THRY ENG MGMT/IND SYS ENG
Semester Hours: 3

Development of applicable engineering management or industrial & systems engineering using classical concepts, contemporary studies, and practices at successful technology-based organizations.

EM 766 - MANAGING CHG IN HIGH TECH ORG
Semester Hours: 3

Challenges to implementing advanced technology equipment, systems, and methods in engineering organizations. Justifying technology, assimilating change, changing management roles, personnel practices and organizational structure, and dealing with impact of new technologies on business policies and strategic planning. Prerequisite: EM 666.

EM 779 - SELECTED TOPICS IN ENGR MGMT
Semester Hours: 3-9

EM 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is working and receiving direction on a doctoral dissertation. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

Industrial and Systems Engineering, PhD

The UAH Department of Industrial & Systems Engineering and Engineering Management (ISEEM) offers a Ph.D. in Industrial Engineering with the following concentrations: Engineering Management, Industrial Engineering, and Systems Engineering. The following tables provide an outline of the Program of Study (POS) for these concentrations. Students must consult with their faculty advisor and supervisory committee when developing their POS.

Program of Study: Engineering Management [1]

Code	Title	Semester Hours
Engineering Major		
EM 660	ENGR MGMT THEORY	3
EM 666	ENGR PROJECT MANAGEMENT	3
EM 747	STRATEGIC ENGINEERING MGT	3
EM 760	ENGR MGMT STRUCTURES & SYSTEMS	3
ISE 623	ENGR ECON ANALYSIS	3
Supporting Courses		
EM 761	EVOL THRY ENG MGMT/IND SYS ENG	3
Select nine (9) hours of supporting graduate engineering coursework from the following areas: Industrial Engineering, Quality Engineering, Reliability Engineering, Systems Engineering, Operations Research, Simulation, Human Factors, or other approved areas		9

First Minor		
Choose nine (9) elective hours from graduate engineering or business courses to add the necessary breadth and depth to the program of study, and to meet the student's professional goals and the department's standards of scholarship. Alternatively, the nine (9) hours may be arranged around a concentrated topic such as cybersecurity, aerospace, business analytics, supply chain management, or other topics approved by the candidate's committee.		9
Second Minor: Mathematics/Statistics		
ISE 526	DESIGN/ANALY OF EXPERIMENT	3
ISE 690	STATISTICAL METHODS FOR ENGR	3
Two additional Math/Statistics electives		6
OR 12 credit hours of equivalent graduate math/statistics		
Dissertation		
Minimum of 18 hours of EM 799		18
Total Semester Hours		**66**

[1] Students not minoring in ISE may be required to take 9-12 semester hours of graduate ISE coursework to provide a basic knowledge of the discipline. This is at the discretion of the student's supervisory committee.

Program of Study: Industrial Engineering

Code	Title	Semester Hours
Engineering Major		
ISE 530	MANUF SYS & FACILITIES DESIGN	3
ISE 547	INTRO TO SYSTEMS SIMULATION	3
ISE 623	ENGR ECON ANALYSIS	3
ISE 626	INTRO OPERATIONS RESEARCH	3
ISE 641	ADVANCED QUALITY CONTROL	3
ISE 726	SYSTEMS MODELING	3
Supporting Courses and First Minor		
ISE 523	INTR STATISTICAL QUALITY CONTR	3
ISE 627	ENGINEERING SYSTEMS	3
ISE 734	DECISION ANALYSIS	3
ISE 761	EVOL THRY ENG MGMT/IND SYS ENG	3
Select six semester hours in graduate coursework from the following areas: Industrial Eng, Quality Eng, Reliability Eng, Systems Simulation, Operations Research, Human Factors, or other approved areas		6
Second Minor: Mathematics/Statistics		
ISE 690	STATISTICAL METHODS FOR ENGR	3
ISE 526	DESIGN/ANALY OF EXPERIMENT	3
Two additional Math/Statistics electives		6
OR 12 credit hours of equivalent graduate math/statistic		
Dissertation		
Minimum of 18 hours of ISE 799		18
Total Semester Hours		**66**

Program of Study: Systems Engineering

Code	Title	Semester Hours
Engineering Major		
ISE 580	SYSTEMS ENGINEERING MODELING	3
ISE 623	ENGR ECON ANALYSIS	3
ISE 627	ENGINEERING SYSTEMS	3
ISE 638	ENGINEERING RELIABILITY	3
ISE 734	DECISION ANALYSIS	3
Plus two systems engineering electives from within ISEEM		6

First Minor: Supporting Courses		
ISE 761	EVOL THRY ENG MGMT/IND SYS ENG	3
Select 12 hours in an approved College of Engineering or College of Science Department or as approved by the supervisory committee chair.		12
Second Minor: Mathematics/Statistics		
ISE 690	STATISTICAL METHODS FOR ENGR	3
ISE 526	DESIGN/ANALY OF EXPERIMENT	3
Two additional Math/Statistics electives		6
OR 12 credit hours of equivalent graduate math/statistics		
Dissertation		
Minimum of 18 hours of ISE 799		18
Total Semester Hours		**66**

Industrial and Systems Engineering, MSE

The Industrial & Systems Engineering and Engineering Management (ISEEM) Department offers two plans leading to the M.S. in Engineering degree. Each plan is designated as:

- Plan I (Thesis),
- Plan II (Non-thesis, coursework only)

For each plan, students may choose concentrations in Industrial Engineering or Systems Engineering. The following sections describe the requirements for each of these concentrations. Please contact the ISEEM Department for additional requirements, policies, and required forms.

Program of Study: Industrial Engineering

The Basic Program of Study (POS), common to the Plan I and Plan II MSE options, contains a minimum of 24 credit hours of graduate-level coursework that must include:

Code	Title	Semester Hours
Engineering Major		
ISE 623	ENGR ECON ANALYSIS	3
ISE 626	INTRO OPERATIONS RESEARCH	3
ISE 641	ADVANCED QUALITY CONTROL	3
ISE 726	SYSTEMS MODELING	3
First Minor		
Select six hours in approved Engineering Management or Systems Engineering		6
Second Minor		
ISE 690	STATISTICAL METHODS FOR ENGR	3
ISE 526	DESIGN/ANALY OF EXPERIMENT	3
OR six (6) equivalent hours of graduate math/statistics		
Total Semester Hours		**24**

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Master's Thesis		
ISE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense		
Total Semester Hours		**30**

Plan II, Non-Thesis Option (Coursework Only)

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Select 6 semester hours of graduate courses to complete an approved extended program of study		6
Total Semester Hours		**30**

Students are encouraged to take ISE 530 and ISE 547 unless they have taken similar courses as part of their undergraduate work.

Program of Study: Systems Engineering

The Basic POS, common to the Plan I and Plan II MSE options, contains a minimum of 24 credit hours of graduate-level coursework that must include:

Code	Title	Semester Hours
Engineering Major		
ISE 580	SYSTEMS ENGINEERING MODELING	3
ISE 623	ENGR ECON ANALYSIS	3
ISE 627	ENGINEERING SYSTEMS	3
3 hours from approved Systems Engineering ISEEM electives		3
First Minor		
Select six (6) hours in approved College of Engineering or College of Science graduate level coursework		6
Second Minor		
ISE 690	STATISTICAL METHODS FOR ENGR	3
ISE 526	DESIGN/ANALY OF EXPERIMENT	3
Or six (6) credit hours of equivalent graduate math/statistics		
Total Semester Hours		**24**

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Master's Thesis		
ISE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense		
Total Semester Hours		**30**

Plan II, Non-Thesis Option (Coursework Only)

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
ISE 726	SYSTEMS MODELING	3
Select 3 semester hours of graduate courses to complete an approved extended program of study		3
Total Semester Hours		**30**

Industrial and Systems Engineering, MSOR

The Industrial & Systems Engineering and Engineering Management (ISEEM) Department offers three plans leading to the MSOR degree. These are designated:

- Plan I (Thesis),
- Plan II (Non-thesis with final project paper; exit exam is an oral examination)
- Plan II (Non-thesis, coursework only; exit exam is over coursework)

The following sections describe the requirements for each of these options. Please contact the ISEEM Department for additional requirements, policies, and required forms.

Basic Program of Study

The Basic Program of Study, common to the Plan I and Plan II (Non-thesis) MSE options, contains a minimum of 24 credit hours of graduate-level coursework that must include:

Code	Title	Semester Hours
Engineering Major		
ISE 626	INTRO OPERATIONS RESEARCH	3
ISE 726	SYSTEMS MODELING	3
Select two of the following		6
ISE 547	INTRO TO SYSTEMS SIMULATION	
ISE 638	ENGINEERING RELIABILITY	
ISE 734	DECISION ANALYSIS	
First Minor		
Select a first minor of 6 semester hours of graduate courses in an approved engineering area of specialization		6
Choose from the following areas (courses are approved by advisor):		
Manufacturing Systems, Quality Engineering, Systems Engineering, Operations Research, Reliability Engineering, Systems Simulation, and Engineering Management		
Second Minor		
ISE 690	STATISTICAL METHODS FOR ENGR	3
ISE 526	DESIGN/ANALY OF EXPERIMENT	3
Total Semester Hours		**24**

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Master's Thesis		
ISE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense		
Total Semester Hours		**30**

Plan II, Non-Thesis Option (Coursework Only)

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Select 6 semester hours of graduate courses to complete an approved extended program of study		6
Total Semester Hours		**30**

Engineering Management Joint Program: COE and COB

Engineering Management at UAH

The University of Alabama in Huntsville Engineering Management program is offered as a joint program between the College of Engineering (COE) and the College of Business (COB). Please click here for more information. (https://www.uah.edu/admissions/learn-more-mseem/)

The Master of Science Degree in Engineering Management is a coursework-only program of 30 credit hours compromised of 10 courses:

- Five core courses foundational to Engineering Management
- Two mathematics-based (statistics/optimization) courses
- Three elective courses; elective courses can be used to provide depth in a secondary area or the flexibility to explore areas of interest. Examples shown below include aerospace, cybersecurity or business analytics, which have been identified as being particularly useful for local professionals interested in Engineering Management. Other electives can be arranged with a Program Advisor from either the COE or COB course offerings.

Engineering Management Core

EM 660 (https://catalog.uah.edu/search/?P=EM%20660) Engineering Management Theory

EM 760 (https://catalog.uah.edu/search/?P=EM%20760) Engineering Management Structures and Systems

EM 666 (https://catalog.uah.edu/search/?P=EM%20666) Project Management

EM 747 (https://catalog.uah.edu/search/?search=em+747) Strategic Engineering Management

ISE 623 (https://catalog.uah.edu/search/?P=ISE%20623) Engineering Economics

Statistics and Optimization Courses

The College of Engineering has a mathematics requirement that can be fulfilled with courses in statistics and optimization. The requirement can be satisfied with two courses drawn from either the College of Engineering or the College of Business.

First mathematics-based course (choose one):

ISE 690 (https://catalog.uah.edu/search/?P=ISE%20690) Statistical Methods for Engineers

MSC 600 (https://catalog.uah.edu/search/?P=MSC%20600) Quantitative Methods

MSC 615 (https://catalog.uah.edu/search/?P=MSC%20615) Decision Modeling

Second mathematics-based course (choose one):

ISE 526 (https://catalog.uah.edu/search/?P=ISE%20526) Design and Analysis of Experiments

ISE 790 (https://catalog.uah.edu/search/?P=ISE%20790) Advanced Statistical Applications

MSC 641 (https://catalog.uah.edu/search/?P=MSC%20641) Advanced Analytics

Elective Courses

A minimum of nine elective hours are required and can be chosen from a customized selection of qualifying graduate courses in Engineering, Science, or Business. These courses can be used to explore diverse areas of interest or clustered to provide depth in a secondary concentration such as supply chain management, aerospace systems, cybersecurity, or business analytics.

Admission to MSE

Admissions requirements:

1. Bachelor's degree in Engineering from an accredited institution with a minimum cumulative GPA of 3.000 (on a 4.000 scale)
2. GPA of 3.000 in all prior graduate work
3. Minimum GRE cumulative score of 300 (with a minimum of 150 Verbal and 155 Quantitative scores) and analytical writing score of 4.000 or better. ISEEM requires the GRE, however candidates can petition the department for a waiver if their experience and/or academic achievement merits a waiver.

Promising applicants (GPA higher than 3.250) with a non-engineering STEM background may gain admittance to the MSE program by meeting the requirements above and by completing a basic selection of courses in fundamentals of math, science, and core engineering topics. Some prerequisites may be necessary to fulfill these requirements.

Two years of work experience beyond the bachelor's degree in a technical position is strongly preferred but not required.

Mechanical and Aerospace Engineering

N274 Technology Hall
Telephone: 256.824.6154
Email: maegrad@uah.edu

Chair: D. Keith Hollingsworth, Ph.D.

Associate Chair: Daniel Armentrout, Ph.D.

Mission

The mission of the Mechanical and Aerospace Engineering (MAE) Department is to provide undergraduate and graduate education, research, and public service in the mechanical and aerospace engineering disciplines and to support the mechanical and aerospace engineering needs of Huntsville, the State of Alabama, the region, the United States of America, and the international community.

Degree Programs

- Master of Science in Engineering (Mechanical Engineering)
- Master of Science in Aerospace Systems Engineering
- Doctor of Philosophy in Mechanical Engineering
- Doctor of Philosophy in Aerospace Systems Engineering

The broad range of faculty research interests in the MAE Department offers opportunities for advanced work in rocket propulsion, combustion, applications of plasma science, fluid and solid mechanics, heat transfer, acoustics, aerodynamics, transport phenomena in energy systems, computational mechanics, experimental mechanics, dynamics and controls, and autonomous vehicles.

Located in one of the nation's leading centers for aviation and space research, UAH has the intellectual and social environment to provide a well-rounded, technologically oriented degree. MAE graduate students have outstanding opportunities for research, collaboration, cooperative employment, and future employment with government research centers and high-tech businesses. In addition, a number of UAH research centers collaborate with the MAE Department, including the Propulsion Research Center, the Center for Rotor Craft Systems Engineering and Simulation, the Center for Modeling, Simulation and Analysis, the Center for Space Plasma and Aeronomic Research, the Center for Applied Optics, and the Nano and Micro Devices Center.

Prospective and current students are encouraged to visit the MAE Department website at www.uah.edu/eng/departments/mae (http://www.uah.edu/eng/departments/mae/) for information about faculty research interests, ongoing research projects, funding opportunities and course availability. Other information about the MAE graduate programs are available in the department office.

MS in Aerospace Systems Engineering or MSE in Mechanical Engineering

Students wishing to pursue an MAE master's degree must meet the admission requirements of the the UAH Graduate School as well as the College of Engineering. Students who are admitted to the MAE master's program have the option to enroll in the M.S. in Aerospace Systems Engineering or the M.S.E. in Mechanical Engineering. All courses in the department are open to students in either option. A beginning student files a Program of Study (POS) in one of the specialized areas of concentration (*e.g.,* aerodynamics, materials, solid mechanics, etc). These selections are made in consultation with the Faculty Advisor (for students in the thesis program) or with the Graduate Director (for students in the non-thesis program). Each area of concentration may have other requirements.

The M.S. in Aerospace Systems Engineering and the M.S.E. in Mechanical Engineering each require 30 credit hours and consist of two options. The thesis option requires 24 credit hours of graduate coursework and six credit hours of thesis coursework. Students under this option must complete a written thesis and an oral defense. The non-thesis option requires 30 credit hours of graduate coursework.

PhD in Aerospace Systems Engineering or in Mechanical Engineering

The MAE Department offers a program leading to the degree of Doctor of Philosophy (Ph.D.) in Aerospace Systems Engineering or in Mechanical Engineering. The Ph.D. is a research-oriented degree awarded upon completion of a defined POS, demonstration of scholarly competence, distinctive achievement in a special field, and demonstrated ability to do an independent, original investigation. Demonstration of substantial scholarly research accomplishments, rather than mere accumulation of residence and course credits, is an essential consideration in awarding the Ph.D. degree. A POS leading to a Ph.D. degree in Chemical Engineering is also administered by the MAE Department. In addition to the admission requirements of

the Graduate School and the College of Engineering for the MSE, students must also have a minimum graduate grade point average of 3.250 for an application to be processed. Specific admission requirements for students with an MSE degree from UAH or from another graduate institution are available by contacting the MAE Department.

The Ph.D. POS should exhibit both a breadth of understanding of engineering with a demonstrated depth in a focused area of Aerospace or Mechanical Engineering. The MAE Ph.D. POS consists of a minimum of 66 course and research credit hours beyond the B.S. degree. The course credit hour requirement for students with an MSE degree is a minimum of 48 credit hours, that is, a minimum of 18 credit hours beyond the MSE degree. The specific Ph.D. POS is designed by the student, their advisor, and the supervisory committee. In addition to the coursework required, a Ph.D. student must pass three examinations before being awarded the degree; the Preliminary Examination, the Qualifying Examination, and the Final Comprehensive Examination. Specific details on each examination can be provided by the MAE Department.

Details about these degree options can be found at http://catalog.uah.edu/grad/colleges-departments/engineering/mechanical-aerospace-engineering/#text .

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Timing Requirements
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Students pursuing a Ph.D. degree are subject to the following four timing requirements:

1. Part I of the Qualifying Examination (i.e., MAE Ph.D. Prelim Exam) must be completed successfully either within **one year** from the start of the Ph.D. degree program or prior to the completion of **12 credit hours of graduate coursework** (whichever comes later).
2. A Ph.D. Dissertation Advisor and Ph.D. Supervisory Committee must be arranged and approved within **one year** of the successful completion of Part I of the Qualifying Examination.
3. Part II of the Qualifying Examination must be completed successfully within **two years** of the successful completion of Part I of the Qualifying Examination but **no less than six months** prior to the Dissertation Defense.
4. All newly admitted Ph.D. students will be required to complete their degree within 10 calendar years. If a student does not complete the degree within the 10-year limit, the student will automatically be withdrawn from the Ph.D. program and from the College of Engineering. Students may reapply to UAH after the 10-year limit.

Exceptions to any of these requirements may be requested only one time (per each requirement) by petition from the student and the associated Ph.D. Dissertation Advisor. Approval of these petitions (including modifications or alterations) are made by both the MAE Department Graduate Committee and by the MAE Department Chair.

Master's Programs in Mechanical and Aerospace Engineering

Doctoral Programs in Mechanical and Aerospace Engineering

MAE 540 - ROCKET PROPULSION I
Semester Hours: 3

Introduction to the operation, analysis, and design of liquid and solid rockets.

MAE 541 - AIRBREATHING PROPULSION
Semester Hours: 3

Survey of airbreathing propulsion systems with special emphasis on gas turbine engines for aircraft and rotorcraft. Thermodynamic power cycles, design of components, and overall engine performance analysis. Discussion of practical design and operations considerations including engine controls, reliability, and durability.

MAE 561 - VIBRATIONS ELASTIC SYS
Semester Hours: 3

Formulation of the equations of motion of discrete and continuous systems, analytical and numerical methods of solution, eigenvalue problems, and dynamic response. (Same as MAE 461 and CE 461 / CE 561).

MAE 563 - INTERMEDIATE DYNAMICS
Semester Hours: 3

Kinematics and dynamics of particles, system of particles, and rigid-bodies. Variational principles and Lagrangian mechanics.

MAE 568 - ELEMENTS OF SPACECRAFT DESIGN
Semester Hours: 3

Fundamentals of spacecraft engineering and design. Topics include: orbital mechanics, space environment, attitude determination and control, communications, space structures, thermal control, propulsion and power, and systems and mission design. (Same as MAE 468.).

MAE 574 - APP MECHANICS OF SOLIDS
Semester Hours: 3

Stresses and strains at a point, theories of failures, stress concentration factors, thick-walled cylinders, torsion of noncircular members, curved beams, unsymmetrical bending, and shear center. (Same as MAE 474 and CE 474 / CE 574).

MAE 577 - EXP TECH SOLID MECHANICS
Semester Hours: 3

Experimental methods to determine stress, strain, displacement, velocity, and acceleration in various media. Theory and laboratory applications of electrical resistance strain gages, brittle coatings, and photoelasticity. Application of transducers and experimental analysis of engineering systems. (Same as MAE 477 and CE 477 / CE 577).

MAE 580 - AIRCRAFT STABILITY & CONTROL
Semester Hours: 3

Stability and control of aerodynamic vehicles. Design of aircraft to obtain good flying characteristics. Complete governing equations and analog solutions of linearized equations. (Same as MAE 480.).

MAE 589 - COMPUTER AIDED ENGR
Semester Hours: 3

Application of computer methods in the analysis and design of structural, thermal, and dynamical systems. Use of state-of-the-art finite element and finite difference computer programs. Practical guidelines for discrete modeling; analysis of modeling errors. Comparison of exact and approximate solutions to boundary value problems. Use of microcomputers in engineering design and analysis. (Same as MAE 489.).

MAE 595 - SELECTED TOPICS MECH & AERO EG
Semester Hours: 1-6

MAE 610 - AERODYNAMICS
Semester Hours: 3

Fundamental concepts in aerodynamics including conservation laws, complex potential theory, thin airfoil theories, finite-wing lifting-line theory, boundary layers and Von Karman momentum integral equations.

MAE 620 - COMPRESSIBLE FLOW
Semester Hours: 3

Study of compressible subsonic, transonic and supersonic flows as described by the Euler equations. Linear and nonlinear theories of shockwaves, expansion waves, and their interactions. Applications to wind tunnels, nozzles, diffusers and aerodynamic bodies.

MAE 623 - COMPUTATIONAL FLUID DYNAMICS I
Semester Hours: 3

Formulations by finite difference, finite element, finite volume, and spectral element methods for incompressible and compressible flows. Explicit and implicit methods, Von Neumann error analysis, consistency, convergence, and accuracy.

MAE 635 - AEROSPACE SYSTEMS ENGINEERING
Semester Hours: 3

Introduction to Integrated Product and Process Development (IPPD) and life cycle analysis with application to Aerospace Systems. Systems engineering and quality engineering methods and tools. Top-down design decision support process. Computer integrated environment and robust design simulation will be addressed. Prerequisite: ISE 601 or ISE 690.

MAE 640 - ROCKET PROPULSION II
Semester Hours: 3

MAE 641 - ADV THERMODYNAMICS
Semester Hours: 3

Application of classical thermodynamics. Treatment of problems involving non-ideal gases and liquids, phase equilibrium, and chemical equilibrium. (Same as CHE 641).

MAE 642 - INTRO TO ELECTRIC PROPULSION
Semester Hours: 3

Physics and performance of electrically-driven in-space propulsion for Earth satellites and deep space missions. The physics of electromagnetics, plasmas, gas kinetics as applied to electrothermal, electrostatic, electromagnetic, and other electric propulsion systems. Characteristics and performance metrics of resistojets, arcjets, ion engines, Hall effect thruster, pulsed plasma thruster, and magnetoplasmadynamic thrusters. Review of orbital mechanics including low-thrust transfers. Overview of current research efforts including plasma behavior, new thruster designs, and novel concepts. Undergraduate students may take this course with instructor permission.

MAE 643 - ADVANCED HEAT & MASS TRANSFER
Semester Hours: 3

Continuation of MAE 450 in the study of conductive, convective, and radiative heat transfer and mass transfer. Emphasis is placed on heat transfer in turbulent flows and high speed flows, combined mode heat transfer, and mass transfer in reacting flows.

MAE 644 - ADVCD SOLID ROCKET PROPUL
Semester Hours: 3

Overview of the design, manufacture and testing of solid rocket propulsion systems. Specific topics include propellant ballistics and combustion, grain design, motor case and nozzle design, thermal protection, motor performance, and reliability and failure. Prerequisite: MAE 540.

MAE 645 - COMBUSTION I
Semester Hours: 3

Combustion chemistry, introduction to mass transfer, chemical kinetics, reactors, simplified governing equations for chemically reacting flow, laminar diffusion and premixed flames.

MAE 646 - COMBUSTION I
Semester Hours: 3

Combustion chemistry, introduction to mass transfer, chemical kinetics, reactors, simplified governing equations for chemically reacting flow, laminar diffusion and premixed flames.

MAE 647 - UNCERTAINTY ANAL IN EXPER
Semester Hours: 3

Uncertainty analysis concepts and techniques; application in planning, design, construction, debugging, execution, data analysis and reporting phases of experimental programs. Discussion of national and international standards and current engineering uncertainty analysis literature.

MAE 649 - TRANSPORT PHENOMENA
Semester Hours: 3

Mass, energy, and momentum transport in steady and transient motions in real and rheological substances. (Same as CHE 649.).

MAE 651 - VISCOUS FLUID MECHANICS
Semester Hours: 3

Fundamentals of incompressible viscous fluid motion, including development of Navier Stokes equation. Exact and approximate solutions for both large and small Reynolds number. Laminar and turbulent boundary layers.

MAE 657 - HELICOPTER THEORY
Semester Hours: 3

Vertical flight, forward flight, performance, design, mathematics of rotating systems, rotary wing dynamics, rotary wing aerodynamics, helicopter aeroelasticity, stability and control, stall, and noise. Prerequisite: MAE 530.

MAE 660 - STRUCTURAL DYNAMICS
Semester Hours: 3

Application of the theory of vibrations to discrete and continuous models of structures. Numerical methods of analysis for both spatial and temporal variables. Modal synthesis and step-by-step time integration methods. Finite element applications; substructuring techniques. (Same as CE 660.).

MAE 661 - ADVANCED DYNAMICS
Semester Hours: 3

Variational methods, optimization, and dynamic stability. Lagrangian and Hamiltonian formulation for dynamical systems and Hamilton-Jacobi methods to orbital mechanics.

MAE 662 - NONLINEAR DYNAM & CHAOS
Semester Hours: 3

Nonlinear and chaotic dynamical systems, phase plane, periodic and strange attractors, stability analysis, critical points, Piapunov exponents, bifurcation points, solitons, logistic maps, Poincare and Henon iterative maps, factals, Mandelbrot and Julia sets, chaos in complex dynamical systems.

MAE 663 - ASTRODYNAMICS
Semester Hours: 3

Astronomical coordinates and time systems; the many-body problems and disturbing functions. General perturbation methods, and application of classical mechanics and Hamilton-Jacobi methods to orbital mechanics.

MAE 664 - ROBOTICS I
Semester Hours: 3

This course prepares students to analyze three-dimensional coordinate transforms, three-dimensional kinematic and dynamic modeling of multi-body systems, as applied to robotic manipulators. Topics are: Spatial descriptions and transformations, manipulator kinematics, inverse manipulator kinematics, Jacobians: velocities and static forces, manipulator dynamics, trajectory generation.

MAE 665 - ROBOTICS II
Semester Hours: 3

This course prepares students to analyze advanced robotic systems, as applied to redundant robots (highly flexible robots acting like an elephant trunk), mobile robots (self-driving cars), unmanned surface vessels (boats/ships), and unmanned aerial vehicles (drones). Topics are: Redundant and hyper-redundant manipulators, applied nonlinear control for manipulators, obstacle avoidance and path planning in 2D workspace for mobile robots, kinematics and control of mobile robots, marine robotic surface vessels dynamic modeling and control, aerial robotic vehicles dynamic modeling and control.

MAE 671 - CONTINUUM MECHANICS
Semester Hours: 3

Kinematics and kinetics, various coordinate systems, constitutive equations for continuous media; governing partial differential equations from first and second laws of thermodynamics; applications to solids, liquids, and gases. (Same as CE 671.).

MAE 672 - ELASTICITY
Semester Hours: 3

Formulation of boundary-value problems of classical elasticity. Application to plane problems, prismatic members, and axisymmetric problems. Introduction to three-dimensional problems. (Same as CE 672.).

MAE 673 - PLASTICITY
Semester Hours: 3

Fundamentals of mechanical behavior of metals and nonmetals for stress states greater than the yield stress state. Deformation and flow theories. Stress-strain relations and yield criteria. Solution of boundary value problems with plastic bodies. Limit analysis of structures. (Same as CE 673.).

MAE 674 - FINITE ELEMENT ANALYS I
Semester Hours: 3

Finite element theory, variational methods, weighted residuals; applications to linear partial differential equations in continuous media; solution of boundary-value and initial-value problems. (Same as CE 674.).

MAE 676 - VISCOELASTICITY
Semester Hours: 3

Mechanical behavior of materials having time-dependent and temperature-dependent material properties. Creep and relaxation phenomena. Elastic-viscoelastic analogies. Formulation of stressstrain laws. Solution of boundary value problems for viscoelastic bodies. (Same as CE 676.).

MAE 677 - OPTICAL TECH IN SOLID MECH
Semester Hours: 3

Overview of conventional methods for experimental stress analysis. Introduction to applied optics with emphasis on non-destructive, laser-based testing methods, fiber optic recording systems,photoelectronic-numerical data acquisition, and computer aided analysis. (Same as CE 677.).

MAE 680 - PERFORMANCE FLIGHT TESTING
Semester Hours: 3

Fundamentals of rotorcraft test and evaluation. Topics include: test planning, requirements analysis, helicopter performance evaluation, fundamentals of propulsion testing, aviation safety, use of modeling and simulation in flight testing, Department of Defense and Federal Aviation Administration requirements and procedures.

MAE 681 - MISSILE TRAJECTORY ANALYSIS
Semester Hours: 3

Methods for generating trajectories of missiles and projectiles are studied as well as control mechanisms. Point mass approximations are developed using approximations and exact representations of drag and atmospheric conditions Full six degree-of-freedoms models are developed and solved numerically. Aerodynamic models are developed for both slowly spinning missiles and spin stabilized projectiles. Projectile linear theory is developed and used to discuss gyroscopic and dynamic stability and introduce rapid trajectory generation. Prerequisite: MAE 580.

MAE 692 - GRAD ENGR ANALYSIS I
Semester Hours: 3

Ordinary differential equations (ODEs), Bessel functions, Legendre polynomials, Laplace transformations, simultaneous differential equations, application of ODEs to mechanical systems, partial differential equations (PDEs) and boundary-value problems, application of PDEs to mechanical systems.

MAE 693 - GRAD ENGR ANALYSIS II
Semester Hours: 3

Green's functions, Fourier series and integrals, linear algebra, vectors, vector analysis and integral theorems, introduction to tensor analysis, analytical functions of a complex variable, Taylor and Laurent expansions, the residue theorem, stability criteria, and Calculus of Variations. Prerequisite: MAE 692.

MAE 695 - SELECTED TOPICS MECH & AERO EG
Semester Hours: 1-9

MAE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours of credit is awarded upon successful completion of master's thesis. Requires thesis advisor permission. The 1 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 1 hour option once in their career.

MAE 723 - COMPUTATIONAL FLUID DYNA II
Semester Hours: 3

Continuation of Computational Fluid Dynamics I, advanced topics in finite difference, finite element, finite volume, and spectral element methods. Prerequisite: MAE 623.

MAE 724 - COMPUTATIONAL FLUID DYNAMI III
Semester Hours: 3

Grid generation techniques with structured and unstructured meshes, adaptive meshes, domain decompositions, and parallel processing. Applications of generated meshes to any one of the following problems: turbulence, combustion, acoustics, radiation, multiphase flows, or magnetohydrodynamics. Prerequisite: MAE 723.

MAE 740 - AEROTHERMODYNAMICS
Semester Hours: 3

Description of the dynamic and thermal fluid flow environments associated with hypervelocity vehicles and propulsion systems with emphasis on thermochemical nonequilibrium behavior. Topics include thermostatistical basis for internal energies, specific heats and shock strengths in dissociated and ionized gases; formulation of reacting flow conservation equations; and recent experimental advances in aerothermodynamics.

MAE 745 - COMBUSTION II
Semester Hours: 3

Droplet evaporation and burning, introduction to turbulent flow, turbulent diffusion and premixed flames, burning of solids, pollutant emissions, and detonation. Prerequisite: MAE 645.

MAE 746 - CONVECTIVE HEAT TRANSFER
Semester Hours: 3

Advanced theory of convective transport processes in fluids, including transport of momentum and energy in laminar flow, boundary layers and turbulent transport in shear flow. Engineering applications include boiling and two phase processes.

MAE 749 - MASS TRANSPORT
Semester Hours: 3

Mass transfer in solid and fluid systems under steady and transient conditions. Integration of momentum, heat and mass transfer equations with application to reactive, rheological and multicomponent systems.

MAE 751 - BOUNDARY LAYER THEORY
Semester Hours: 3

Development of boundary layers using singular perturbation theory. Curvature and compressible effects and the order of their importance. Modern applications and computational approaches.

MAE 754 - HYPERSONIC FLOW
Semester Hours: 3

Theories for treating the laminar and turbulent boundary layers of reacting fluids, mixtures, related chemical, thermodynamic, and physical phenomena in hypersonic flows. Leading edge bluntness, shock wave interactions, and vorticity effects.

MAE 755 - ADVANCED AERODYNAMICS
Semester Hours: 3

Transonic, supersonic, and hypersonic flows. Application of compressible potential theory, similarity rules, slender body theory and Newtonian flow theory to the analysis of aerodynamics of aircraft, missiles, re-entry vehicles, and other flight vehicles.

MAE 757 - OPT TECH/FLUID MECHANICS
Semester Hours: 3

Laser sources, molecular interactions with light and diatomic spectroscopy needed fluorescence, Brillouin scattering, four wave mixing, CARS and other applications in optical fluid diagnostics. (Same as CHE 757.).

MAE 758 - TURBULENCE
Semester Hours: 3

Turbulence in gases and liquids; boundary layers, atmospheric phenomena. Prerequisites: MAE 651 and MAE 671.

MAE 762 - WAVE MOT/CONT ELAS BODIES
Semester Hours: 3

Elements of stress wave propagation in bounded elastic media. Propagation of elastic waves in infinite and semi-infinite bodies, cylinders, rods and beams. (Same as CE 762).

MAE 765 - RANDOM VIBR/ELASTIC SYSTEMS
Semester Hours: 3

Dynamic analysis of elastic systems including the response of complex structures to random excitations. Typical excitations include random wind, thermal, earthquake, aerodynamic, and ocean wave phenomena. Probabilistic mechanics methods. Concepts of reliability. Stationary and ergodic processes.

MAE 768 - DYN AEROSPACE VEHICLES
Semester Hours: 3

Elements of advanced rotational kinematics of rigid bodies. Attitude motion of space vehicles in circular and elliptic orbits. Methods of gravitation and spin stabilization of gyrostat.

MAE 772 - THEORY STRUCT STABILITY
Semester Hours: 3

Energy criterion for stability of elastic structure under conservative loading. Stability concept for general continuous systems. Rigorous and approximate methods of analysis. Buckling of structural elements under impulsive and nonconservative loading. Postbuckling behavior. Prerequisite: MAE 671.

MAE 774 - FINITE ELEM ANALY II
Semester Hours: 3

Advanced topics in finite element analysis; application to nonlinear partial differential equations in continuum mechanics; theoretical studies of convergence and stability of solutions. (Same as CE 774.) Prerequisite: MAE 674.

MAE 778 - FRACTURE MECHANICS
Semester Hours: 3

Theory of crack propagation, stress intensity factors, mapping techniques, series expansion, asymptotic approximations, field singularities, integral transforms, numerical solutions. (Same as CE 778.) Prerequisite: MAE 672.

MAE 780 - THEORY OF ACOUSTICS
Semester Hours: 3

Simple harmonic oscillators, damped and forced oscillators, 1-D wave equation, vibration of a string, 2-D wave equation, vibration of membranes, the acoustic wave equation, plane waves, cylindrical and spherical waves, reflection and transmission, radiation and reception of acoustic waves, absorption and attenuation of sound, cavities and wave guides, and architectural acoustics. Prerequisite: MAE 692.

MAE 795 - SELECTED TOPICS MECH & AERO EG
Semester Hours: 1-9

MAE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation.

Aerospace Systems Engineering, PhD

The Mechanical and Aerospace Engineering (MAE) Department offers a Ph.D. program in Aerospace Systems Engineering.

The following table is an outline of the program of study requirements. Students should consult their dissertation advisor and supervisory committee to develop their program of study.

Program of Study

Code	Title	Semester Hours
Engineering Major		
Minimum of 27 semester hours of graduate coursework from MAE or related departments		27
With approval, a Master's Thesis may be counted 6 semester hours towards this total.		
First Minor		
ISE 627	ENGINEERING SYSTEMS	3
9 semester hours of graduate courses in an approved engineering area of specialization		9
Second Minor		
MAE 692	GRAD ENGR ANALYSIS I	3
6 semester hours of graduate coursework in mathematics (typically MAE 623, MAE 661, MAE 662, MAE 671, MAE 674, MAE 693, MAE 780 or ISE 690)		6
Doctoral Dissertation		
18 hours (minimum) of MAE 799 - Doctoral Dissertation		18
Total Semester Hours		**66**

With prior approval, up to nine semester hours of 500-level courses may be taken in fulfillment of the Basic and specific program requirements.

Aerospace Systems Engineering, MSASE

The Mechanical and Aerospace Engineering (MAE) Department offers two options leading to the Master of Science degree in Aerospace Systems Engineering (MSASE). These are designated:

- Plan I (Thesis),
- Plan II (Non-thesis)

The following sections describe the requirements for each of these options. For both options, *the majority of coursework*, not including MAE 699, *must have the MAE prefix*. With prior approval, up to nine semester hours of 500-level courses may be taken in fulfillment of the Basic and specific program requirements.

Basic MSASE Program of Study

The Basic Program of Study, common to both the Plan I and Plan II (Non-thesis) MSASE options, consists of a minimum of 24 semester hours of graduate-level course work that must include:

Code	Title	Semester Hours
Engineering Major		
Select an engineering major consisting of 12 semester hours of graduate courses including supporting engineering courses		12
First Minor		
ISE 627	ENGINEERING SYSTEMS (*)	3
3 semester hour graduate course in an approved engineering area of specialization		3
Second Minor		
MAE 692	GRAD ENGR ANALYSIS I	3
3 semester hours of graduate coursework in mathematics; typically MAE 623, MAE 661, MAE 662, MAE 671, MAE 674, MAE 693, MAE 780 or ISE 690(*)		3
Total Semester Hours		**24**

*The majority of coursework must have the MAE prefix; ISE 627 and ISE 690 do not count toward this total.

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
MAE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense and submit a journal manuscript to the research advisor		
Total Semester Hours		**30**

Plan II, Non-Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Select 6 semester hours of graduate courses to complete an approved extended program of study		6
Total Semester Hours		**30**

Mechanical Engineering, PhD

The Mechanical and Aerospace Engineering Department offers a Ph.D. program in Mechanical Engineering.

The following table is an outline of the Program of Study (POS) requirements. Students should consult their dissertation advisor and supervisory committee to develop their POS.

Program of Study

Code	Title	Semester Hours
Engineering Major		
Minimum of 27 semester hours of graduate coursework from MAE or related departments		27
With approval, a Master's Thesis may be counted 6 semester hours towards this total.		
First Minor		
12 semester hours of graduate courses in an approved engineering area of specialization		12
Second Minor		
MAE 692	GRAD ENGR ANALYSIS I	3

6 semester hours of graduate coursework in mathematics (typically MAE 623, MAE 661, MAE 662, MAE 671, MAE 674, MAE 693, MAE 780 or ISE 690)	6
Doctoral Dissertation	
18 hours (minimum) of MAE 799 - Doctoral Dissertation	18
Total Semester Hours	**66**

With prior approval, up to nine semester hours of 500-level courses may be taken in fulfillment of the basic and specific program requirements.

Mechanical Engineering, MSE

The MAE Department offers two plans leading to the MSE degree for the Mechanical Engineering option. These are designated:

- Plan I (Thesis)
- Plan II (Non-thesis)

The following sections describe the requirements for each of these options. For both options, *the majority of coursework*, not including MAE 699, *must have the MAE prefix*. With prior approval, up to nine semester hours of 500-level courses may be taken in fulfillment of the Basic and specific program requirements.

Basic Program of Study

The Basic POS, common to both the Plan I and Plan II (non-thesis) MSE options, contains a minimum of 24 credit hours of graduate-level coursework that must include:

Code	Title	Semester Hours
Engineering Major		
Select an engineering major consisting of 12 semester hours of graduate courses including supporting engineering courses		12
First Minor		
Select a first minor of 6 semester hours of graduate courses in an approved engineering area of specialization		6
Second Minor		
MAE 692	GRAD ENGR ANALYSIS I	3
Select 3 additional semester hours of graduate coursework in mathematics (typically MAE 623, MAE 661, MAE 662, MAE 671, MAE 674, MAE 693, MAE 780, or ISE 690 (*)		3
Total Semester Hours		**24**

*The majority of coursework must have the MAE prefix; ISE 627 and ISE 690 do not count toward this total.

Plan I, Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
MAE 699	MASTER'S THESIS	6
Complete an acceptable thesis including a public defense		
Total Semester Hours		**30**

Plan II, Non-Thesis Option

Students selecting this option must:

Code	Title	Semester Hours
Complete Basic Program of Study as described above		24
Select 6 semester hours of graduate courses to complete an approved extended program of study		6
Total Semester Hours		**30**

Interdisciplinary Programs

Interdisciplinary Master's Programs

- Cybersecurity, MS Interdisciplinary - Management Track (p. 49)
- Cybersecurity, MS Interdisciplinary - Computer Engineering Track (p. 148)
- Cybersecurity, MS Interdisciplinary - Computer Science Track (p. 150)
- Materials Science, MS (p. 151)

Interdisciplinary Doctoral Programs

- Biotechnology Science and Engineering, PhD (p. 140)
- Materials Science, PhD (p. 142)
- Optical Science and Engineering, PhD (p. 144)

Biotechnology Science and Engineering, PhD

Biotechnology Science & Engineering

Degree

Doctor of Philosophy

Program Coordinator
Dr. Matthew Niemiller, Biological Sciences
Shelby Science and Technology center Rm 302M
256-824-3077
Email: matthew.niemiller@uah.edu

Program Office
Shelby Science and Technology center Rm 369F
256-824-3192

Adjunct Faculty

More than 10 scientists from NASA's Marshall Space Flight Center (Space Science Laboratory) and local biotechnology companies in Huntsville serve as adjunct faculty to the program and have expertise in at least one of the thrust areas of Biotechnology Science and Engineering.

Mission

The Biotechnology Science and Engineering Graduate Program (B.S.E.) is an interdisciplinary program of the University of Alabama in Huntsville (UAH) concerned with research and scholarly activity in the diverse areas of biotechnology. The program's mission is to provide Ph.D.-level graduates who are broadly trained in the areas of science and engineering pertinent to biotechnology and who will benefit the economic, educational, and cultural development of Alabama. Graduates of the program are expected to be able to make significant contributions to biotechnology in academic, governmental, and business settings.

Biotechnology is not a single area of study itself, but is a multidisciplinary field concerned with the practical application of biological organisms and their subcellular components to industrial or service manufacturing, to environmental management and health and medicine. It is, in essence, a series of enabling technologies drawn from the fields of microbiology, cellular biology, molecular biology, genetics, biochemistry, immunology, fermentation technology, environmental science and engineering which allow one to synthesize, breakdown or transform materials to suit human needs. Biotechnology ("Current Trends in Chemical Technology, Business, and Employment," American Chemical Society, Washington, D.C. 1998) can therefore be defined as the safe study and manipulation of biological molecules for development of products or techniques for medical and industrial application. Although biotechnology in the broadest sense is not new, the current ability and demand for manipulating living organisms or their subcellular components to provide useful products, processes or services has reached new heights. Modern biotechnology has resulted from scientific scrutiny of old and familiar processes and from new advances in molecular biology, genetic engineering and fermentation technologies.

The future industrial landscape will continue to include research, development and the manufacturing of products such as proteins and nucleic acids that will be based wholly or in large part on biological processes. The interdisciplinary program in Biotechnology Science and Engineering will provide broad training in sciences and engineering dealing with the handling and the processing of macromolecules and living systems. Students will receive advanced training in one of three specializations:

1. Structural Biology
2. Biomolecular Sciences
3. Bioprocess Engineering

The principal core of instructors and research advisors are drawn from the UAH Departments of Biological Sciences, Chemistry, and Chemical and Materials Engineering. The program includes significant involvement from local biotechnology companies as well as NASA's Marshall Space Flight Center.

In addition to a set of core courses, the Ph.D. program requires the successful completion of a comprehensive exam, seminar attendance, the preparation of a U.S. National Institutes of Health (NIH) or National Science Foundation style research proposal, oral presentations and defense of a dissertation describing original research. It is the intent of the program to produce internationally competitive graduates who will make significant contributions to the field of biotechnology.

Admission Requirements

Applicants may be unconditionally admitted to the program if they have:

1. A bachelor's degree in science or engineering from an approved college or university;
2. A minimum grade point average (GPA) of 3.000 overall;
3. A combined score of 300 on the verbal, quantitative and analytical sections and at least 3.000 in the writing section of the Graduate Record Examination (GRE);
4. A TOEFL (iBT) score of: all sub-scores equal to or greater than 18 OR IELTS score of: all sub-scores equal to or greater than 6.0 for international students.

Applicants may be admitted conditionally if they do not meet these requirements but indicate the potential for success in the Biotechnology Science and Engineering program. Applicants must have knowledge from coursework in the areas of general biology, cell biology, genetics and molecular biology, general and organic chemistry, physics and calculus to satisfy the prerequisites of calculus-based physical or biophysical chemistry. Students with deficiencies in any of these areas may be admitted only conditionally pending remedy of the deficiencies.

To obtain a Ph.D. in Biotechnology Science and Engineering, the student must satisfy all requirements of the School of Graduate Studies as well as those of the Biotechnology Science and Engineering Program.

The requirements are as follows:

1. Successfully complete the core courses:

Code	Title	Semester Hours
CHE 561	BIOSEPARATIONS RECOMBI TECH/PR	3
CH 561	BIOCHEMISTRY I	3
CH 562	BIOCHEMISTRY II	3
BYS 519	GENE STRUCTURE & FUNCTION	3
BYS 543	MOLECULAR BIOLOGY OF THE CELL	3
Total Semester Hours		**15**

2. Pass the Preliminary Examination

Each student must pass the preliminary examination which has to be taken at the end of the first summer of residence, and will cover materials from the core courses in the areas of Biochemistry, Cellular and Molecular Genetics and Bioprocessing/Bioseparations. Students will take examinations in all three areas during the first attempt. Students are required to repeat only the part of the exams that they did not pass. Students will have a maximum of two attempts to pass the preliminary examination. Appeals to this policy must be filed with the Director of the Biotechnology Program who will consult with the Graduate Dean and the Deans of the Colleges of Engineering and Science.

3. Choose a dissertation advisor and committee

Students who qualify for the Ph.D. program by passing the preliminary examination will choose a dissertation advisor and a Supervisory Committee during the fall semester of their second year. The committee will meet for the first time with the student to review the initial research goals (Research Start Meeting).

4. Write and defend a research proposal

In consultation with the dissertation advisor and committee, the student will begin working on a research project which will subsequently lead to an NIH or NSF style proposal. This written proposal will be submitted to the committee by the middle of the second summer. By the first semester of the third year, the student will defend this proposal in a seminar, followed by questions from committee members (Annual Research Appraisal I) (ARA-I). Successful completion of the written and oral presentation of the dissertation proposal constitutes the School of Graduate Studies Qualifying Examination.

5. Complete an acceptable program of study

The program of study will consist of at least 48 semester hours of coursework at the graduate level including the core courses required to prepare for the preliminary examinations and courses required to prepare the student to conduct original research in their area of study. Students must register for a total of three semester hours of seminar. A maximum of three seminar semester hours may be considered towards fulfillment of the graduate course requirements. A minimum of 18 semester hours of BSE 799 must be included in the program of study.

6. Complete and defend a research dissertation

During the fall semesters of the next two years, students will meet with their advisors and committee for research appraisals (ARA). Following these annual evaluations, the student will begin writing the dissertation and plan to defend it before the fifth year after passing the preliminary examination. The primary dissertation advisor and the committee have the discretion to allow students to defend the dissertation earlier if the work is of high quality and sufficient progress has been made toward the goals stated in the research proposal.

All requirements for the Ph.D. must be completed in no more than five years after the approval of the Research Proposal (ARA-I).

Materials Science, PhD

http://matsci.uah.edu (http://matsci.uah.edu/)

Degree: Materials Science, Ph.D.

Telephone: 256-824-5186

Email: materials.science@uah.edu

Program Director: Judith Schneider, Ph.D.

The Materials Science Ph.D. program is novel in that the three University of Alabama system campuses offer a joint doctoral degree without the existence of a separate Materials Science Department on any campus of the system. In this program, faculty members from the various departments on each campus constitute the materials science faculty. Participating faculty come from the Departments of Chemical & Materials Engineering, Chemistry, Engineering Mechanics, Metallurgical Engineering, Mineral Engineering, and Physics at The University of Alabama (UA); from the Departments of Biochemistry, Biomedical Engineering, Biomaterials, Chemistry, Materials Engineering, Optometry, Physics, and the School of Medicine at the University of Alabama at Birmingham (UAB); and from the Departments of Chemical Engineering, Chemistry, Mechanical and Aerospace Engineering, and Physics at The University of Alabama in Huntsville (UAH). The program is governed by a tri-campus coordinating committee consisting of faculty members representing each of the three campuses. The UAH faculty component is led by the UAH Materials Science Director. Students successfully completing the program will receive a Ph.D. diploma issued jointly by all three universities. Students can pursue a track in either Science or Engineering related to the science of materials, placing special emphasis on materials processing, the production of new materials, and on the application of materials to the needs of technology.

Admission Requirements

General requirements of the School of Graduate Studies (see Admissions Information section of this catalog) must be satisfied. Students entering the program are expected to have strong, but diverse, undergraduate training. They will typically have bachelor's degrees in chemistry, chemical engineering, materials science, materials engineering, mechanical engineering, civil engineering or physics. In order to be successful in this program it is recommended that a student have:

1. A bachelor's degree or its equivalent from an approved college or university in engineering or one of the physical sciences;
2. A minimum B level scholarship overall or over the last 60 semester hours of undergraduate credit.

An applicant whose scholastic record reveals a deficiency may be admitted on a conditional basis as provided in the Graduate School regulations. The student must then follow the Graduate School's policies in achieving unconditional admission status before completing the competency preliminary examination.

Program Objective

The Materials Science objective is for program graduates to attain successful careers and recognition as leaders in industry, government, or academia and in the community within a few years of graduation. Graduates will demonstrate the ability to create innovative solutions through application of their knowledge base and critical thinking.

Learning Outcomes

Materials Science students will:

- acquire comprehensive knowledge, skills, and vision for successful careers in materials science and related fields
- demonstrate the ability to carry out original scholarly research and to defend the scientific concepts in their research specialty
- present findings of their work

Program Examination Requirements

Upon entering the program, a student chooses a faculty member to provide guidance on courses and supervise the research for the dissertation. The supervisor chairs a dissertation committee consisting of no fewer than four additional members. The committee members will be selected based on the student's academic interest and area of research. At least one of the committee members will be from the student's research area at one of the other cooperating universities and another will be a UAH materials science faculty member from a department other than that of the dissertation supervisor. The dissertation committee is charged with supervision and approval of the student's research and progress toward the completion of all requirements leading to the awarding of the degree.

Passage of the preliminary competency examination is required of all candidates for the Doctor of Philosophy Degree. This is achieved by the student taking at least two courses in each of the three topical areas below within the first 24 months of enrollment into the program as part of the Program of Study (POS).

- Structure and Properties of Materials
- Characterization and Testing
- Thermodynamics and Processing

These courses provide examination of materials and questions that require substantive knowledge of experimental and theoretical topics in materials science. The examinations given in each of these courses are designed to assess the breadth and depth of a student's knowledge. As material science is inherently a multi-disciplinary subject, fulfillment of this course requirement to the specific topic can be met across a variety of courses in different home departments on each of the campuses.

The Preliminary Competency Examination is a comprehensive examination covering the subject of a student's proposed dissertation and consists of two parts. In part one, the student answers written questions submitted by the members of the supervisory committee. In part two, the student describes the plan of their dissertation in an oral presentation before the members of the committee.

After passing the two-part Preliminary Competency Examination, the student is advanced to candidacy for the doctoral degree. The final Examination is administered by the supervisory committee and consists of an oral presentation and defense of the results of the dissertation. Grading of student performance in program examinations is the responsibility of the dissertation supervisory committee.

Coursework Requirements

A minimum of 48 credit hours of graduate-level coursework plus at least 18 credit hours of MTS 799 (https://catalog.uah.edu/search/?P=MTS%20799) are required. A student may transfer up to 24 credit hours of approved graduate coursework toward the 48 credit-hour requirement. The student and the dissertation supervisor select courses appropriate to the student's dissertation area and complete a POS. Materials Science, by virtue of being multidisciplinary, enables the student, guided by the advisor, to tailor the courses across departments, colleges, and institutions to meet the graduate education and research needs and interest of the student. Students take courses to prepare for the Preliminary Competency Examination and to complete their Program of Study as approved by their dissertation advisor.

Candidacy and Dissertation Requirements

Admission to candidacy for the doctoral degree will be contingent upon the successful completion of the qualifying exam, called Preliminary Competency Examination. Normally, a student will be considered eligible to take Preliminary Competency Examination when all of the required coursework has been completed. After being admitted to candidacy, the student must then complete the remaining requirements for the degree, with the principal remaining requirement involving the doctoral research and dissertation.

Residence Requirement

The minimum period in which the doctoral degree can be earned is three full academic years of graduate study. The student must spend the last or penultimate academic year in continuous residence as a full-time graduate student at one of the campuses.

Time Limits

The Preliminary Competency Examination is generally to be completed by all full-time students within two years after first entering the program, with exceptions being made for part-time students.

The Final Program Examination is to be attempted within a reasonable time after the Preliminary Competency Examination. In general, it is to be taken no later than one year prior to submitting an application for graduation.

All requirements for the doctoral degree must be completed within a period of five years after the completion of Preliminary Competency Examination. Credits earned towards an M.S. or Ed.S. degree may be applied to the doctoral degree provided that they are applicable to the area of specialization or to the core. Dated credits may be accepted if recommended by a student's supervisory committee, the UAH Materials Science Coordinator, and approved by the Graduate School. For application toward this degree, the student may be required to demonstrate competence in the dated coursework.

Advisement

Students admitted into the program without having already communicated with a dissertation supervisor will initially be assisted in program planning and other academic matters by a temporary faculty advisor appointed by the Materials Science Director. Also, upon being accepted into the program, students will be assigned to one of the participating departments as their temporary "home" department. They may apply for an assistantship and, if awarded, the teaching or research duties associated with the assistantship will normally be assigned in that department by the Department Chair. A student may select a dissertation research project in a participating department other than the temporary home department. If the research project is acceptable to the UAH Materials Science Program Committee, a permanent advisor (normally the research supervisor selected by the student) will be assigned.

Guidelines for Graduate Students and Faculty in the Materials Science PhD Program

Welcome to the Materials Science Program at UAH

UAH offers a Ph.D. degree through the Joint Tri-Campus Materials Science Ph.D. Program and an M.S. degree at UAH. The UAH Graduate Catalog contains a general description of the program. Further information can be obtained by emailing materials.science@uah.edu.

Optical Science and Engineering, PhD

Optical Science and Engineering, PhD Degree

Room 201 Optics Building (Physics Department)
Telephone: 256.824.2482
Program Coordinator: Don A. Gregory (https://www.uah.edu/science/departments/physics/faculty-staff/dr-don-gregory/), Ph.D., Physics Department

Mission

The mission of the Optical Science and Engineering (OSE) doctoral program is to provide a competitive graduate education and research opportunity in the rapidly advancing and expanding fields of optical science and engineering, to provide students with a unique technical learning environment, to involve students in fundamental and applied research, and to prepare these students for productive and fulfilling optics and optics related careers.

OSE Program

Optics and photonics are major fields in science and technology today, with electro-optic and opto-electronic components being found in practically all modern devices. Through cooperation between the Colleges of Engineering and Science and under the direction of the Graduate School, the Optical Science and Engineering doctoral program was formally approved at UAH in 1992. This unique program is highly multi-disciplinary and comprises a combination of advanced coursework and research in both fundamental and applied subjects. The OSE faculty is made up of optical scientists and engineers from the departments of Physics, Electrical and Computer Engineering, and the Center for Applied Optics. In addition, the program enlists members of the strong Huntsville optics community for giving seminars and teaching specialty courses.

Degree Requirements

Because students will come into this program with diverse undergraduate and graduate training, the multidisciplinary curriculum has been structured on a common basis for all entering students, but can compensate for individual differences while providing depth in specific areas. A total of 48 credit hours of graduate coursework are required, of which most are in designated optics courses. An additional 18 credit hours must be taken in dissertation research. Students must also satisfy any Seminar class attendance requirements of their home department (typically Physics or one of the Engineering departments). In addition, all general requirements of the Graduate School must be met in order to remain in good standing.

Admissions Requirement

Applicants may be unconditionally admitted to the program if they have:

1. A bachelor's degree in science or engineering from an approved college or university;
2. A minimum grade point average (GPA) of 3.000 overall;
3. A combined score of 300 on the verbal, quantitative and analytical sections and at least 3.0 in the writing section of the Graduate Record Examination (GRE).
4. For international students,TOEFL (iBT): All sub-scores greater than or equal to 18; Or IELTS: All sub-scores greater than or equal to 6.5.
5. Three letters of reference.

The first step for any potential OSE student is to be accepted into the UAH Graduate School. The applications received by the Graduate School will then be evaluated by a subcommittee of the OSE faculty before being recommended for admission to the program. An applicant whose scholastic record reveals a deficiency may, upon recommendation of the Program Director and the approval of the Graduate Dean, be admitted on a conditional basis, as per Graduate School regulations (p. 11). However, that student must follow the Graduate School's policies in achieving unconditional admission status prior to taking the written OSE Preliminary Examination, normally given at the end of the spring semester.

The student will complete three study phases, punctuated by three program examinations.

Phase I

New full-time students typically come into the OSE program via a one academic year teaching assistantship in the department of physics or in one of the engineering departments. The core phase of instruction consists of 19 semester hours of coursework and lab work in the following classes: Geometrical Optics (PH/OSE 541), Physical Optics (PH/OSE 542), Fourier Optics (PH/OSE 632), Lasers (PH/OSE 645), Radiometry (PH/OSE 546), Optical Testing (OSE 654), and Optical Testing Lab (OSE 653 (https://catalog.uah.edu/grad/course-descriptions/ose/)). To complete this phase and become eligible to continue, the student must pass the written Preliminary Examination (typically administered at the end of the spring semester) on the above topics. Only two attempts will be permitted. After successful completion of this phase, the student should have acquired the common optics background necessary for continuing in the doctoral program. It is the student's responsibility to seek out a dissertation advisor during this first year and complete a draft Program of Study. Once the Preliminary Examination has been passed, a graduate committee will be formed and a final Program of Study will be completed and submitted to the OSE Program Director for review. The Program of Study will then be submitted it to the Graduate School for final approval.

Phase II

Consists of completing coursework in the Program of Study. Much of this coursework will support the dissertation research to be conducted in Phase III. Credits earned toward a thesis based master's degree (including up to 9 hours of master's thesis) may be applied to the doctoral degree. Phase II is completed when the student has passed the Qualifying Examination which is prepared and administered by the student's graduate committee. This exam consists of both written and oral parts. Written questions are typically drawn from material covered in the courses listed on the Program of Study and may be written by any or all of the committee members. The student will be given a time limit for submitting the solutions (typically a week). The oral part of the exam consists of defending a proposal for dissertation research prepared by the student and distributed to the graduate committee at least two weeks prior to the exam. The proposal will demonstrate that the student is intimately familiar with the research to be done, that published research related to the proposal has been reviewed, and that the student has a clear understanding of how to proceed and can set realistic goals. If the student fails the Qualifying Examination, a second attempt will be scheduled. Only two attempts are allowed.

Phase III

Consists of all experimental and/or theoretical work needed to complete the student's dissertation. These activities will be directly supervised by the student's advisor with input from the supervisory committee obtained during regular meetings. There must be at least two supervisory committee meetings with the student before the dissertation defense. Since the Ph.D. is a research degree, recipients must demonstrate the ability to perform independent original research and to clearly communicate this work both in written and oral formats. A paper on the dissertation research must have been submitted to a recognized refereed technical journal before the Final Examination, which consists of a public, oral presentation and defense of the dissertation.

Advisement

A student admitted to the program will schedule a meeting with the OSE Program Director for initial advisement and it is the student's responsibility to consult with all OSE faculty members in the intended area of specialization in order to arrive at a permanent advisor for dissertation research.

A graduate supervisory committee will be assembled when the student has passed the Preliminary Examination and selected a research project. The committee will include an advisor and at least four other members. At least one of the committee members will be from a department other than the student's home department, which is typically Physics. The fifth member may also be from another university or outside any university as long as approval to serve has been granted by the School of Graduate Studies. The composition of the committee will follow the rules governing such committees as set forth by the graduate school degree requirements (p. 376). The graduate committee is charged with supervision and approval of the student's research and course of study leading to the completion of all requirements for the degree.

The following elective optics courses are also available to students in the OSE program. See descriptions under indicated departments

Code	Title	Semester Hours
Electrical Engineering		
EE 532	OPTICAL SYSTEMS DESIGN	3
EE 543	OPTICAL COMM SYS & NETWORKS	3
EE 570	OPT & PHOTONIC SYSTEMS DESIGN	3
EE 604	DIGITAL IMAGE PROCESSING	3
EE 633	ELECTRO-OPTICAL ENGINEER	3
EE 634	OPTICAL COMMUNICATIONS	3
EE 733	NONLINEAR OPTICS APPLICATIONS	3
EE 734	FIBER OPTICS	3
EE 735	STATISTICAL OPTICS	3
EE 738	OPT TRANSF/PATTN RECOGNI	3
Physics		
PH 544	OPTOELECTRONICS	3
PH 570	OPTICAL & PHOTONIC SYSTEMS DESIGN	3
PH 642	OPTICAL PHYSICS	3
PH 651	QUANTUM MECHANICS I	3
PH 652	QUANTUM MECHANICS II	3
PH 733	QUANTUM DEVICES	3
PH 745	LASERS II	3
Mechanical Engineering		
MAE 677	OPTICAL TECH IN SOLID MECH	3
MAE 757	OPT TECH/FLUID MECHANICS	3

Cybersecurity, MS Interdisciplinary - Management Track

For an overview of the Master of Science program in Cybersecurity - Business track (MSCBS-M) click here (https://www.uah.edu/business/grad/degrees/mscbs/).

Program Prerequisites

Prerequisites for the MSCBS-M track include a bachelor's degree in any field and demonstration of competency in each of the following two areas:

1. **Information Systems Competency.** Students must demonstrate this competency by successful completion of IS 301 or its equivalent, which will not count towards the requirements of the Business track of the MSCBS degree.
2. **Computer Programming Competency.** Students must demonstrate this competency by successful completion of IS 310 or its equivalent, which will not count towards the requirements of the Business track of the MSCBS degree.

Degree Requirements

The MS-CBS program consists of 30 scredit hours of graduate coursework. The coursework includes a five-course core that is required of all students, nine credit hours of management track required courses, and six credit hours of electives. The directed elective choices are designed to provide students with a broader understanding of multiple cybersecurity functions normally expected in an organization.

IS 692/CPE 692/CS 692 is the capstone course and should be taken toward the end of the student's program. Students must earn a grade of B- or better in the capstone course.

Code	Title	Semester Hours
Cybersecurity Core Courses		**9**
IS 550	CYBERSECURITY MANAGEMENT [1]	
IS 663	COMPUTER FORENSICS	
or CS 580	MOBILE DIGITAL FORENSICS	
IS 692	CYBERSECURITY PRACTICUM	
or CPE 692	CYBERSECURITY CAPSTONE	
or CS 692	CYBERSECURITY CAPSTONE	
Management Track-required Courses		**15**
IS 501	CYBERSECURITY PRINCIPLES [1]	
IS 560	NETWORKING & IT INFRASTRUCTURE [1]	
IS 577	NETWORK DEFENSE & SECURITY [1]	
IS 650	SELECTED RESEARCH TOPICS [2]	
or IS 580	SEMINAR IN MANAGEMENT INFORMATION SYSTEMS	
IS 670	BUSINESS CONTINGENCY PLANNING	
Elective, select two courses from the following: [3]		**6**
IS 571	BUSINESS ANALYTICS & AI [1]	
IS 640	DATA MANAGEMENT AND DATA MINING	
CPE 534	OPERATING SYSTEMS	
CPE 645	COMPUTER NETWORK SECURITY	
CPE 646	MOBILE & WIRELESS NETWORKS	
CPE 647	UBIQUITOUS COMPUTING	
CPE 648	ADVANCED COMPUTER NETWORKS	
CPE 649	ADV CYBERSECURITY ENGINEERING	
CS 685	APPLIED CRYPTOGRAPHY	
CS 687	DATABASE SYSTEMS	
CS 553	CLIENT/SERVER ARCHITECTURES	
CS 565	NETWORK SECURITY	
CS 617	DES & ANALY OF ALGORITHM	
CS 650	SOFT'W ENGINEERING PROC	
CS 670	WIRELESS SENSOR NETWORKS	
CS 690	ADVANCED OPERATING SYSTEMS	
Total Hours		**30**

1. MS-CBS students whose previous studies include the undergraduate equivalents of IS 501, IS 550, IS 560, IS 571, and/or IS 577 must substitute a 3-credit-hour graduate-level IS course for each applicable course.
2. Students may substitute an IS course approved by the Department Chair.
3. Students are required to satisfy the prerequisites for any elective they choose. Students who wish to substitute some other courses as directed electives may seek prior approval for such a substitution by contacting the Graduate Advisor in the College of Business.

Additional Information

Thesis Option

A thesis option is available. Students interested in this option should contact both the faculty member who the student wants to serve as the thesis advisor, and the Graduate Advisor in the College of Business, before completing 12 hours of graduate study. If selected, the student will register for the IS 699 Master's Thesis course for six credit hours in lieu of six credit hours of electives.

Transfer Credit

In accordance with the Graduate School transfer policy (p. 376), students may transfer up to twelve semester hours of acceptable graduate credit earned in an approved institution and may count it toward a master's degree. No transferred credit may be more than ten years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

The College of Business will only review business discipline course(s) for transfer credit if the institution is accredited by AACSB International (https://www.aacsb.edu/). The Department Chair may, at their discretion, approve or reject the proposed course credit transfer.

Inquiries about the transferability of specific courses should be directed to the Graduate Advisor in the College of Business, who will consult with the Department Chair to determine whether the course will be accepted for transfer credit.
In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the Department and by the Graduate Dean prior to the student enrolling at the other institution.

For more information contact:

Tressa Hillman-Moore

Graduate Advisor
Business Administration Building Room 102
256.824.6732
gradbusiness@uah.edu

Cybersecurity, MS Interdisciplinary - Computer Engineering Track

The CPE program offers a Master of Science degree in Cybersecurity as part of an interdisciplinary program with the College of Science and the College of Business. The program requires 30 semester hours of graduate course work. There is no thesis option.

For this degree program, at least 50 percent of the coursework must be at the 600 level or above and a grade of B or better is required for all courses. All coursework must be approved by a faculty advisor.

Admission Requirements

Students must meet the minimum requirements for graduate school admissions as required by the UAH Graduate School.

Direct admission to the computer engineering track requires that a student hold an ABET-accredited Bachelor's degree in computer science or computer engineering. All potential applicants must demonstrate proficiency in the following foundation coursework.

Code	Title	Semester Hours
CPE 211	INTRO COMPUTER PROG FOR ENGR	3
CPE 212	FUNDAMENTALS SOFTWARE ENGRG	3
CS 214	INTRO DISCRETE STRUCTURE	3
CS 317	INTRO DESIGN/ANALYSIS OF ALG	3
CPE 348	INTRO TO COMPUTER NETWORKS	3
CPE 431	INTRO COMPUTER ARCHITECTURE	3
CPE 434	OPERATING SYSTEMS	3

Applicants for graduate study must apply for admission to the Graduate School. More information about the admissions process may be found on the Graduate School Admission webpage (https://www.uah.edu/admissions/graduate/).

Degree Requirements

IS 692 (https://catalog.uah.edu/search/?P=IS%20692)/CPE 692 (https://catalog.uah.edu/search/?P=CPE%20692)/CS 692 (https://catalog.uah.edu/search/?P=CS%20692) is the capstone course and should be taken toward the end of the student’s program. Students must earn a grade of B- or better in the capstone course.

The program of study for the MS in Cybersecurity must include:

Code	Title	Semester Hours
Cybersecurity Core Courses		**9**
IS 550	CYBERSECURITY MANAGEMENT	
IS 663	COMPUTER FORENSICS	
or CS 580	MOBILE DIGITAL FORENSICS	
IS 692	CYBERSECURITY PRACTICUM	
or CPE 692	CYBERSECURITY CAPSTONE	
or CS 692	CYBERSECURITY CAPSTONE	
Computer Engineering Track-Required Courses		**15**

CPE 549	INTRO TO CYBERSECURITY ENGINRG	
CS 585	INTRO CYBERSECURITY ENGR	
CPE 645	COMPUTER NETWORK SECURITY	
CPE 646	MOBILE & WIRELESS NETWORKS	
CPE 649	ADV CYBERSECURITY ENGINEERING	
Cybersecurity Electives		
Select two courses from the following:		6
CPE 534	OPERATING SYSTEMS	
CPE 647	UBIQUITOUS COMPUTING	
CS 553	CLIENT/SERVER ARCHITECTURES	
CS 617	DES & ANALY OF ALGORITHM	
CPE 648	ADVANCED COMPUTER NETWORKS	
CS 565	NETWORK SECURITY	
CS 650	SOFT'W ENGINEERING PROC	
CS 670	WIRELESS SENSOR NETWORKS	
CS 685	APPLIED CRYPTOGRAPHY	
CS 687	DATABASE SYSTEMS	
CS 690	ADVANCED OPERATING SYSTEMS	
IS 560	NETWORKING & IT INFRASTRUCTURE	
IS 571	BUSINESS ANALYTICS & AI	
IS 577	NETWORK DEFENSE & SECURITY	
IS 640	DATA MANAGEMENT AND DATA MINING	
IS 670	BUSINESS CONTINGENCY PLANNING	
IS 691	INFORMATION SYSTEMS STRATEGY & APPLICATIONS	
CPE 555	SECURE SOFTWARE DEV	
CPE 557	SOFTWARE REVERSE ENGR	
CPE 559	SYSTEMS SECURITY	
CPE 590	SPECIAL TOPICS IN COMP ENGR	
CPE 690	SELECTED TOPICS COMPUTER ENGRG	
CS 595	INDEPENDENT STUDY	
CS 596	SPECIAL TOPICS	
CS 695	INDEPENDENT STUDY	
CS 696	SELECTED TOPICS IN CS	
CS 795	INDEPENDENT STUDY	
CS 796	ADVANCED SELECTED TOPICS	
Total Semester Hours		**30**

Restrictions on Elective Courses

1. Computer Engineering track students should take at least one elective course from CPE courses.
2. Students can take only one course between these courses.
   a. CS 670 and IS 560
   b. CS 685 and CPE 645
   c. CS 670 and CPE 646
   d. CS 687 and IS 640
3. At least half of the credit hours must be completed in courses numbered 600 or higher.
4. At least half of the credit hours must be CPE courses.
5. CPE 590, 690, CS 595, 596, 597, 598, 695, 696, 795, and 796 should be cybersecurity-related and require approval of advisor and approval of course instructor.

Cybersecurity, MS Interdisciplinary - Computer Science Track

Purpose

The Master of Science in Cybersecurity (Computer Science track) program (MSCBS) is designed to educate students to become expert cybersecurity professionals. The focus of this program is on technological knowledge at the most in-depth levels, so that graduates of this program will be able to address the challenges that are at the forefront of national security and commercial security in the cyber domain.

Graduates of this program will be able to create new software solutions to new cybersecurity problems. They will be able to work to protect government and commercial sites against Advanced Persistent Threats, that is, very capable and well-funded attackers that are supported by foreign governments and/or organized crime, and in the event of an attack, to trace the attack back to the perpetrators. They will be able to work in digital forensics for law enforcement agencies to find digital evidence of crime and to bring criminals to justice. Also, graduates from this program will be able to work for agencies of the United States (U.S.) government to take action against enemies of the U.S., including the creation of zero-day exploits (that is, exploiting a previously unknown vulnerability).

Admission Requirements

Admission is granted to students who demonstrate high promise for success in graduate studies and who hold baccalaureate degrees in either Computer Science or Computer Engineering. Students from other disciplines will be required to successfully complete the Computer Science breadth requirements.

Breadth Requirements

The breadth requirements can be satisfied in one of the following ways:

- Completion of the course at UAH with a grade of B or better.
- Completion of an equivalent course at another institution with a grade of B or better.
- Testing out of the course, where permitted by departmental policy.

Applicants to graduate programs in Computer Science must satisfy the following breadth requirements before admission to the program:

Code	Title	Semester Hours
Mathematics		
MA 171	CALCULUS A	
MA 172	CALCULUS B	
MA 244	INTRODUCTION TO LINEAR ALGEBRA	
MA 385	INTRODUCTION TO PROBABILITY AND STATISTICS	
Computer Science		
CS 121	COMPUTER SCIENCE I *	
CS 214	INTRO DISCRETE STRUCTURE	
CS 221	COMP SCI II: DATA STRUCTURES *	
CS 309 & 309L	COMPUTER ORG & SWTCHNG THRY and LABORATORY	
CS 317	INTRO DESIGN/ANALYSIS OF ALG	
CS 321	INTRO OBJECT-ORIENTED PROG JAV *	
CS 413 & 413L	INTRO DIGITAL COMP ARCHITECTUR and LABORATORY	
CS 490	INTRO TO OPERATING SYSTEMS	

*An introductory sequence covering Object-Oriented Programming and Data Structures in C/C++/Java.

Degree Requirements and Restrictions

The MSCBS program consists of 30 semester hours of graduate coursework. The coursework includes a three-course core that is required of all students (nine credit hours), five computer science track required courses (15 credit hours), and six credit hours of electives. The directed elective choices are designed to provide students a broader understanding of multiple cybersecurity functions normally expected in an organization.

Computer Science Track

CS 692 is the capstone course and should be taken toward the end of the student's program. Students must earn a grade of B or better in the capstone course.

Restrictions on Elective Courses

1. Computer Science-track students should take two elective courses from the CS or CPE elective courses listed in the table of electives below.
2. At least half of the hours must be completed in courses numbered 600.
3. Management-track students require instructor approval before enrolling in a CPE or CS course.
4. Computer science students must select CS 580 instead of IS 663 as the forensics core course.
5. CS 695, CS 696, CS 795, CS 796 require approval from the student's advisor and approval of the course instructor. The course topic must be cybersecurity related.

Code	Title	Semester Hours
Cybersecurity Core Courses		**9**
IS 550	CYBERSECURITY MANAGEMENT	3
CS 580	MOBILE DIGITAL FORENSICS	3
or IS 663	COMPUTER FORENSICS	
CS 692	CYBERSECURITY CAPSTONE	3
or IS 692	CYBERSECURITY PRACTICUM	
or CPE 692	CYBERSECURITY CAPSTONE	
Cybersecurity: Computer Science Track		**15**
CPE 549	INTRO TO CYBERSECURITY ENGINRG	3
CS 585	INTRO CYBERSECURITY ENGR	3
CS 565	NETWORK SECURITY	3
CS 670	WIRELESS SENSOR NETWORKS	3
CS 685	APPLIED CRYPTOGRAPHY	3
Electives		**6**
Select two of the following:		
CPE 647	UBIQUITOUS COMPUTING	3
CPE 648	ADVANCED COMPUTER NETWORKS	3
CPE 649	ADV CYBERSECURITY ENGINEERING	3
CS 617	DES & ANALY OF ALGORITHM	3
CS 640	MACHINE LEARNING	3
CS 641	DATA MINING	3
CS 650	SOFT'W ENGINEERING PROC	3
CS 687	DATABASE SYSTEMS	3
CS 690	ADVANCED OPERATING SYSTEMS	3
CS 695	INDEPENDENT STUDY *	3
CS 696	SELECTED TOPICS IN CS *	3
CS 795	INDEPENDENT STUDY *	3
CS 796	ADVANCED SELECTED TOPICS *	3
*Should be cybersecurity related. Requires approval of advisor and course instructor.		

Materials Science, MS

Degree: Master of Science

Telephone: 256-824-5186

Email: materials.science@uah.edu

Program Director: Judith Schneider, Ph.D.

Degree: Master of Science

Telephone: 256.824.5186
Email: materials.science@uah.edu

Program Coordinator: Judith Schneider, Ph.D.

Admission Requirements

General requirements of the Graduate School (see Admissions Information section of this catalog) must be satisfied. In addition, students admitted to the graduate Materials Science Program are assumed to have background training in chemistry, mathematics, physics, and possibly biology and engineering, depending upon the student's research interests. Students should realize that if deficiencies exist, some additional undergraduate courses may be required. The time required to complete the degree may then be proportionately increased.

Program Objective

The objective of the Materials Science program is to educate and enhance student skill sets so that they can participate in meaningful research that supports the research, education, policy, and manufacturing sectors.

The Materials Science M.S. program at The University of Alabama in Huntsville (UAH) is an interdisciplinary masters program that "focuses on the general application of mathematical and scientific principles to the analysis and evaluation of the characteristics and behavior of solids, including internal structure, chemical properties, transport and energy flow properties, thermodynamics of solids, stress and failure factors, chemical transformation states and processes, compound materials, and research on industrial applications of specific materials." The UAH M.S. in Materials Science is not part of the tri-campus program. Students receiving a master's degree in materials science may be based in one of several departments including chemistry, physics, materials engineering, chemical engineering, civil engineering or mechanical engineering. Students may receive their masters in materials science as a precursor to their doctoral program. Although a non-thesis option is available, students are encouraged to pursue the thesis option as it enhances the student's technical skill set, exposes them to new research opportunities and makes them more attractive to employers.

Learning Outcomes

Materials Science students will

- acquire a comprehensive knowledge of materials science at an introductory graduate level,
- perform semi-independent research (M.S. Plan I students), and
- develop project management skills.

Research

Research in Materials Science focuses on the fundamental relations that exist between the structure of materials and properties and the methods for synthesizing and processing these materials. This is known as the *materials triangle*. A material may be a metal, a ceramic, or a polymer, and it may be dispersed in the solid, liquid or gaseous state. Depending upon the desired application, the structure of the material may have to be investigated at the nuclear, atomic, molecular, granular, or larger length scales. The property that is determined by the structure may be mechanical, electrical, magnetic, optical, thermal, chemical, or biological. Synthesizing may be done by thermal, mechanical, photochemical, electrochemical, or biological processes. Many basic academic disciplines can be fruitfully applied to the solution of materials science problems. Among them, we note particularly chemistry, physics, biology, and engineering. Faculty members guiding students in the Materials Science Program represent all four of these areas.

Master of Science Degree Requirements

General requirements of the Graduate School under Plan I or Plan II must be satisfied. The M.S. degree is a general degree in materials science. As such, it is based upon a core sequence of courses emphasizing areas of materials science, in particular:

- Structure and Properties of Materials
- Characterization and Testing
- Thermodynamics and Processing

Plan I

This plan requires 24 credit hours of graduate coursework in addition to six hours of Master's Thesis (MTS 699). The 24 credit hours of graduate course work is comprised of six credit hours of core classes listed in addition to 18 credit hours of electives. The elective courses should consist of six credit hours (two courses) each from the subcategories of: Structure and Properties of Materials, Characterization and Testing, and Thermodynamics and Processing. This allows the electives to be tailored to a student's area of research as selected in consultation with their advisor.

Materials Science Core Courses:

- MTS 601 - Nature of Materials
- MTS 602 - Properties of Materials

Students should also register for MTS 780 (one credt hour) during every semester they are in residence at UAH, although these credits do not apply toward the 30 credit hours required for the M.S. degree.

Additional Information

Of the 18 credit hours of electives, no more than nine credit hours can be below the 600 level. A Program of Study (POS) must be planned in consultation with a member of the materials science faculty serving as an advisor. A list of courses within the approved subcategories can be obtained from the Program Director.

After a student following Plan I selects a thesis topic and research advisor, a supervisory committee will be formed. This committee should consist of three members of the materials science faculty, including the research advisor as Committee Chair (if the research advisor is a full member of the UAH Graduate Faculty). A student must complete a written thesis and successfully defend it by an oral presentation before the supervisory committee.

Plan II

This plan requires 30 or more credit hours of graduate coursework in Materials Science or a related discipline. The 30 credit hours of graduate course work is comprised of six credit hours of the core classes listed in addition to 24 credit hours of electives. The elective courses should consist of six credit hours (two courses) each from the subcategories of: Structure and Properties of Materials, Characterization and Testing, and Thermodynamics and Processing. The remaining six credit hours from be from any of the approved subcategories in addition to any special topics offered. This allows the electives to be tailored to a student's area of research as selected in consolation with their advisor.

Materials Science Core Courses:

- MTS 601 - Nature of Materials
- MTS 602 - Properties of Materials

Students should also register for MTS 780 (one credit hour) during every semester they are in residence at UAH, although these credit hours do not apply toward the 30 credit hours required for the M.S. degree.

Additional information

Of the 24 credit hours of electives, no more than 12 credit hours can be below the 600 level. A POS must be planned in consultation with a member of the materials science faculty serving as an advisor. A list of courses within the approved subcategories can be obtained from the Program Director.

College of Nursing

1610 Ben Graves Drive
Telephone: 256.824.6345
Email: nursing@uah.edu

Dean:
Karen H. Frith, PhD, RN, NEA-BC, CNE, Professor

Mission

Educate and inspire individuals to become visionary nurse leaders who act with integrity, discover through scientific methods, and champion strategies to promote health equity in Alabama, the nation, and global communities. We are committed to a healthy learning and work environment where diversity and civility promote creativity, innovation, and social responsibility to improve the human condition.

Vision

To be recognized as an academic leader promoting wellness, advancing health equity, addressing community needs, and transforming healthcare through innovative nursing practice, education, and research.

Core Values

- Integrity - Resolutely adhering to moral, ethical, and professional standards.
- Inspiration - Encouraging, role-modeling, and mentoring others to pursue their professional dreams.

- Caring - Acting with compassion and providing person-centered care.
- Respect – Promoting diversity and inclusivity by fostering a civil, healthy learning and work environment.

- Excellence - Pursuing and achieving goals of the highest caliber.
- Wellness - Maximizing well-being in different states of health.

Accreditation

The UAH College of Nursing BSN, MSN, and DNP programs are accredited by the Commission on Collegiate Nursing Education (CCNE). The College of Nursing maintains approval status by the Alabama Board of Nursing.

Degrees and Certificates Offered

The College of Nursing offers the Joint Nursing Science Ph.D., Doctor of Nursing Practice, Master of Science in Nursing, and Post-Master's certificates in Family Nurse Practitioner, Adult-Gerontology Acute Care Nurse Practitioner, and Nursing Education.

Joint Nursing Science Ph.D.

The purpose of the Joint Nursing Science Ph.D. program is to prepare nurse scholars who will advance nursing science by generating new knowledge. It is a joint program between The University of Alabama in Huntsville (UAH) and The University of Alabama (UA).

Joint Nursing Science Ph.D. Program Outcomes

- Knowledge Synthesis: As assessed by a comprehensive exam, students will: 1) demonstrate substantive knowledge related to the body of literature and theories about rural and/or medically underserved populations to inform nursing practice, and 2) appraise and synthesize models and theories from previously conducted research.

- Research Conduct: As assessed by a successfully defended dissertation, students will demonstrate the ability to design and conduct ethical and culturally competent nursing research that is theoretically, methodologically, and analytically sound with the potential to influence health outcomes and generate new knowledge.

- Research Dissemination: Students will contribute to nursing science by generating new knowledge and actively disseminating research at national and/or international venues and in respected peer-reviewed journals.

- Collaborative Leadership: Students will demonstrate collaborative leadership as evidenced by serving as lead author on a professional presentation or manuscript by an interprofessional team that has been accepted for publication.

Joint Nursing Science Ph.D. Admission Requirements

Admission to the Joint Ph.D. program is determined by the Joint Ph.D. Oversight Committee who will assess the entire composite of information gained from a variety of sources. Each applicant must meet the following criteria and/or provide:

- An application to the Joint Ph.D. Graduate Program.
- Submit all official transcripts to The University of Alabama in Huntsville Office of Graduate Admissions by mail or an electronic transcript service.
- Evidence of successful completion of a bachelor of science in nursing degree at an accredited program or a master's degree in nursing. Applicants with bachelor's degrees in a closely related health field and master's degrees in nursing also will be considered.
- A minimum graduate Grade Point Average (GPA) of 3.000 on a 4.000 scale. Official transcripts must be sent to the university Graduate College.
- Official evidence of scores on the Graduate Record Examination taken within five years of application. GRE information can be obtained online at www.gre.org (http://www.gre.org/). The GRE requirement can be waived with a graduate GPA of 3.000 or higher or with five years or more of experience in the field or with an advanced degree in the US.
- Resume or curriculum vitae
- Three (3) letters of reference from professionals or professors who can adequately evaluate the applicant and the applicant's previous work or potential for success. Two of the letters are strongly preferred from nurses with doctoral degrees.
- Scientific Writing Sample: This sample of your written work should demonstrate your intellectual ability (such as logic, critical thinking, analysis, or synthesis) and your technical writing skills (composition, grammar, references or citations). For example, you could submit an academic paper, essay, published article, or a professional report written by you. If someone other than you contributed to this document (including editing), explain your contribution and the contributions of others.
- Statement of Purpose: In four double-spaced pages, respond to the following:
  - Why do you want to pursue a Ph.D. in Nursing Science?
  - What professional goals do you hope to achieve during and beyond your Ph.D. program?
  - Describe prior experiences that have prepared you for doctoral study (e.g. research, presentations, publications, leadership roles in practice, education, or professional organizations).

  - What are your research interests?
  - How might research in this area advance the science of nursing?
- RN License Requirement
  - Applicants must have an active, unencumbered license as a Registered Nurse in the United States. Applicants who hold an equivalent certification or licensure outside of the United States will be considered on a case-by-case basis.
  - Applicants who are not yet licensed will be considered for conditional admission, but proof of licensure must be submitted prior to completing 12 credit hours of Ph.D. coursework.
- Transfer applicants: Evidence of good academic standing at the current institution. Determination of whether or not credits may be transferred will be based on evaluation of comparability of requested transfer course to Ph.D. course and university policy, and is completed after admission.
- A statistics course is a required prerequisite for the program.

After the first review of the application and at the request of the Joint Ph.D. Oversight Committee, applicants will be asked to successfully complete personal interviews with Oversight Committee members. Research interests, professional involvement, and motivation for successful completion of doctoral study in the Ph.D. program will be assessed.

Completed applications are reviewed by the Oversight Committee throughout the year for summer enrollment. Applicants must register for courses within two years of acceptance into the Ph.D. program, or the acceptance is void.

Joint Nursing Science Ph.D. Program Degree Requirements

- In addition to the graduate degree requirements of the Joint UA UAH Nursing Science Ph.D. Program, a student is required to complete a minimum of 63 hours of graduate coursework.
- A minimum grade of B must be attained in each course in the student's program of study. Students must also attend two (2) Joint Ph.D. Intensives during their course of study.

Please note that curricular changes may be made in the coming year. Please contact the College of Nursing Office of Graduate Programs for the most current information.

Joint Nursing Science Ph.D. Progression Requirements

The Graduate Retention Policy provides guidance related to retention and timely progression through the Joint Nursing Science Ph.D. program of study. This policy provides transparency and consistency in treatment of Ph.D. students.

If a student fails to progress in a course, the Associate/Assistant Dean for Graduate Programs (ADGP) from the Ph.D. student’s home campus will hold a conference with the student to determine strategies to improve learning, ensure retention, and enhance progression.

1. Repeating Courses:
   a. The following policies apply to all students who are required to repeat a course.
      i. If a grade of a C, D, or F is earned in any required course, that course must be repeated. Ph.D. students must attain a B or higher in all courses in the Joint Nursing Science Ph.D. program.
      ii. If a grade of I (incomplete) is not resolved by the end of the fourth week of the semester following the earned grade (whether or not actively enrolled), the grade of I will be converted to an earned grade of F.
      iii. Once the last day to drop with a grade of W has passed, the student considering a withdrawal must notify the faculty of record and contact the Graduate Advisor at the home campus.
2. Progression and Suspension:

   Two or more C's, D's, or F's in the same course or two different courses will result in **academic suspension** from the Joint Nursing Science Ph.D. program.

3. Suspension:

   A student who is suspended as a result of this policy may request a one-time consideration for reinstatement (see Appendix C: Application for Reinstatement to the Joint Nursing Science Ph.D. program). Any additional W's, D's, or F's will result in a final indefinite suspension.

4. Leave of Absence:

   Under compelling circumstances beyond the student's control, a graduate student may request that the department petition the Graduate School with the rationale for granting a leave of absence. If granted by the Graduate School, a leave of absence will cover one or more upcoming semesters rather than any prior semester(s). A leave of absence is not a method of avoiding continuous registration requirements, and it does not lengthen the time limit for degree completion. When a student returns from a leave of absence, the Graduate School must be notified and will work with the department and student to determine the number of semesters remaining on the time limit and the degree requirements that remain.

   Process for Requesting a Leave of Absence

- The student contacts the academic advisor at his/her home campus to request a leave of absence (LOA).
- The academic advisor discusses the LOA policy, time limits, and revised Program of Study (POS).
- The academic advisor informs the Ph.D. Coordinator or Associate Dean at home campus and joint campus.
- The academic advisor sends the LOA form to the student (see Appendix C).
- The student returns the completed and signed form to the academic advisor, who forwards it to the Graduate school for a decision.
- Once a decision is received from the Graduate School, the academic advisor at the home campus informs the student, the advisor at the other campus, and the coordinators of the decision and updates information in the database or tracking system.

Students should also refer to the University Academic Probation and Dismissal policy for additional information.

Doctor of Nursing Practice (DNP)

The purpose of the DNP program is:

- To prepare graduates at the highest level of nursing practice to provide complex hospital and community-based care for patients and families.
- To redesign and evaluate nursing and health care systems.

The University of Alabama in Huntsville, College of Nursing offers a Post-Baccalaureate to DNP and Post-Masters to DNP pathways. The post-baccalaureate to DNP pathway allows a seamless progression from the completion of a baccalaureate degree to advanced practice with education at the doctoral level to address the growing complexity of patient care and health care systems. The Post-Masters to DNP pathway expands the preparation and accountability of masters-prepared nurses in population-based care, leadership, health policy, health system improvement, and evidence-based practice.

DNP Program Outcomes

Upon successful completion of the DNP program, the graduate will be able to:

1. Synthesize historical and theoretical foundations of nursing science for the complex care of individuals, families, communities, and populations.
2. Integrate scientific, theoretical, ethical, and legal principles to design holistic care delivery models for compassionate, person-centered care.
3. Redesign systems to improve health equity of diverse communities and populations.
4. Disseminate scientific evidence to improve health outcomes and transform health care delivery.
5. Lead improvement activities to promote safe, quality health outcomes.
6. Create strategies for intra- and interprofessional communication and collaboration to improve health care access and outcomes for diverse populations.
7. Lead system-based initiatives to improve health care for current and future needs.
8. Collaborate in the development and use of emerging health technologies to improve health care delivery.
9. Advocate for social justice, equity, inclusion, and ethical principles in health care.
10. Model lifelong learning to enhance personal, professional, and leadership development.

Post MSN to DNP Admission Requirements

1. Graduation from a Commission for Collegiate Nursing Education (CCNE), Accreditation Commission of Nursing Education (ACEN) or Commission on Nursing Education Accreditation (CNEA) accredited baccalaureate program with a major in nursing (for BSN to DNP).
2. Hold a master's degree in advanced practice nursing from an accredited institution (for MSN to DNP).
3. Submit a UAH Application for Graduate Admission.
4. Submit official transcripts from all higher education programs attempted.
5. Submit proof of current/active unencumbered licensure and advanced specialty certification.
6. Submit CV/resume.
7. Submit a Professional Statement describing career goals and identified area of clinical practice interest.
8. Meet health and background clearance requirements.
9. A statistics course is a required prerequisite for the program.
10. Due to select board of nursing regulations, special attention must be given to the location of DNP project implementation. Students must consult with the Graduate Academic Advisor regarding any restrictions in their state.

Post BSN to DNP Admission Requirements

1. Apply to the MSN program first (for BSN to DNP applicants).
2. A statistics course is a required prerequisite for the program.

DNP Progression Requirements

1. A program of study is provided to students on admission to the DNP program outlining the required sequence of courses to complete the DNP degree. Students are responsible for following their programs of study. Deviations from the program of study must be discussed with the Program Manager for Graduate Admissions and Advisement to ensure timely progression through the curriculum. Students may request a leave of absence for up to three semesters and receive a revised program of study.
2. The University grading system is described elsewhere in the *UAH Graduate Catalog*. Grade point average (GPA) is calculated by dividing the total number of quality points earned by the total number of semester hours attempted. At the completion of each semester, students access their grades in Banner.
3. Students who receive a "C" in any DNP course and the student's graduate GPA falls below a 3.000, will be placed on academic probation by the University. The student has an additional 12 semester hours to bring the GPA up to 3.000 in accordance with the UAH School of Graduate Studies policy.
4. Students who receive a "C" in a DNP course (regardless of graduate GPA) will be reviewed for progression by the DNP Coordinator and faculty of record. These individuals will make a recommendation to the Associate Dean of Graduate Programs for either continuation in the program with a repeat of the course or dismissal from the nursing program. The Associate Dean of Graduate Programs will review the recommendation and deliver a final decision. After receiving a second "C", requests aimed at continued progression will not be considered.
5. If the recommendation is for the student to continue in the program and repeat the course, he/she may retake the course the next time the course is offered.
6. If the student obtains a "C" in a nursing course and is allowed to continue, receives a "C" in any nursing course, this student will not be allowed to progress regardless of graduate GPA, and the student will be dismissed from the DNP program in the College of Nursing. A grade of C, D, F, or U (unsatisfactory) does not count toward the program of study for the DNP program.
7. Students who are dismissed from the DNP program may apply for readmission within one year of that action by completing the readmission form found in the *DNP Student Handbook* and sending it to the Program Manager for Graduate Admissions and Advisement. An Admission and Progression Committee will review the application for readmission and all relevant information about student performance in class, clinical, or DNP project. The Committee will recommend readmission or deny readmission to the Associate Dean for Graduate Programs. If readmission is recommended by the Committee, the Associate Dean will consider the availability of space in the next cohort and will communicate a date for reentry to the student. At a minimum, students who are readmitted be restricted from enrollment for one semester to resolve problems that contributed to poor academic performance. Students who are readmitted and subsequently earn another grade below "B" in any nursing course will be permanently dismissed from the DNP program.
8. Under certain extenuating circumstances, a student may be eligible for a Leave of Absence (LOA). An appointment with the Graduate Admissions Advisor to file a LOA form is required. The time limit of 6 years for DNP degree completion, potential impact on financial aid, and possible significant changes to the program of study must be considered when thinking about this option. Return to the program is contingent on class seat availability. The DNP Program will be completed in six years. This timespan includes a minimum of three consecutive semesters of NUR739 (seven credit hours). Students who approach the six-year maximum time frame for completion must make an appointment with the Graduate Admissions Advisor to file a one-year extension. The extension may be granted one time. Failure to meet the deadline may result in dismissal from the program.
9. A student may withdraw from a course if policies and deadline for withdrawal are followed as specified by the Office of the Registrar and the College of Nursing. It is the student's responsibility to understand the withdrawal policies. More than three course withdrawals in a program will be considered a lack of progress toward the degree. Three withdrawals may require academic counseling from the College of Nursing Graduate Administration and/or dismissal.
10. Courses taken at other universities will be considered for transfer credit only if a grade of "B" or higher is obtained in the course. The maximum transferable credit hours is 12 for graduate and doctoral programs. Students are responsible for requesting a transfer of credit review from the College of Nursing Program Manager for Graduate Admissions and Advisement and provide documentation.
11. Students should also refer to the University Academic Probation and Dismissal policy for additional information.
12. In addition to the graduate degree requirements of the UAH Graduate School, a student is required to complete a minimum of 40 hours of graduate coursework.
13. A minimum grade of B must be attained in each teaching nursing course in the student's program of study.

Please note that curricular changes may be made in the coming year. Please contact the College of Nursing, Office of Graduate Programs for the most current information.

Master of Science in Nursing (MSN)

Graduate tracks offered through the College of Nursing are focused on preparing advanced practice nurses in direct care provider roles as a family nurse practitioner, adult-gerontology acute care nurse practitioner, or in an indirect care provider role in nursing administration. The Master of Science degree is awarded upon successful completion of one of the three tracks.

Advanced practice nursing is distinguished by autonomy of practice and characterized by both increased complexity in clinical decision making and skills in managing organizations and health care environments.

Comprehensive health assessment skills provide a foundation for the critical thinking used in diagnostic decision making and treatments of complex human responses of diverse individuals, families, and communities to health problems. Advanced practice nursing students are guided in classroom and clinical experiences to formulate clinical decisions to manage common health problems, acute and chronic illness, and promotion of wellness.

Theory and research form a central core of knowledge for all tracks in the master's program. Building on content in these areas, all students integrate education, management, leadership, and consultation into their clinical experiences as they practice in a variety of settings. Practice sites for clinical courses are individually arranged with the student. Classes are usually offered one day per week and may be offered on campus, or through web-based courses.

Students who successfully complete their program of study are eligible to sit for the national certification examination in their area of expertise in the nurse practitioner program and after work requirements are met in the nursing administration program.

MSN Program Outcomes

Upon successful completion of the MSN program, the graduate will be able to:

1. Integrate theoretical foundations of nursing knowledge, science, humanities, and scholarly inquiry in advanced-level nursing practice.
2. Demonstrate advanced-level nursing practice that is evidence-based and adheres to scientific, ethical, legal, and professional standards in the delivery of compassionate, person-centered care.
3. Evaluate policies, care delivery models, and organizational structures/processes for efficacy in meeting current and future health care needs of diverse communities and populations.
4. Evaluate findings from research to create evidenced-based practice policies and protocols to improve health care delivery and outcomes.
5. Use improvement processes in all health care settings to promote quality and safety principles.
6. Engage in strategies that promote intra-and interprofessional communication and collaboration to deliver advanced care for diverse populations.
7. Evaluate system-based strategies to provide equitable care and improve access to health care.
8. Incorporate informatics principles in the use of current and emerging technologies in advanced-level nursing practice.
9. Exemplify professional practice at the advanced level by promoting ethical values, professional standards, inclusion, equity, and social justice.
10. Assume responsibility for life-long learning and continuing personal, professional, and leadership development.

MSN Admission Requirements

1. Graduation from a Commission for Collegiate Nursing Education (CCNE), Accreditation Commission of Nursing Education (ACEN) or Commission on Nursing Education Accreditation (CNEA) accredited baccalaureate program with a major in nursing.
2. Overall grade-point average of 3.000 on a 4.000 scale in all baccalaureate coursework or on the last 60 semester hours of baccalaureate coursework completed.
3. Acceptable score on either the Graduate Record Examination (GRE) or the Miller Analogies Test (MAT) taken within the last five years. The minimum score on the MAT is 410. The minimum scores for the GRE are 150 Verbal, 150 Quantitative, and 3.000 Analytical Writing. (Students with an overall GPA of 3.000 may waive #3).
4. Submit a UAH Application for Graduate Admission.
5. Submit official transcripts from all higher education programs attempted.
6. Submit CV/resume.
7. Three completed College of Nursing Graduate Recommendation Forms from individuals familiar with the applicant's academic and clinical abilities. Forms are available in the College of Nursing Office of Graduate Programs.
8. Current unencumbered registered nurse license. If a student is permitted to meet course clinical requirements in a state other than Alabama, the student must be licensed in that state. Students will not be allowed to continue in the track if any license is placed on probation, suspended, or revoked. Licensure must be maintained throughout the program.
9. A minimum of one year of clinical experience as a Registered Nurse (RN) is required to be eligible for admission as a full-time student in the Family Nurse Practitioner track (FNP). Students admitted for part time study in the FNP track with less than one year of clinical experience as a RN must maintain employment as a RN to obtain additional clinical experience throughout their enrollment.
10. A minimum of one year of clinical experience as a Registered Nurse (RN) in a critical care area (intensive care unit or emergency department) is required to be eligible for admission as a full-time student in the Adult-Gerontology Acute Care Nurse Practitioner (AGACNP) track. Students admitted for part time study in the AGACNP track with less than one year of clinical experience as a RN must maintain employment as a RN in critical care to obtain additional clinical experience throughout their enrollment.
11. A statistics course is a required prerequisite for the program.

12. Due to select board of nursing regulations, special attention must be given to the location of the Nurse Administration Internship clinical. Students must consult with the Graduate Academic Advisor regarding any restrictions in their state.

MSN Degree Requirements

In addition to the graduate degree requirements of the UAH Graduate Program, a student is required to complete a minimum of 30-42 semester hours of graduate coursework in one of the following tracks:

- Adult-Gerontology Acute Care Nurse Practitioner
- Family Nurse Practitioner
- Nursing Administration
- Nurse Education

A minimum grade of B must be attained in each nursing course in the student's program of study.

Please note that curricular changes may be made in the coming year. Please contact the College of Nursing Office of Graduate Programs for the most current information.

MSN Synthesis Requirement

The MSN student is expected to complete a synthesis requirement as part of the graduate program in nursing. The purpose of this synthesis requirement is to demonstrate development of the knowledge base, values, and skills related to the particular program of study as a prerequisite for graduation. There are two options in which the MSN student may meet the synthesis requirement:

Completion of a capstone course and one of the following:

1. Completion of a traditional research thesis under the guidance of a committee of graduate nursing faculty within the College of Nursing. This option requires that the students enroll in **a minimum of** six semester hours of thesis credit (not necessarily in the same semester). Oral defense serves as the final comprehensive examination for students completing the thesis or scholarly project option. This oral examination must follow the policies outlined in the UAH Graduate Catalog.
2. Completion of one graduate level elective. Graduate level electives are designed to offer in depth study of areas on interest to graduate level nursing students.

MSN Progression Requirements

A program of study is provided to students on admission to the MSN program outlining the required sequence of courses to complete the MSN degree. Students are responsible for following their programs of study. Deviations from the program of study must be discussed with the Program Manager for Graduate Admissions and Advisement to ensure timely progression through the curriculum. Students may request a leave of absence for up to three semesters and receive a revised program of study.

The University grading system is described elsewhere in the *UAH Graduate Catalog*. Grade point average (GPA) is calculated by dividing the total number of quality points earned by the total number of semester hours attempted. At the completion of each semester, students access their grades in Banner.

As stated in the UAH Graduate Catalog, students with a cumulative grade point average less than 3.000 at the end of each semester will be placed on Academic Probation Status (APS) (https://catalog.uah.edu/grad/academics/academic-probationary-status/). In addition, the College of Nursing requires all graduate courses to be passed with a grade of “B” or higher. Courses taken at other universities will be considered for transfer credit only if a grade of "B" or higher is obtained in the course.

Students who receive less than a “B” will be reviewed for progression the Admission and Progression Committee, which is composed of faculty from their track. The student will be required to submit a request to continue in the MSN program using the form found in the *MSN Student Handbook.* This Committee will recommend either continuation in the program with a repeat of the course or dismissal from the MSN program. The Committee will make recommendations to the Associate Dean of Graduate Programs. If the student has a hold on registration by the Dean of the Graduate School, the form and the recommendation from the Admission and Progression Committee will be forwarded to the Graduate School. The student will be given a specified period of time to remedy the grade point average to 3.000. Failure to remedy the grade point average within the time period specified in the plan will lead to dismissal from the Graduate School, as described in the published policy in the *Graduate Catalog*. If a student makes a “C,” “D,” or “F” in the repeated course or in a second course, he or she will be dismissed from the MSN program by the Associate Dean of Graduate Programs.

Students who are dismissed from the MSN program may apply for readmission within one year of that action by completing the readmission form found in the *MSN Student Handbook* and sending it to the Program Manager for Graduate Admissions and Advisement. An Admission and Progression Committee will review the application for readmission and all relevant information about student performance in class, clinical, or lab. The Committee will recommend readmission or deny readmission to the Associate Dean for Graduate Programs. If readmission is recommended by the Committee, the Associate Dean will consider the availability of space in the next cohort and will communicate a date for reentry to the student. At a minimum, students

who are readmitted be restricted from enrollment for one semester to resolve problems that contributed to poor academic performance. Students who are readmitted and subsequently earn another grade below "B" in any nursing course will be permanently dismissed from the MSN program.

Under certain extenuating circumstances, a student may be eligible for a Leave of Absence (LOA). An appointment with the Program Manager, Graduate Admissions and Advising to file an LOA form is required. Students should consider that there might be a potential impact on financial aid and possible significant changes to the program of study. Return to the program is contingent on class seat availability.

A student may withdraw from a course if policies and deadline for withdrawal are followed as specified by the Office of the Registrar and the College of Nursing. It is the student's responsibility to understand the withdrawal policies. More than three course withdrawals in a program will be considered a lack of progress toward the degree. Three withdrawals may require academic counseling from the College of Nursing Graduate Administration and/or dismissal.

Students should also refer to the University Academic Probation and Dismissal policy for additional information.

Nurse Practitioner

The nurse practitioner is a skilled health care provider who uses expert clinical judgment and decision making in conducting comprehensive health assessments, making differential diagnoses, and prescribing of pharmacologic and non-pharmacologic interventions in the direct treatment of health problems. Nurse practitioners function as care providers, case managers, researchers, consultants, and educators. Two nurse practitioner tracks are offered at the college:

- Family Nurse Practitioner
- Adult-Gerontology Acute Care Nurse Practitioner

Although both are advanced practice nurses, family nurse practitioners function as primary care providers focusing on common health care problems across the lifespan. Family nurse practitioners establish collaborative practices with primary care physicians to deliver culturally sensitive care to clients. Adult-gerontology acute care nurse practitioners focus on the care of adults and older adults with acute illnesses and may practice in the hospital, home, or clinic setting. Adult-gerontology acute care nurse practitioners provide expert interventions focused on health promotion, illness prevention, and health care management.

Nursing Administration

This track prepares nurses who will influence the future of health care through visionary nursing leadership. Competencies include communication, financial skills, information technology, leading and managing change, policy analysis, and empowerment for professional practice. Graduates are prepared to assume positions in education, administration, management, or specialty area roles in a variety of care delivery sites.

Post-Master's Family Nurse Practitioner Certificate

Students already possessing a master's degree in nursing have the opportunity to pursue a family nurse practitioner certificate. Students are admitted to the family nurse practitioner certificate program to complete the requirements in four semesters. The transcripts and resumes of prospective students will be evaluated to determine if additional courses are needed. See the *Certificates* tab.

Graduate Certificate Program in Nursing Education

Students who are currently enrolled in graduate education or those possessing a master's degree have the opportunity to continue their education and obtain a certificate in nursing education. Classes for this program are arranged in a manner to allow for full-time employment or continued study in the master's program. The program is composed of six courses, and requirements for the certificate program may be completed in one calendar year.

More detailed information about opportunities for students seeking graduate degrees and certification may be obtained from the College of Nursing Office of Graduate Programs 256.824.6669.

Online Learning

Online courses are offered by the College of Nursing to improve access to higher education. The College of Nursing offers the Joint Nursing Science Ph.D., DNP, and the MSN in Nursing Administration program completely online. The nurse practitioner programs include hybrid courses allowing the student maximum flexibility. All courses contain web-based enhancement.

Courses offered completely online or those with a hybrid of on-campus/online are delivered in *Canvas*, the official course management system for UAH. Faculty in the College of Nursing use a common template to organize courses for student ease of navigation. Other educational technologies such as Screencast-o-matic, Turnitin, wiki pages, chats, etc., are used to enhance student interaction, learning, and enjoyment.

Facilities

The College of Nursing utilizes the facilities and resources of the entire university, the community, and affiliated health care agencies. The college is housed in a four-story building centrally located on the UAH campus. Classrooms equipped with current educational technology as well as the Learning and Technology Resource Center (LTRC) with a state-of-the-art simulation to assist students to learn in multiple ways.

The College of Nursing maintains contracts with over 1,300 health-related agencies to offer a wide range of clinical sites for student educational experiences. Agencies in the local area include the Huntsville Hospital Health System, Crestwood Medical Center, local Public Health Departments, skilled nursing homes, home health agencies, and the University of Alabama at Birmingham Medical Clinics--Huntsville Campus. Other hospitals, clinics, physicians' offices, and rural health clinics across Alabama and southern Tennessee are also used for student experiences.

Transportation

Clinical learning experiences are varied in settings and are located within Huntsville and surrounding communities. Students are expected to travel to and from all clinical experiences. Students are responsible for providing their own transportation and carrying appropriate insurance. The College of Nursing is not liable for any traffic violations or auto mishaps during student commutes.

Advising and Assistance

The focus of advising in the College of Nursing is to assist students to successfully progress toward their educational objectives. Advising is designed to provide assistance where desired and appropriate. All pre-admission graduate students are advised in the College of Nursing Office of Graduate Programs located on the second floor of the Nursing Building.

Students admitted to the graduate program work with the academic advisor who assists them throughout the remainder of the academic program. Program coordinators assist students in completing a program of study for the track to which they have been admitted, as well as providing guidance for future employment or educational endeavors.

Requirements for Enrollment and Admitted Students

1. Documentation of professional liability insurance must be provided to the College of Nursing Office of Graduate Programs or third-party designee prior to enrollment in a nursing class. The insurance must be a minimum of one million/three million of coverage and renewed annually while enrolled in the program. NP students are required to have "NP Student" coverage. Liability coverage can be obtained from Nurses Services Organization (NSO) at www.nso
2. Documentation of cardiopulmonary resuscitation (CPR) training must be provided to the College of Nursing Office of Graduate Programs prior to enrolling in a nursing class. CPR certification must be maintained throughout the program. Students entering the adult-gerontology acute care nurse practitioner tracks must obtain and maintain Advanced Cardiac Life Support certification (ACLS) prior to enrolling in a clinical nursing class.
3. Students are required to undergo drug testing and a criminal background check prior to enrollment in nursing courses, annually thereafter, and for cause at other points. Information and procedures are provided upon admission. If the College deems the drug testing and/or background check information to be unsatisfactory, acceptance or enrollment into the College may be denied or an offer of acceptance rescinded. If a student's acceptance or enrollment is denied or rescinded based on the information obtained from a criminal background check report, the student will be advised of the name and address of the consumer reporting agency that furnished the report and of the right to dispute the accuracy and completeness of any information contained in the report by contacting the consumer reporting agency directly. If the College decides, based on the individual's written description, explanation, and documentation about information obtained in the criminal background check, that the results of the check are deemed to be satisfactory, the individual shall be informed that the College's positive decision is not a guarantee that every clinical facility will permit the student to participate in educational clinical experiences at that facility or that any state will accept the individual as a candidate for registration, permit or licensure. Convictions of pleas of guilty of, pleas of nolo contendere (no contest) to, any criminal charges, or any pending criminal charges are ground for dismissal from the College of Nursing. Any crimes involving violence against the person, including but not limited to murder, manslaughter, use of deadly force, assault and battery (other than simple), sex crimes, abuse of children or the elderly, abduction, or robbery at any time prohibit a student form admission or progression in the Nursing Program. The Associate Dean will inform any disqualified student, and the student will not be allowed to continue in any Nursing Program.
4. Students may also be required to have additional drug screens and/or criminal background checks prior to attending selected clinical agencies. All requirements for clinical placement at agencies must be met by the student in order to be placed at that location.
5. Documentation of current license to practice as a registered nurse must be provided to the College of Nursing Office of Graduate Programs prior to enrollment in a nursing class. Registered nurse students must submit proof of an active, unencumbered current license. If a student is permitted to meet course clinical requirements in a state other than Alabama, the student must be licensed in that state. Registered nurse students will not be allowed to continue in the program if any nursing license is placed on probation, suspended, or revoked. Licensure must be maintained throughout the program.
6. Completion of three modules in "Culturally Competent Nursing Care: A Cornerstone of Caring" found at https://ccnm.thinkculturalhealth.hhs.gov/default.asp
7. OSHA Certification: Students can access the OSHA training requirement through their Canvas Student Portal, and once complete, students must submit a copy of their OSHA certificate.

8. HIPAA Certification: Students can access the HIPAA training requirement through their Canvas Student Portal, and once complete, students must submit a copy of their HIPAA certificate
9. Essential functions define selected attributes and behaviors students must demonstrate to successfully complete their education and subsequently enter nursing practice. These essential functions are determined to be required for initial and continued enrollment in the College of Nursing. Students must be able to perform each of the following essential functions with or without reasonable accommodations:
    a. Critical thinking ability sufficient for clinical judgment consistent with the level of educational preparation. Examples (not all inclusive) of necessary activities include identifying cause-effect relationships in clinical and classroom situations, using the scientific method in developing plans of care, and evaluating the effectiveness of nursing interventions.
    b. Professional relationship sufficient for professional interactions with a diverse population of individuals, families, and groups. Examples (not all inclusive) include establishing rapport with patients/clients and colleagues, engaging in successful conflict resolution, and being accountable to peers.
    c. Communication adeptness sufficient for verbal and written professional interactions. Examples (not all inclusive) include explaining treatment procedures, initiating health teaching, and documenting and interpreting nursing actions and patient/ client responses.
    d. Mobility abilities sufficient to move from room to room and maneuver in small spaces. Examples (not all inclusive) include moving about clients' rooms, work spaces, and treatment areas; and administering cardiopulmonary procedures.
    e. Gross and fine motor abilities sufficient for providing safe, effective nursing care. Examples (not all inclusive) include calibrating and using equipment, positioning of clients in therapeutic positions, and completing physical examinations on patients.
    f. Auditory ability sufficient for monitoring and assessing health needs. Examples (not all inclusive) include hearing basic conversations, cries for help, monitoring alarms, emergency signals, and auscultatory sounds.
    g. Visual abilities sufficient for observation and assessment necessary in nursing care. Examples (not all inclusive) include reading documents such as patient charts and laboratory reports; reading calibrations on syringes, sphygmomanometers, and thermometers, and equipment outputs such as waves, printouts, and digital readings; and accurately observing client behaviors such as color changes and nonverbal communication.
    h. Tactile abilities sufficient for physical assessment. Examples (not all inclusive) include performing palpation, percussion, temperature changes, complete physical examinations and other activities related to therapeutic interventions.
    i. Behavioral/Social abilities sufficient to demonstrate emotional stability, maintenance of composure under stress, development of mature, empathetic, and effective nurse-patient relationships. Using logical, unimpaired judgment in the classroom and clinical activities is also an example of this essential function.

These essential functions are not intended to be a complete listing of all nursing behaviors, but they are a sampling of the types of abilities needed by nursing students to meet program objectives and requirements. The College or its affiliated agencies may identify additional critical behaviors or abilities. The identified essential functions are adopted from the Americans with Disabilities Act: Implications for Nursing Education by the Southern Regional Education Board and the Council on Collegiate Education. The College of Nursing encourages students who need accommodations for essential functions to contact the UAH Disability Support Services Office.

Health Requirements

The clinical experiences of graduate nursing students require a health screening program. The following steps are required as part of admission to and enrollment in the graduate program:

1. Each student is required to have a health examination by a physician or a certified nurse practitioner. Reports of the results of this examination must be submitted on forms provided by the College of Nursing and must be received by the College of Nursing Office of Graduate Programs by published deadlines. Individual clinical agencies may require additional documentation for specific health requirements which must be met by students;
2. Each student must be immunized for Hepatitis B. For initial enrollment, certification that the series of three injections has begun or results of a recent titer must be received by the College of Nursing Office of Graduate Programs by published deadlines. Documentation of the completed series is required for continued enrollment and must be received by the College by published deadlines. Immunizations and titers are at the expense of the student;
3. Each student is required to be immunized against measles, mumps, rubella, and rubeola with a two-dose series or have a titer showing immunity. If the titer shows non-immunity or equivocal results, the student must take the two-dose immunization.
4. Each student is required to be immunized against varicella with a two-dose series or have a titer showing immunity. If the titer shows non-immunity or equivocal results, the student must take the two-dose immunization.
5. Annual influenza vaccinations are required by the first of October.
6. The CDC does require a two-step TB skin test initially; however, if you have had initial testing and annual screening through your employer, documentation of a single step will be sufficient. Annual single PPD skin test update required OR T-Spot OR QuantiFERON TB Gold Blood draw annual update is required. *If a TB skin test is positive, a chest x-ray must have been completed within the last five years (annual symptom evaluation must be completed and uploaded).
7. Tetanus Diphtheria, Pertussis (Tdap) booster required every 10 years after initial TDap. The Tdap immunization must never be more than 10 years old during matriculation.
8. Documentation of current immunization, healthcare provider's statement, or copy of recent titer results must be received by the College of Nursing Office of Graduate Programs by the published deadlines. Immunizations and titers are at the expense of the student.

9. Documentation of current health insurance must be received by the College of Nursing Office of Graduate Programs by published deadlines. Hospitals and health agencies provide emergency treatment to students for injury or illness occurring in the course of program requirements in their agencies. Such treatment will be at the expense of the student. Students are required to maintain health insurance throughout the program.
10. Each student must complete a certified background check and a drug screen before starting the program and annually thereafter.
11. All health requirements must be completed prior to the first day of class in the semester. Students who fail to meet this requirement will not be allowed to start classes until all health requirements are met.

Student Financial Services

Student Financial Services, located in the Student Services Building, provides financial aid information and assists students in meeting individual needs. Financial aid for graduate students in the College of Nursing comes primarily from the following sources:

1. Alabama Board of Nursing Scholarships. Fifteen scholarships are granted each year to graduate students attending schools in Alabama. Funding is $3,800 for full-time study for one year. Students must make application directly to the Alabama Board of Nursing. Contact the Alabama Board of Nursing for further information.
2. Alabama Board of Nursing Loan Repayment plan.
3. Elizabeth M. Fisher Memorial Scholarship.
4. Joan Williamson NANPA Scholarship.
5. Graduate Teaching Assistantships.
6. Graduate Tuition Scholarships.
7. Nurse Faculty Loan Program.

Course Load

The usual course load for a full-time graduate student in nursing is from 9 to 12 semester hours. Students may choose to complete a degree in full-time or part-time study with the exception of the post-master's students.

Professional Licensure

If you are interested in obtaining professional licensure, please check with the appropriate licensing body in the state where you intend to practice. Additional information can be found at https://www.uah.edu/academic-affairs/offices/oirea/state-authorizations/professional-licensures. (https://www.uah.edu/academic-affairs/offices/oirea/state-authorizations/professional-licensures/)

Joint Nursing Science PhD Program

- `Nursing, Joint Nursing Science PhD (p. 173)`

Doctor of Nursing Practice

- Nursing, MSN to DNP (p. 174)
- Nursing, BSN to DNP (p. 174)

Master of Science in Nursing

- Nursing, MSN - Adult-Gerontology Acute Care Nursing Practitioner (p. 175)
- Nursing, MSN - Family Nurse Practitioner (p. 175)
- Nursing, MSN - Nursing Administration (p. 176)
- Nursing, MSN - Nursing Education (p. 176)

ADN to MSN (Jump Program) (http://catalog.uah.edu/undergrad/colleges-departments/nursing/nursing-bsn/jump/)

Certificates in Nursing

- Nursing Education (p. 176)
- Post-Master's Adult Gerontology Acute Care Nurse Practitioner Program (pending approval)
- Post-Master's Family Nurse Practitioner Program (p. 177)

NUR 500 - SPECIAL TOPICS
Semester Hours: 2-4

Advanced study of selected area of interest in nursing.

NUR 518 - GLOBAL HEALTH: INTERNATIONAL STUDY
Semester Hours: 3

This course will focus on a selected international health care system. The international system will be compared with the US Health Care System in relation to economic, social, cultural, policy, and environmental influences. Culmination of the course will center on international experiences with health care facilities, policy making bodies, historical, and cultural introductions in another country.

NUR 524 - HEALTH CARE AND THE LAW
Semester Hours: 3

Introduction to basic health law in the context of application to nursing practice. Content relates to involvement with legal principles in nursing and healthcare. Federal, state and local aspects of law are included. (Cross listed with NUR 424).

NUR 525 - HUMAN SEXUALITY
Semester Hours: 3

Theory and issues related to human sexuality in health and illness. Emphasis on theory and values, clarification of human sexuality needs. Elective, open to all university students. (Cross listed with NUR 425).

NUR 527 - INTRODUCTION TO FORENSIC NURSING
Semester Hours: 3

This elective course provides an overview of the field of forensic nursing. Course concepts include care for victims of violence, forensic issues in healthcare, forensic investigation, and career information for forensic nursing. Current health care practices and medical/legal/ethical issues will be discussed.

NUR 528 - GERONTOLOGICAL NURSING
Semester Hours: 3

Nursing care of older adults in multiple settings. Issues and trends are incorporated.

NUR 534 - PALLIATIVE CARE
Semester Hours: 3

Palliative care is when there is no longer a medical treatment or cure for a physical problem. This palliative care course includes meeting the physical, emotional, social, cultural, and spiritual needs of individual and their families. A course focus will be on coping, grief, bereavement, pain relief and managing living implications for individuals with life-threatening illnesses. There will be recognition of the importance of individuality, vulnerability, and resilience in the quality of living during the dying process.

NUR 537 - NURSING AS A POLITICAL FORCE
Semester Hours: 3

The course explores the historical, current, and future impact of nursing on the political process. Local, state, national, and international aspects of nursing as a political force are analyzed. Emphasis is on political systems, regulatory processes, and organizational issues influencing health care delivery. Elective, open to all university students.

NUR 539 - NURSING MEDICAL MISSIONS
Semester Hours: 3

This course will focus on global health and humanitarian concepts and issues, and the nursing care needed to impact those issues. These issues will be examined and analyzed in relation to the mission country's economic, social, cultural, policy, and environmental influences. Culmination of the course will center on international experiences with supervised nursing care for a medical mission in another country. This course is an accepted elective in the Nursing Program. Additional work is required for graduate credit.

NUR 540 - ONCOLOGY NURSING
Semester Hours: 3

This course provides a holistic approach to the nursing care of people with cancer. The nursing process is used as the basis for promoting health and facilitating adaptation in the person with cancer. The course includes clinical experiences in selected agencies.

NUR 550 - ISSUES IN TRANSPLANTATION
Semester Hours: 3

This course is designed to provide basic theoretical knowledge related to nursing care of the donor/transplantation client and their families. Course content focuses on historical and current issues in donor/transplantation nursing including the impact of legal, ethical, political, economic, and socio-cultural issues. Students will examine the roles of the professional nurse and the interdisciplinary team in the management of care for the donor/transplant client and their families. Topics of future research and critical thinking will be discussed.

NUR 602 - SCHOLARLY INQUIRY FOR ADVANCED NURSING PRACTICE
Semester Hours: 3

This course explores research methods, evidence-based practice, ethical research and frameworks to guide scholarly inquiry. The learner will analyze quality improvement studies, clinical practice guidelines, and research studies. Synthesis of learning will involve developing a clinical question, evauating evidence, and disseminating an interprofessional scholarly product with practice recommendations.

NUR 604 - ROLE DEVELOPMENT FOR THE ADVANCED PRACTICE NURSE
Semester Hours: 3

This course prepares the graduate nursing student for the transition into advanced practice. Role development includes initiating and maintaining professional working relationships, understanding of legal, financial, ethical, and professional expectations and responsibilities, analysis of pertinent health policies, and demonstration of management principles and practices expected of the advanced practice nurse.

NUR 605 - ADVANCED HEALTH ASSESSMENT
Semester Hours: 3

This course provides an opportunity for the advanced practice nurse to utilize theoretical and evidence-based clinical practice guidelines to conduct a comprehensive and systematic assessment as a foundation for decision making in caring for patients across the lifespan.

NUR 605L - CLINICAL
Semester Hours: 0

NUR 606 - ADVANCED PATHOPHYSIOLOGY
Semester Hours: 3

This course is designed to expand on the previous knowledge of anatomy, physiology, and developmental disease processes. Physiological alterations, as they affect individuals across the lifespan, are reviewed with an introduction of diagnostic reasoning as it relates to disease manifestations.

NUR 607 - PHARMACOLOGY IN ADVANCED PRACTICE
Semester Hours: 3

This course is designed to provide the advanced practice nurse with pharmacological knowledge and clinical reasoning skills necessary to analyze data obtained from the health history, pharmacological review, and evaluation of treatment plans for patients across the lifespan.

NUR 610 - FAMILY NURSE PRACTITIONER I
Semester Hours: 6

This clinical course introduces the roles of the advanced practice nurse in direct and indirect health services for assessment, health promotion, illness prevention, and health management of patients across the lifespan. Prerequisite with concurrency: NUR 605, NUR 606 and NUR 607.

NUR 610L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 611 - FAMILY NURSE PRACTITIONER II
Semester Hours: 6

This clinical course promotes the integration of advanced practice principles of evidence-based health promotion and disease prevention across the lifespan. Prerequisites: NUR 602, NUR 604, NUR 610.

NUR 611L - CLINICAL
Semester Hours: 0

NUR 612 - FAMILY NURSE PRACTITIONER III
Semester Hours: 6

This clinical course promotes the integration of principles of evidenced-based, culturally competent care in primary care, emphasizing health promotion and disease prevention across the lifespan for the advanced practice nurse. Prerequisite: NUR 611.

NUR 612L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 613 - FAMILY NURSE PRACTITIONER IV
Semester Hours: 6

This course is the capstone family nurse practitioner clinical course in which the advanced practice student assumes the professional role by integrating, translating, and applying evidence-based care while working collaboratively and respectfully within the healthcare system providing patient-centered care to improvie patient and system outcomes. Prerequisite: NUR 612.

NUR 613L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 620 - ADULT GERONTOLOGY ACTUE CARE NURSE PRACTITIONER I
Semester Hours: 6

Clinical course that introduces advanced nursing skills necessary for the assessment, health promotion, disease prevention, and health management of the complex, acute, critically and chronically ill patient across the entire spectrum of adulthood. Prerequisites with concurrency: NUR 605, NUR 606, NUR 607.

NUR 620L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 621 - ADULT GERONTOLOGY ACTUE CARE NURSE PRACTITIONER II
Semester Hours: 6

This clinical course focuses on the assessment and management of adults with acute health problems in secondary or tertiary settings. The student develops increasing interpretive skills with assessment parameters using collaborative protocols in delivering care to patients with selected acute/critical alterations in health. Prerequisites: NUR 602, NUR 604, NUR 620.

NUR 621L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 622 - ADULT GERONTOLOGY ACUTE CARE NURSE PRACTITIONER III
Semester Hours: 6

This clinical course promotes the integration of principles of evidence-based patient-centered care of critically ill adult-gerontological patients with complex comorbidities. Prerequisite: NUR 621.

NUR 622L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 623 - ADULT GERONTOLOGY ACUTE CARE NURSE PRACTITIONER IV
Semester Hours: 6

This course is the capstone adult-gerontology acute care nurse practitioner clinical course in which the advanced practice student assumes the professional role by integrating, translating, and applying evidence-based case while working collaboratively and respectfully within the healthcare system providing patient-centered care to improve patient and system outcomes. Prerequisite: NUR 622.

NUR 623L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 629 - US HEALTH CARE SYSTEM
Semester Hours: 2

The focus of this course is to explore the structure and complexity of the US health care system. Content will include underlying values, major historical developments, reimbursement methods, stakeholders, and issues driving reform. Prerequisite with concurrency: NUR 630.

NUR 630 - THEORETICAL FOUNDATIONS FOR NURSE ADMINISTRATORS
Semester Hours: 3

This course focuses on the Nurse Administrator's relationships and roles in a variety of health care systems. Theories of management and organization are analyzed from the perspective of structure, communication, dynamics, trends, and key management, responsibilities, and functions in health care delivery systems.

NUR 631 - LEADERSHIP IN RESOURCE MANAGEMENT
Semester Hours: 3

This course focuses on the role of the nurse leader in resource allocation and management in health care systems and related organizations. Content related to human resource management includes workforce development, the healthcare workforce, recruitment, selection, retention, development, and labor relations. Prerequisite: NUR 630.

NUR 632 - ECONOMIC AND POLICY IMPLICATIONS FOR LEADERS IN HEALTH CARE SYSTEMS
Semester Hours: 4

This course focuses on economic and financial implications for nurse administrators with emphasis on executive level budget management and business planning skills. The course is designed to assist nurse administrators in gaining conceptual knowledge regarding budgeting in health systems and policy factors impacting cost, quality and access to healthcare. Prerequisites: NUR 630.

NUR 634 - INTERNSHIP IN NURSING LEADERSHIP
Semester Hours: 3

This is the culminating course that provides opportunities to synthesize leadership learning, administrative theory, and operational skills in budgeting and finance, and resource management. This knowledge is applied through the identified nurse executive competencies in selected health care related organizations. Course objectives reflect the AONL competencies and QSEN standards. Clinical hours 3, Contact hours 135. Prerequisites: NUR 630.

NUR 634L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 638 - INFORMATICS FOR NURSE ADMINISTRATORS
Semester Hours: 3

The focus of this course is on the structuring and processing of health information for making decisions in health care. Prerequisite: NUR 630.

NUR 640 - CURRICULUM DEVELOPMENT IN NURSING
Semester Hours: 3

Principles and concepts of curriculum development are examined with respect to their application to development of both the theoretical and clinical components of nursing programs. Includes principle regarding theories of learning, the changing nature of knowledge and societal needs as basic considerations directing curricular planning and revision.

NUR 641 - TEACHING/LEARNING IN NURSING COURSE INFORMATION
Semester Hours: 3

Emphasis is on the development of classroom and clinical laboratory teaching skills and includes a critical appraisal of specific teaching strategies. The student is provided the opportunity to acquire knowledge in the use and design of common and innovative teaching methods including web-based and interactive delivery systems.

NUR 642 - TESTING AND EVALUATION IN NURSING
Semester Hours: 3

Major emphasis on the development of classroom and clinical skills in appraisal and evaluation methods of student performance. The student is provided with the opportunity to acquire skills in constructing various types of testing and evaluation (formative and summative) procedures as they relate to nursing education.

NUR 643 - FACULTY ROLE DEVELOPMENT IN NURSING
Semester Hours: 3

Role theory serves as the basis for the discussion and practice in developing teaching, service and research role of a faculty member in a nursing program. Discussion on legislative and professional agencies issues and policies impinging on the teaching role.

NUR 644 - PRACTICUM IN TEACHING
Semester Hours: 3

Opportunities to do practice teaching with nursing students in various phases of their basic educational programs. Learning activities will be planned on an individual basis and based on the specific teaching responsibilities of their primary course assignment. Selected baccalaureate degree and/or associate degree programs will be used as practice sites. Prerequisites with concurrency: NUR 640, NUR 641, NUR 642.

NUR 645 - CAPSTONE NURS EDUC CERTIF CRS
Semester Hours: 3

The major emphasis of this capstone education course is the development of the professional teaching role within an institutional setting. The focus is on the student's ability to function as a professional leader utilizing knowledge gained to promote change, engage in professional actives; promote continuous improvement; and serve as a mentor in an educational environment. Prerequisites: NUR 640, NUR 641, NUR 642, NUR 643, NUR 644.

NUR 646 - INSTRUCTIONAL TECHNOLOGY IN NURSING EDUCATION
Semester Hours: 3

The appropriate use of educational technology can afford faculty an opportunity to engage learners and bring concepts to life while supporting formative and summative assessment. This course will examine instructional technology, the design and integration of educational strategies, and methodological tools to engage learners to meet course and curriculum goals.

NUR 647 - STRATEGIC PLANNING
Semester Hours: 3

The focus of this course is to prepare Nursing Administration graduate students to comprehend and actively engage in organizational strategic planning. Emphasis is on the development of organizational blueprints, tracking current trends, forecasting, and innovative strategies in healthcare to achieve an organization's mission and vision, thus remaining competitive in the healthcare industry. Prerequisite with concurrency: NUR 630.

NUR 648 - CONCEPTS OF HEALTH ASSESSMENT AND PROMOTION FOR NURSE EXECUTIVES
Semester Hours: 3

This course focuses on concepts in health assessment and health promotion for individuals and populations. This course is designed for nurses preparing for leadership roles in health care organizations. Prerequisite with concurrency: NUR 630.

NUR 649 - QUALITY, SAFETY, AND RISK MANAGEMENT
Semester Hours: 3

This course focuses on the quality, safety, and risk management concepts for nurse leaders. Content includes the use of quality tools and use of data to evaluate and promote quality outcomes. Prerequisite with concurrency: NUR 630.

NUR 650 - INDEPENDENT STUDY
Semester Hours: 2-4

Planning, implementation, and evaluation of related phenomena of special interest observed in nursing practice.

NUR 652 - CLINICAL PRACTICUM
Semester Hours: 3

NUR 670 - HUMAN FACTORS IN HEALTHCARE COMPUTING
Semester Hours: 3

Overview of epidemiologic methods with discussion of application to diagnosis and choice of therapy. Concepts and mechanisms related to transmission, acquisition of disease, trends and distribution of patterns of disease discussed. The application of epidemiology to human health problems and rural settings is emphasized. Prerequisite: NUR 638.

NUR 671 - USABILITY EVAL HEALTHCARE I.T.
Semester Hours: 3

This course examines usability methods for the design and testing of healthcare information technology including health information websites, electronic health records, clinical decision support systems, and medical equipment with an emphasis on the user experience. The iterative nature of user-centered design and usability testing of health IT will be emphasized. Prerequisite: NUR 679.

NUR 698 - SPECIAL RESEARCH TOPICS
Semester Hours: 1-4

Application of activities appropriate to student program of study. Intended to expand student knowledge and enhance track specific content.

NUR 699 - PLAN I: THESIS
Semester Hours: 1-4

Independent research investigation related to practice of nursing under faculty guidance. Minimum of six hours required. Prerequisite: NUR 602.

NUR 700 - CLINICAL DATA MANAGEMENT AND ANALYSIS
Semester Hours: 3

This course provides students with the knowledge to understand, collect, manage, and measure clinical data. Students will explore data collection and management processes, level of measurement, basic statistics, and measurement for improvement in order to effectively use clinical data. Data entry exercises employed through analytical tools and statistical software packages will allow the students to practice and apply the basic data management and analysis skills needed for the evaluation of clinical data and evidence-based practice.

NUR 701 - WRITING FOR PUBLICATION
Semester Hours: 3

This course concerns the development of skills in writing, editing, and preparing manuscripts for publication from initial idea to submission of a publishable manuscript. The course emphasizes a writing process that encourages productivity and collegial peer review. Legal and ethical aspects of authorship prepare students for responsible practices expected of scholars. Students should have mastered basic writing skills, e.g. grammar, syntax, and computer skills, prior to enrolling in this course.

NUR 729 - EVIDENCE-BASED PRACTICE, DESIGN AND TRANSLATION
Semester Hours: 3

The purpose of this course is to provide students with models for evidence-based practice (EBP) design and improvement science. Students learn to formulate clinical questions in answerable format and search for and identify best research evidence. The focus of the course is to evaluate and critically appraise evidence for rigor and applicability to a clinical problem and the impact on the improvement of clinical outcomes. Students will translate evidence into practice environments for safe, quality care. Students will gain access to information that will support optimal clinical decision-making. All content and assignments are applied by the student to begin development of the DNP Project. Prerequisite: NUR 700.

NUR 731 - PHILOSOPHICAL, THEORETICAL AND CONCEPTUAL FOUNDATIONS FOR ADVANCED PRACTICE NURSING
Semester Hours: 3

This course assists students to use theory and conceptual models to guide the advanced nursing practice and scholarship at the doctoral level. The content is derived from the philosophical and scientific underpinnings of nursing, natural and psycho-social sciences. Prerequisite: NUR 701.

NUR 733 - INFORMATICS FOR ADVANCED NURSING PRACTICE
Semester Hours: 3

This course focuses on the collection, organization, and analysis of information in nursing and health care. Students are introduced to the specialty of nursing informatics, the information system life-cycle, telemedicine, and the use of technology to enhance nursing care delivery and patient safety. Students will also learn how to manipulate large and small patient databases for the analysis of patient outcomes. Prerequisite with concurrency: NUR 729.

NUR 734 - ADVANCED EXPERIENTIAL CLINICAL COURSE
Semester Hours: 1-7

This course is designed to validate Master's level competencies in clinical and organizational leadership. The course is required for post-master's DNP students who are graduates of Master of Science in Nursing programs with less than 500 clinical hours.

NUR 735 - POPULATION HEALTH IN ADVANCED PRACTICE NURSING
Semester Hours: 3

This course prepares students to implement population-based health promotion and disease prevention activities. The course applies an epidemiologic framework and focuses on a spectrum of issues affecting health which includes emerging infectious diseases, emergency preparedness, disparities in health and healthcare services, and the impact of exposomics on population health. Prerequisite with concurrency: NUR 729.

NUR 737 - INTERDISCIPLINARY LEADERSHIP AND ROLE DEVELOPMENT FOR PRACTICE EXCELLENCE
Semester Hours: 3

This course focuses on organizational and systems leadership and skills critical to role development in independent and interprofessional practice. Content includes communication, conflict resolution, collaboration and negotiation, leadership, and team functioning to enhance the experience and outcomes of patient care and to reduce the cost of care.

NUR 738 - DNP PROJECT DEVELOPMENT
Semester Hours: 3

This course is designed to assist the student in finalizing the DNP project plan and developing an application to the Institutional Review Board (IRB) for the protection of human subjects. The student will document previously acquired abilities and competencies in a professional portfolio. Students will participate in the seminar sessions to obtain guidance and receive peer suggestions about the portfolio and project plans. Prerequisites: NUR 734, NUR 742 and NUR 743.

NUR 739 - DNP PROJECT
Semester Hours: 7

The DNP project is planned, implemented, and evaluated by the DNP student in consultation with the DNP committee. The student writes a manuscript suitable for publication and makes a scholarly presentation of findings to peers and faculty. A minimum of seven credit hours for this course are distributed across several semesters as determined by the chair. Prerequisite with concurrency: NUR 738.

NUR 740 - HEALTH POLICY AND POLITICS:IMPLICATIONS IN HEALTH CARE
Semester Hours: 3

This course focuses on the unique challenges of engaging and influencing health care policy at local, state, national or international levels. It is designed to develop skills, techniques, and approaches to the critical analysis of health policy proposals, health policies, and to identify stakeholders in policy development. The health policy framework is analyzed from a governmental, institutional, and organizational perspective. Prerequisite: NUR 729.

NUR 742 - PROGRAM EVALUATION METHODS
Semester Hours: 3

The purpose of this course is to synthesize knowledge related to translation/implementation science models and strategies to improve health outcomes. The emphasis in the course is the use of program evaluation as a tool to achieve positive changes in health status, initiate and manage quality improvement, engage in risk anticipation, and facilitate organizational and system level changes. Prerequisite with concurrency: NUR 729.

NUR 743 - EVIDENCE-BASED PRACTICE STRATEGIES
Semester Hours: 3

This course expands on evidence-based design to refine a problem statement and a clinical question. Content includes conducting a systematic review of the literature to guide the selection of methods, strategies, tools and metrics needed to complete a successful DNP project. Students will develop and have approved a proposed DNP project plan. Prerequisite: NUR 742.

NUS 710 - INDEPENDENT STUDY
Semester Hours: 1-6

This course is for Joint PhD Nursing Science program students who are interested in an independent study option to identify additional literature synthesis, planning, implementation, and evaluation of related phenomena of special interest to advance nursing science.

NUS 713 - SPECIAL TOPICS
Semester Hours: 3

This course is for Joint PhD Nursing Science program students who are seeking opportunities to explore special topics that expand their knowledge and/or skills to conduct sponsored research projects. The focus of this three-credit hour didactic course will be developed in collaboration between the faculty and student(s).

NUS 741 - BSN-PHD RESEARCH SEMINAR I
Semester Hour: 1

The purpose of this course is to prepare BSN-PHD students with the foundational skills of deep reading, comprehensive literature review and critique, critical thinking, and writing skills necessary for successful advancement in a doctoral program. This course will further help students by providing more individualized support and structure to facilitate successful progression through the PhD program.

NUS 742 - BSN-PHD RESEARCH SEMINAR II
Semester Hour: 1

The purpose of this course is to aid BSN-PhD students in developing skills to assess scientific rigor, develop an argument, critique published research, professionally present (verbally and written) critique findings, develop a manuscript for publication, and will provide an opportunity to obtain hands on research experience. This course will further help students by providing more individualized support and structure to facilitate successful progression through the PhD program.

NUS 743 - BSN-PHD RESEARCH SEMINAR III
Semester Hour: 1

The purpose of this course is to prepare BSN-PhD students with the foundational skills of systematically appraising the literature to develop an appropriate and comprehensive significance section, analyzing health policy that directly relates to the students' research areas of interest, and evaluating research methodology and accompanying statistical analyses. These are important for successful advancement in a doctoral program. This course will further help students by providing more individualized support and structure to facilitate successful progression through the PhD program.

NUS 750 - PHILOSOPHY OF SCIENCE
Semester Hours: 3

The purpose of this course is to explore the evolution of philosophy and science. Epistemology, knowledge generation, knowledge acquisition, and ways of knowing will be examined. Scientific inquiry will include reasoning, logic, and persuasive argument development.

NUS 752 - INFORMATICS FOR HEALTH CARE TERMS AND SCHOLARLY INQUIRY
Semester Hours: 3

The purpose of this course is to prepare nurse scientists to use informatics, electronic tools, and healthcare technologies for the purposes of nursing research. The course will focus on the use of informatics in the data management of individuals, groups and organizations as the nurse scientist plans and executes a program of research.

NUS 754 - ETHICAL AND LEGAL ISSUES IN RESEARCH
Semester Hours: 3

The purpose of this course is to introduce the student to doctoral scholarship in support of beginning a program of responsible conduct of research. This course explores current ethical and legal issues in the science of nursing research. The course will delve into best practices in research design with regard to ethics, authorship, data management and record keeping, intellectual property and ownership of data, and human subjects research. In addition, the course will cover conflicts of interest, mentoring, collaborations, peer review, research misconduct, and current ethical issues in research.

NUS 756 - APPLICATION OF THEORETICAL MODELS
Semester Hours: 3

The purpose of this course is to provide students a foundation for contributing to theory development processes, analyzing and critiquing theoretical foundations of research, and applying theoretical models to nursing research. This course addresses the relationship between theory and research and provides an understanding of the use of theoretical models and conceptual foundations to guide nursing research and practice. Prerequisites: NUS 750.

NUS 758 - QUANTITATIVE RESEARCH METHODS
Semester Hours: 3

This course provides students with foundational knowledge and skills in the development of experimental and nonexperimental quantitative designs. Topics will include training in the choice of research questions/aims/hypotheses and a responsive approach; the development of an ethical, strategic design; the implementation of a strategic sampling plan; the choice of suitable measurements (reliable and valid) and analytic plans; issues in research such as treatment fidelity; and the drafting of research proposals. Additional content will briefly introduce more advanced concepts such as mixed methods research or community-based participatory research. Special emphasis will be placed on clinical nursing designs, such as repeated-measures intervention studies. Prerequisites: NUS 750.

NUS 760 - STATISTICS I
Semester Hours: 3

The purpose of this course is to provide the student with the skills to conduct and interpret statistical data. Emphasis will be placed on describing types of variables, testing hypotheses, selecting appropriate parametric and nonparametric statistical tests, analyzing data, and interpreting results. Prerequisite: NUS 758.

NUS 762 - HEALTH CARE POLICY FOR RURAL AND MEDICALLY UNDERSERVED POPULATIONS
Semester Hours: 3

The purpose of this course is to explore the policy environment that influences and shapes public health and health care service delivery, including rural and medically underserved communities. Students will develop skills, techniques, and approaches to identify gaps, critically analyze and research health related issues. Utilization and delivery of data to promote and impact healthcare policy changes will be an important measure of outcome. Students will develop the ability and confidence to critically assess current health policy issues in a thoughtful, comprehensive and rigorous manner and to engage in the policy process.

NUS 764 - SCIENTIFIC WRITING
Semester Hours: 3

The purpose of this course is to develop writing skills to produce scientific writing that is clear, concise, and logical. This course will also explore the publication to include abstract and manuscript development and the submission process. Additional pathways to dissemination of nursing content will be explored as well.

NUS 766 - EPIDEMIOLOGY IN RURAL AND MEDICALLY UNDERSERVED POPULATIONS
Semester Hours: 3

The purpose of this course is to introduce epidemiological methods for measuring population health, designing and implementing observational and experimental studies, critically reading the public health literature, and applying research findings to global and community health. Prerequisite: NUS 760.

NUS 768 - STATISTICS II
Semester Hours: 3

This course provides advanced coursework in applied statistical approaches to data management and analysis. With an emphasis on multivariate statistical approaches, the purpose of the course is to help nursing students to develop improved skills in conceptualizing, executing, analyzing, and interpreting advanced analytic strategies and to enhance their ability to propose strong, tailored analytic approaches for specific study designs and research aims. Students will also gain proficiency in using R software, a freely available and power statistical package. They will enhance their knowledge of regression, OEANOCOVE, MANOVA/MANCOVA, discriminant analysis, exploratory and confirmatory factor analysis, structural equation modeling, multilevel modeling, and advanced categorical approaches. Understanding the mathematics, logic, application of these techniques is emphasized. Prerequisite: NUS 760.

NUS 770 - GRANT WRITING
Semester Hours: 3

The purpose of this course is to prepare students in the foundations of writing grants for federal external funding. This course will help students identify a step-wise process to develop a grant proposal through federal funding sources. Strategies for successful grant writing include identifying funding sources for the topic, writing a competitive grant application, developing a collaborative team of researchers for the project, and understanding the review process. Prerequisite: NUS 764.

NUS 772 - QUALITATIVE RESEARCH METHODS
Semester Hours: 3

The purpose of this course is to assist the student in using selected qualitative research methods. Learning modules will explore qualitative approaches, sampling, data collection, data analysis and dissemination. The course will review and explore the use of technology to assist the qualitative researcher. Prerequisites: NUS 750, NUS 756, and NUS 758.

NUS 776 - ADVANCED RESEARCH METHODS
Semester Hours: 3

The purpose of this course is to assist students in developing the knowledge and skills to design a mixed methods research (MMR) study. MMR is an advanced method for collecting, analyzing, and "mixing" both quantitative and qualitative data within a single study to understand a research problem more completely. Prerequisites: NUS 752, NUS 758, NUS 760, NUS 768, and NUS 772.

NUS 780 - INTRODUCTION TO OMICS
Semester Hours: 3

The purpose of this course is to introduce the revolution of omics and discuss the role nurse scientists can play in precision health development. Nurse scientists are in a position to provide a unique contribution to person-centered health approaches by broadening their understanding of molecular advances to improve health outcomes. A variety of different omics will be explored and the practical advantages, limitations, and challenges in individualized health promotion will be discusses.

NUS 781 - OMICS IN NURSING RESEARCH
Semester Hours: 3

The purpose of this course is to provide an overview of advanced concepts of omics research by utilizing a biobehavioral systems approach in nursing science. The National Institute of Nursing Research's strategic plan for Genomic Nursing Science is used as the framework for integrating omics and nursing research. Practical application in omics theories, methodologies, technology, bioinformatics, and responsible conduct of research is discussed. Additionally, resources in building capacity for the next generation of omics scientists are review. Prerequisite: NUS 780.

NUS 782 - CURRICULUM DEVELOPMENT AND PROGRAM EVALUATION FOR NURSE EDUCATORS
Semester Hours: 3

The purpose of this course is to examine the procedures for designing, implementing, and evaluating nursing education curriculum. The process will be examined beginning with the program mission. Educational theories, philosophy, concepts, and program evaluation will be explored. The nurse educator's role in curriculum design and program evaluation is assessed.

NUS 783 - INSTRUCTIONAL METHODS AND ASSESSMENT IN NURSING EDUCATION
Semester Hours: 3

The purpose of this course is to discover teaching styles and implement instructional technologies to promote learning in diverse populations of students. Throughout the semester, students will explore didactic and clinical learning activities and evaluation strategies to demonstrate transfer of learning. Prerequisite: NUS 782.

NUS 784 - DATA SCIENCE AND EMERGING TECHNOLOGIES
Semester Hours: 3

The purpose of this course is to apply concepts associated with data analytic methods and the use of burgeoning technologies in healthcare. The course prepares the nurse scientist to engage with other researchers in the areas of data analytics, simulation, telehealth, and robotics. The appropriate integration of health care technologies to support nursing research will be emphasized.

NUS 785 - RESEARCH AND DEVELOPMENT (R&D) OF INNOVATIVE HEALTH CARE TECHNOLOGY
Semester Hours: 3

The purpose of this course is to develop the scientific skills to move an innovation from concept to implementation following a research and development (R&D) process. The course prepares the nurse scientist to engage with researchers inside and outside Prerequisite: NUS 784 or permission of professor.

NUS 798 - COMPETENCY ASSESSMENT
Semester Hours: 0

All students enrolled in the Joint Nursing Science PhD program are required to register for this course at the beginning of the semester during which they take the comprehensive examination. A grade will be determined entirely by an assessment of the student's performance on the comprehensive examination, and the grade will be either satisfactory/unsatisfactory. The course may be repeated once and must be passed if the student is to progress to dissertation. Prerequisite: NUS 776.

NUS 799 - DOCTORAL DISSERTATION
Semester Hours: 9

This independent research course partially fulfills required doctoral level research dissertation hours toward the PhD in the student's field. A minimum of 24 dissertation hours are required, at 1-12 hours per semester. The course is conducted under the guidance of the PhD chair. After completing requirements for admission to candidacy, the student registers for a minimum of 3 hours per semester in this course, each semester, until all dissertation requirements have been approved. Material covered will be of an advanced nature aimed at providing doctoral students with an understanding of the latest research and current developments within the field. Discussion and advisor guidance will be focused on readings of research articles and development of research methodology with the aim of producing an original research contribution that represents a novel development in the field, or a novel perspective on a pre-existing topic in the field. Prerequisite: NUS 776.

Joint Nursing Science, PhD

The purpose of the Joint Nursing Science Ph.D. program is to prepare nurse scholars who will advance nursing science by generating new knowledge. It is a joint program between The University of Alabama in Huntsville (UAH) and The University of Alabama (UA).

In addition to the graduate degree requirements of the Joint UA UAH Nursing Science Ph.D. program, a student is required to complete a minimum of 63 semester hours of graduate coursework.

A minimum grade of B must be obtained in each course in the student's program of study. Students must also attend two (2) Joint Ph.D. Intensives during their course of study.

Please note that curricular changes may be made in the coming year. Please contact the College of Nursing Office of Graduate Programs for the most current information.

Program Requirements

Code	Title	Semester Hours
Core Requirments		
NUS 741	BSN-PHD RESEARCH SEMINAR I (For BSN to Ph.D. program only)	1
NUS 743	BSN-PHD RESEARCH SEMINAR III (For BSN to Ph.D. program only)	1
NUS 742	BSN-PHD RESEARCH SEMINAR II (For BSN to Ph.D. program only)	1
NUS 750	PHILOSOPHY OF SCIENCE	3
NUS 752	INFORMATICS FOR HEALTH CARE TERMS AND SCHOLARLY INQUIRY	3
NUS 754	ETHICAL AND LEGAL ISSUES IN RESEARCH	3
NUS 756	APPLICATION OF THEORETICAL MODELS	3
NUS 758	QUANTITATIVE RESEARCH METHODS	3
NUS 760	STATISTICS I	3
NUS 762	HEALTH CARE POLICY FOR RURAL AND MEDICALLY UNDERSERVED POPULATIONS	3
NUS 764	SCIENTIFIC WRITING	3
NUS 766	EPIDEMIOLOGY IN RURAL AND MEDICALLY UNDERSERVED POPULATIONS	3
NUS 772	QUALITATIVE RESEARCH METHODS	3
NUS 768	STATISTICS II	3
NUS 770	GRANT WRITING	3
NUS 776	ADVANCED RESEARCH METHODS	3
NUS 798	COMPETENCY ASSESSMENT	0
NUS 799	DOCTORAL DISSERTATION (DISSERTATION)	18
Cognates - select 6 hours		
NUS 780	INTRODUCTION TO OMICS	3
NUS 781	OMICS IN NURSING RESEARCH	3
NUS 782	CURRICULUM DEVELOPMENT AND PROGRAM EVALUATION FOR NURSE EDUCATORS	3

NUS 783	INSTRUCTIONAL METHODS AND ASSESSMENT IN NURSING EDUCATION	3
NUS 784	DATA SCIENCE AND EMERGING TECHNOLOGIES	3
NUS 785	RESEARCH AND DEVELOPMENT (R&D) OF INNOVATIVE HEALTH CARE TECHNOLOGY	3

Nursing - MSN to DNP

In addition to the graduate degree requirements of the Graduate School, a student is required to complete a minimum of 40 semester hours of coursework in the Doctor of Nursing Practice (DNP) program. The DNP degree is distinguished by the completion of a DNP Project that demonstrates synthesis of the student’s coursework and lays the groundwork for future scholarship. Because the DNP is focused on mastery of advanced practice in a specialty area, the DNP Project should demonstrate the achievement of that mastery. The practice doctorate focuses heavily on practice that is innovative and evidence-based, reflecting the application of credible research findings, through an integrative practice experience. The DNP Project is evidence that the student can independently identify a problem of contemporary significance through familiarity with the current literature in the major field, organize, design, implement, and evaluate a project that addresses the problem and present the project in cogent, well-written exposition. The DNP Project documents the outcomes of the student’s doctoral education experience, providing a measurable medium for evaluating the mastery of and growth in knowledge and clinical expertise.

The project will be completed under the direction of a chair and supervising committee. The project has several approval points including a proposal review, Institutional Review Board (IRB) review, and final evaluation. The final evaluation of the DNP Project must be scheduled through the College of Nursing at least two weeks in advance of the proposed evaluation date taking into account the expected date of graduation and the deadlines set by the Graduate School. Results of the DNP Project are expected to be manuscript-ready in preparation for submission as a refereed scholarly publication.

DNP Courses

Code	Title	Semester Hours
NUR 700	CLINICAL DATA MANAGEMENT AND ANALYSIS	3
NUR 701	WRITING FOR PUBLICATION	3
NUR 729	EVIDENCE-BASED PRACTICE, DESIGN AND TRANSLATION	3
NUR 731	PHILOSOPHICAL, THEORETICAL AND CONCEPTUAL FOUNDATIONS FOR ADVANCED PRACTICE NURSING	3
NUR 733	INFORMATICS FOR ADVANCED NURSING PRACTICE	3
NUR 734	ADVANCED EXPERIENTIAL CLINICAL COURSE (if needed)	1-7
NUR 735	POPULATION HEALTH IN ADVANCED PRACTICE NURSING	3
NUR 737	INTERDISCIPLINARY LEADERSHIP AND ROLE DEVELOPMENT FOR PRACTICE EXCELLENCE	3
NUR 738	DNP PROJECT DEVELOPMENT	3
NUR 739	DNP PROJECT	7
NUR 740	HEALTH POLICY AND POLITICS:IMPLICATIONS IN HEALTH CARE	3
NUR 742	PROGRAM EVALUATION METHODS	3
NUR 743	EVIDENCE-BASED PRACTICE STRATEGIES	3
Total Semester Hours		**40-47**

Nursing - BSN to DNP

In addition to the Post-Master’s of Science in Nursing (MSN) to DNP program, the College of Nursing offers the Post-Bachelor of Science in Nursing (BSN) to DNP pathway. The post-baccalaureate to DNP pathway is for nurses with a BSN degree entering directly into the DNP Program without first earning an MSN degree.

The added content in the post-baccalaureate to DNP pathway will allow a seamless progression from the completion of a baccalaureate degree to advanced practice. Advanced practice specialty training at the doctoral level is needed to address the growing complexity of patient care and health care systems. In addition, expanding accountability of clinical expert nurses in advanced practice roles requires competencies in population-based care, leadership, health policy, health system improvement, research and evidence-based practice. The MSN degree is awarded once the student has completed that portion of the curriculum.

Note:

Programs of Study will be individualized based on semester started and full-time or part-time status.

The post-baccalaureate to DNP Nursing Administration track is totally online (one required visit after completion of the MSN portion).

The post-baccalaureate to DNP (FNP and AGACNP) tracks are hybrid programs during the MSN portion with students attending class on campus for one day every other week each semester.

Nursing, MSN - Adult Gerontology Acute Care Nursing Practitioner Track

Adult-Gerontology Acute Care Nurse Practitioner

Adult-Gerontology Acute Care Nurse Practitioners (AGACNP) focus on the care of all adults with acute illnesses and may practice in the hospital, hospital-based clinics, long-term care settings, and private practice. They provide expert interventions focused on patients who are physiologically unstable, technologically dependent, highly vulnerable for complications, requiring frequent monitoring and intervention. AGACNP obtain medical histories, perform physical examinations, order screening and diagnostic tests, and provide pharmacological and non-pharmacological treatment. Graduates of the AGACNP program are eligible to sit for national certification. Students choose either Plan I Thesis option or Plan II Elective option.

Code	Title	Semester Hours
Core Requirements		
NUR 602	SCHOLARLY INQUIRY FOR ADVANCED NURSING PRACTICE	3
NUR 500	SPECIAL TOPICS (PLAN II: One NUR Elective 500 or Higher)	3
Track		
NUR 604	ROLE DEVELOPMENT FOR THE ADVANCED PRACTICE NURSE	3
NUR 605	ADVANCED HEALTH ASSESSMENT	3
NUR 606	ADVANCED PATHOPHYSIOLOGY	3
NUR 607	PHARMACOLOGY IN ADVANCED PRACTICE	3
NUR 620	ADULT GERONTOLOGY ACTUE CARE NURSE PRACTITIONER I	6
NUR 621	ADULT GERONTOLOGY ACTUE CARE NURSE PRACTITIONER II	6
NUR 622	ADULT GERONTOLOGY ACUTE CARE NURSE PRACTITIONER III	6
NUR 623	ADULT GERONTOLOGY ACUTE CARE NURSE PRACTITIONER IV	6
Total Semester Hours		**42**

Nursing, MSN - Family Nurse Practitioner Track

Family Nurse Practitioner

Family nurse practitioners (FNPs) are advanced practice nurses who are competent clinicians focused on managing health conditions and preventing disease for patients across the lifespan. FNPs review medical histories, perform comprehensive and focused physical exams, order diagnostic tests, diagnose and develop individualized treatment plans. FNPs practice in a variety of settings, such as private practice, community health, health care systems, and universities. FNPs can practice independently or in collaboration with a physician, depending on their state’s practice laws.

Code	Title	Semester Hours
Core Requirements		
NUR 602	SCHOLARLY INQUIRY FOR ADVANCED NURSING PRACTICE	3
NUR 500	SPECIAL TOPICS ((One NUR Elective 500 or Higher))	3
Track		
NUR 604	ROLE DEVELOPMENT FOR THE ADVANCED PRACTICE NURSE	3
NUR 605	ADVANCED HEALTH ASSESSMENT	3
NUR 606	ADVANCED PATHOPHYSIOLOGY	3
NUR 607	PHARMACOLOGY IN ADVANCED PRACTICE	3
NUR 610	FAMILY NURSE PRACTITIONER I	6
NUR 611	FAMILY NURSE PRACTITIONER II	6
NUR 612	FAMILY NURSE PRACTITIONER III	6
NUR 613	FAMILY NURSE PRACTITIONER IV	6
Total Semester Hours		**42**

Nursing, MSN - Nursing Administration Track

Nursing Administration

This track prepares nurses who will influence the future of health care through visionary nursing leadership. Competencies include communication, financial skills, information technology, leading and managing change, policy analysis, and empowerment for professional practice. Graduates are prepared to assume positions in education, administration, management, or specialty area roles in a variety of care delivery sites.

Code	Title	Semester Hours
Core Requirements		
NUR 602	SCHOLARLY INQUIRY FOR ADVANCED NURSING PRACTICE	3
NUR 629	US HEALTH CARE SYSTEM	2
Track		
NUR 630	THEORETICAL FOUNDATIONS FOR NURSE ADMINISTRATORS	3
NUR 631	LEADERSHIP IN RESOURCE MANAGEMENT	3
NUR 632	ECONOMIC AND POLICY IMPLICATIONS FOR LEADERS IN HEALTH CARE SYSTEMS	4
NUR 634	INTERNSHIP IN NURSING LEADERSHIP	3
NUR 638	INFORMATICS FOR NURSE ADMINISTRATORS	3
NUR 647	STRATEGIC PLANNING	3
NUR 648	CONCEPTS OF HEALTH ASSESSMENT AND PROMOTION FOR NURSE EXECUTIVES	3
NUR 649	QUALITY, SAFETY, AND RISK MANAGEMENT	3
Total Semester Hours		**30**

Nursing, MSN - Nursing Education Track

Nursing Education

Code	Title	Semester Hours
Core Requirements		
NUR 602	SCHOLARLY INQUIRY FOR ADVANCED NURSING PRACTICE	3
NUR 605	ADVANCED HEALTH ASSESSMENT	3
NUR 606	ADVANCED PATHOPHYSIOLOGY	3
NUR 607	PHARMACOLOGY IN ADVANCED PRACTICE	3
Track		
NUR 640	CURRICULUM DEVELOPMENT IN NURSING	3
NUR 641	TEACHING/LEARNING IN NURSING COURSE INFORMATION	3
NUR 642	TESTING AND EVALUATION IN NURSING	3
NUR 643	FACULTY ROLE DEVELOPMENT IN NURSING	3
NUR 644	PRACTICUM IN TEACHING	3
NUR 646	INSTRUCTIONAL TECHNOLOGY IN NURSING EDUCATION	3
NUR 652	CLINICAL PRACTICUM	3
Total Semester Hours		**33**

Nursing Education, Graduate Certificate

The College of Nursing provides a post-graduate certificate in nursing education to prepare nurses to teach in post-secondary education and health care settings. Courses are open to current graduate students enrolled in any of the masters or doctoral tracks offered by the College of Nursing as well as to nurses already holding a master's degree in nursing. Students not already enrolled must be formally admitted to the program and meet the same admission standards as other graduate students.

The purpose of the 18-credit hour program is to:

- Prepare nurses with a master's degree or higher to teach in a variety of settings, *i.e.,* associate degree nursing programs, clinical faculty in baccalaureate programs, and health care agency educational programs.

- Prepare nurses with the theory and practice experiences to develop and implement educational offerings in a variety of settings for diverse populations.
- Prepare nurses with a variety of teaching strategies and delivery systems for today's new learning environment.
- Prepare nurses with the necessary tools and strategies to effectively evaluate nursing performance in both clinical and classroom settings.
- Prepare nurses with the skills necessary for role development as faculty members.

The program of study is as follows:

Code	Title	Semester Hours
NUR 640	CURRICULUM DEVELOPMENT IN NURSING	3
NUR 641	TEACHING/LEARNING IN NURSING COURSE INFORMATION	3
NUR 642	TESTING AND EVALUATION IN NURSING	3
NUR 643	FACULTY ROLE DEVELOPMENT IN NURSING	3
NUR 644	PRACTICUM IN TEACHING	3
NUR 646	INSTRUCTIONAL TECHNOLOGY IN NURSING EDUCATION	3
Total Semester Hours		**18**

Post-Master's Family Nurse Practitioner Certificate

The Post-Master's Family Nurse Practitioner (FNP) certificate option is designed for individuals who have already earned a master's degree in Nursing, but who desire additional preparation for a FNP Certification. Students must be formally admitted to the program to enroll and must meet identical academic standards as students enrolled in the master's program. In order to facilitate this certificate of study, a variety of teaching and communications methods are used. Graduates from this program are eligible to sit for the FNP national certification examination.

Students admitted to the Post-Master's FNP certificate must have already completed Advanced Health Assessment, Advanced Pharmacology, and Advanced Pathophysiology at UAH or another institution within the last two years or take the courses at UAH while enrolled in courses leading to an FNP certificate.

Program prerequisites or co-requisites:

Code	Title	Semester Hours
NUR 605	ADVANCED HEALTH ASSESSMENT	3
or transfer equivalent taken within last 2 years		
NUR 606	ADVANCED PATHOPHYSIOLOGY	3
or transfer equivalent taken within last 2 years		
NUR 607	PHARMACOLOGY IN ADVANCED PRACTICE	3
or transfer equivalent taken within last 2 years		

The program of study is as follows:

Code	Title	Semester Hours
NUR 610	FAMILY NURSE PRACTITIONER I (Post Master's)	6
NUR 611	FAMILY NURSE PRACTITIONER II (Post Master's)	6
NUR 612	FAMILY NURSE PRACTITIONER III (Post Master's)	6
NUR 613	FAMILY NURSE PRACTITIONER IV (Post Master's)	6
Total Semester Hours		**24**

College of Science

Materials Science Building
Second Floor, C 203 - C 207

Mission

The College of Science provides quality education with leading-edge research opportunities through interdisciplinary programs administered by seven departments and vibrant collaborations across campus and community. Faculty bring their innovative research into the classroom, equipping students with advanced knowledge, skills, and abilities, and preparing leaders for this generation and beyond.

Departments

Degrees and Programs

The College of Science offers the following graduate degree programs:

Applied Mathematics	Ph.D.
Atmospheric Science	M.S., Ph.D.
Biology	M.S.
Chemistry	M.S.
Computer Science	M.S., M.S.S.E., Ph.D.
Earth System Science	M.S.
Mathematics	M.S.
Physics	M.S., Ph.D.
Space Science	M.S., Ph.D.
Software Engineering	M.S.

The College of Science offers the following interdisciplinary graduate degree programs:

Biotechnology Science and Engineering	Ph.D.
Cybersecurity	M.S.
Materials Science	M.S., Ph.D.
Optical Science and Engineering	Ph.D.

* These programs are described in the Interdisciplinary Programs (p. 140).

Master's Degrees in Science

Doctoral Degrees in Science

Atmospheric and Earth Science

National Space Science and Technology Center
Cramer Research Hall, Room 4044
Telephone: 256.961.7877
Email: aes@uah.edu

Chair: Dr. John Mecikalski (https://www.uah.edu/science/departments/atmospheric-science/faculty-staff/john-mecikalski/)

The Atmospheric and Earth Science department offers the following graduate degree programs:

Master of Science - Atmospheric Science (p. 186)
Master of Science - Earth Systems Science (p. 188)
Doctor of Philosophy - Atmospheric Science (p. 184)

The Atmospheric and Earth Science department offers the following graduate degree certificate:

Graduate Certificate in Geographic Information Systems & Remote Sensing (p. 190)

Admission Requirements

Refer to the Graduate Program Admission Requirements webpage (https://www.uah.edu/science/departments/atmospheric-earth-science/aes-graduate-programs/admission-requirements/) for general admission and degree requirements. The applicant should have training through a calculus sequence (including the calculus of vector-valued functions), a course in linear algebra, and courses in ordinary and partial differential equations. He or she should also have completed at least two semesters of chemistry, two semesters of calculus-based physics and have demonstrable computer proficiency in at least one high-level programming language.

Program Objective

The Atmospheric Science Department's first objective is to produce graduates who are successful in writing scientific research papers in peer-reviewed scientific journals and in making presentations at national or international scientific conferences and workshops. Our second objective is to produce graduates who successfully obtain employment as research scientists in a research center, government lab, or corporation, or in academic positions at a university.

Learning Outcomes

Students will demonstrate:

- Knowledge of the reviewed literature in atmospheric science that is relevant to their specific research
- Proficiency in scientific methodology while successfully carrying out a research project from concept to completion
- Effective oral communication skills in reporting the results of their scientific research

Graduate Certificate

- Graduate Certificate in Geographic Information Systems & Remote Sensing (p. 190)

Master's Programs in Atmospheric Science

- Atmospheric Science, MS (p. 186)
- Earth System Science, MS (p. 188)

Doctoral Program in Atmospheric Science

- Atmospheric Science, PhD (p. 184)

AES 501 - SURVEY ATMOSPHERIC SCIENCE
Semester Hours: 3

General survey of the field of atmospheric science includes thermodynamics, atmospheric dynamics, cloud physics, and atmospheric radiation. Quantitative examination of atmospheric properties including atmospheric composition, structure and dynamics.

AES 502 - SCIENTIFIC & SOCIETAL ASPECTS OF NATURAL DISASTERS
Semester Hours: 3

Examination of the physical causes of major natural geophysical hazards and their impact on the natural and built environment, society and the economy. Evaluation of the ability to forecast events, and develop sound mitigation and recovery measures. Specific case studies are considered.

AES 507 - ENVIRONMENTAL THREATS, PUBLIC POLICY, & DECISION MAKING
Semester Hours: 3

Researchers, policymakers and environmental campaigners have identified 25 potential future threats to the global environment. This course examines the nature and consequences of these threats and their potential impacts for the survival of the human race.

AES 508 - PYTHON FOR ID ESS APPLICATIONS
Semester Hours: 3

Introduction to GIS model building, Python programming, and automation of scripts for ArcGIS. Techniques in Model Builder, Python, and the methods for automation will be taught using data from numerous available data sources across the internet with heavy emphasis on the Earth Sciences.

AES 509 - SCIENTIFIC PROGRAMMING FOR EARTH & ATMOSPHERIC SCIENTISTS
Semester Hours: 3

Survey of data types and languages commonly used in the meteorological community along with practical application to meteorology. Course is designed to prepare students for graduate work and research in atmospheric science.

AES 510 - OPERATIONAL WEATHER FORECASTING
Semester Hours: 3

Operational Meteorology covers subjective and objective methods of atmospheric prognosis, including techniques for forecasting operationally-important weather elements. Course explores interpretation, use and systematic errors of computer-generated products, human factors within forecasting, and application of meteorological theory in an operational setting. Course instruction is accomplished through analysis of various weather events from beginning to completion.

AES 514 - GEOSPATIAL APPLICATIONS
Semester Hours: 3

An introductory look at the ways in which GIS can be put to use in different fields of study, drawing examples from Demography, Sociology, Archaeology, History and Ecology. Focus on cartography and map creation principles and public geospatial data acquisition.

AES 515 - ADVANCED TOPICS IN GIS
Semester Hours: 3

Advanced special topics: visualization of GIS and remote sensing data, landscape characterization (pattern vs. process), multitemporal analysis, aggregation of data types, developing an integrated GIS environment for performing complex space-time modeling analyses, and land-atmosphere ineractions. Same as AES 415.

AES 520 - INTRODUCTION TO ATMOSPHERIC CHEMISTRY & AIR POLLUTION
Semester Hours: 3

An introduction designed to provide students with the basics of atmospheric chemistry and air pollution concepts. Topics include air pollutants, air-pollution meteorology, atmospheric gases and aerosols, and atmospheric processes.

AES 541 - ATMOSPHERIC THERMODYNAMICS & CLOUD PHYSICS
Semester Hours: 3

Thermodynamic & cloud physical processes in the atmosphere. Atmospheric statics & stability. Role of aerosols in nucleation of cloud and ice particles. Physical processes that produce the growth of hydrometeors in cold and warm clouds. Applicable measurement techniques.

AES 551 - ATMOSPHERIC FLUID DYNAMICS I
Semester Hours: 3

Fluid dynamics in the atmosphere. Coriolis acceleration, scale analysis, and appropriate approximations of the complete governing equations. Numerical analysis and interpretation of weather phenomena.

AES 554 - FORECASTING MESOSCALE PROCESSES
Semester Hours: 3

Detection and forecasting of atmospheric mesoscale phenomena including the structure and evolution of clouds, precipitation (including floods), thunderstorms, and severe weather. Includes basics of instruments used to detect mesoscale phenomena, most notably satellite and radar. Prerequisites: AES 551.

AES 561 - ATMOSPHERIC RADIATION I
Semester Hours: 3

Fundamentals of terrestrial atmospheric radiation. Topics include: basic concepts, radiative transfer equation, gaseous absorption, scattering by molecules and particles, band models, and transmittance along an inhomogeneous path.

AES 571 - INTRODUCTION TO RADAR METEOROLOGY
Semester Hours: 3

Introduction to principles of radar meteorology, including radar operations, hardware, interpretation, and analysis. Topics covered include doppler, dual-polarization and dual-wavelength radar theory, methods, and applications. Prerequisite: AES 541.

AES 572 - SATELLITE METEOROLOGY
Semester Hours: 3

The goal for this course is to provide students in undergraduate and graduate level Earth and Atmospheric Science a background in satellite meteorology. During all components of the course there will be a heavy emphasis on practical meteorological satellite interpretation with respect to land surface and especially atmospheric features. Prerequisites: AES 508 or AES 509.

AES 590 - SPECIAL TOPICS IN AES
Semester Hours: 1-3

Selected topics of interest not included under other courses.

AES 603 - CLIMATE DYNAMICS
Semester Hours: 3

Origin and evolution of the climate system including underlying causes for past climates such as occurred during the ice ages. Statistical processing of various time series to extract climactic signals in the data. Determination of global-scale forcing mechanisms, which impact climate. Prerequisites: AES 541 and AES 551.

AES 606 - DATA ANALYSIS ATMOSPHERIC SCIENTISTS
Semester Hours: 3

A theoretical and practical introduction to various data analysis methods commonly used in atmospheric science. Topics include forecasting techniques to generate models to fit data, model assessment using parametric tests, probability theory, and Monte Carlo methods to solve a variety of problems. Prerequisite: AES 509.

AES 610 - LAND USE APPLICATIONS & SUSTAINABILITY
Semester Hours: 3

Study of land use and sustainability issues using satellite image processing and GIS. International examples of urbanization, agriculture, transportation, water management, and natural resources exploitation. Discussions of current literature and quantitative analyses of satellite and situ data. Prerequisite: AES 515 or consent of instructor.

AES 612 - ADVANCED GIS FOR EARTH AND ATMOSPHERE PROBLEMS
Semester Hours: 3

Advanced GIS and remote sensing/image processing. Discussion, guided readings, and group labs to interact with student peers and instructor to develop geospatial solutions to problems relevant to their thesis research including appropriate research design, data collection, and analysis. Prerequisites: AES 515 and AES 610.

AES 620 - ATMOSPHERIC CHEMISTRY & AEROSOLS
Semester Hours: 3

Primary processes, thermodynamics, photochemistry, kinetics, models, and measurements applied to troposphere and stratosphere; natural and anthropogenic; chlorine, nitrogen, hydrogen, and oxygen catalytic cycles; ground- and satellite-based observations of trace species. Prerequisite: AES 520.

AES 622 - AIR POLLUTION MODELING
Semester Hours: 3

Air pollution Lagrangian and Eulerian modeling concepts and methods from micro to synoptic scales; plume, large eddy simulations and urban-regional models in research and regulatory applications; transport, dispersion, chemistry, clouds, aerosols, and wet/dry deposition. Prerequisites: AES 520 and AES 551.

AES 624 - AEROSOIS AND CLOUDS
Semester Hours: 3

Principles of atmospheric aerosois and clouds, including chemistry, physics, dynamics and their roles on climate and air quality. Prerequisites: AES520.

AES 625 - AIR POLLUTION APPLICATIONS & DECISION MAKING
Semester Hours: 3

Course will review principles of air pollution, measurement methods, regulation, national and international standards and how research is used to make decisions regarding air quality. The course will use ground-based, satellite, and numerical modeling information through a case study approach. Prerequisite: AES 501.

AES 630 - PHYSICAL CLIMATOLOGY
Semester Hours: 3

This course examines the physical aspects of the global climate system, including the global energy balance, surface energy balance, hydrologic cycle, climate classification, and ocean circulation, natural and anthropogenic climate change and other selected topics such as climate sensitivity. Prerequisite: AES 501 or AES 541.

AES 632 - ENERGY, CLIMATE, ENVIRONMENT
Semester Hours: 3

This course focuses on energy and its impact on the environment including climate change and air pollution. Specific energy forms, such as fossil fuels, nuclear energy, and solar energy, are discussed.

AES 635 - GENERAL CIRCULATION
Semester Hours: 3

Detailed examination of the observed dynamic, thermodynamic and chemical structure of the atmosphere, including mid-latitude baroclinic systems, tropical systems, global-scale energy, mass and momentum budgets, and the fundamental climatology of the atmosphere. Prerequisites: AES 541 and AES 551.

AES 642 - PRECIPITATION PHYSICS FOR RADAR
Semester Hours: 3

Cloud microphysics theory, models, in-situ and radar observations of hydrometers will be utilized together to explore advanced concepts in precipitation physics and their connection to radar meteorology, including coalescence, break-up, freezing, size sorting, aggregation, rimming, and melting. Prerequisites: AES 541 and AES 571.

AES 651 - ATMOSPHERIC FLUID DYNAMICS II
Semester Hours: 3

Wave motions in the atmosphere with emphasis of Rossby, Kelvin and gravity waves. Systematic scaling of primitive equations to develop quasi-geostrophic and Elkman-layer theory. Shallow water theory, stratified flows, and barotropic and baroclinic instability. Prerequisite: AES 551.

AES 652 - ADVANCED SYNOPTIC METEOROLOGY
Semester Hours: 3

Analysis, interpretation, and forecasting synoptic-scale, and mesoscale phenomena, including air masses, frontal systems, cyclones, anticyclones, and waves toward understanding process dynamics. Emphasize the use of observational, satellite and numerical model data, including radars and profilers. Prerequisites: AES 541 and AES 551.

AES 655 - BOUNDARY LAYER METEOROLOGY
Semester Hours: 3

Survey of atmospheric boundary layer (ABL) properties. Review of turbulence, convective and stable boundary layers, surface forcing, boundary layer discontinuities, and singular phenomena within the ABL. Atmospheric field measurements are used to enhance understanding of ABL process. Prerequisites: AES 541 and AES 551.

AES 656 - TROPICAL METEOROLOGY
Semester Hours: 3

Overview concepts of the dynamics and climatology of the tropics and of significant tropical precipitation systems. Topics also include Kelvin waves, equatorial flows, convective scale dynamics, island meteorology, tropical cyclones, ENSO, radiative-convective equilibrium, and gregarious cloud systems. Prerequisites: AES 541 and AES 551.

AES 657 - NOWCASTING THEORY METHODS
Semester Hours: 3

Theory, methods and applications of 0-6 hour weather and ecological prediction, which is a forecast time period when numerical prediction models have low skill. Topics include predictability, data assimilation, statistical methods, and algorithms using Earth and atmospheric science observations.

AES 670 - SATELLITE REMOTE SENSING I
Semester Hours: 3

Using a hands on approach, this course covers a broad range of topics concerning digital image processing applied to the remote sensing of atmospheric, cloud and surface properties using various satellite data sets. Prerequisite: AES 509.

AES 671 - GROUND BASED REMOTE SENSING
Semester Hours: 3

Principles and measurement capabilities of active and passive ground-based remote sensing systems: radar, wind profiler, lidar, sodar, and passive radiometer systems. Integration of remote sensing measurements to retrieve properties of atmospheric phenomena. Hands-on usage and field measurements. Prerequisite: AES 541.

AES 672 - DUAL POLARIZATION RADAR METEOROLOGY
Semester Hours: 3

Theory, analysis, and interpretation of dual polarization radar for meteorological applications. Course covers dual polarization radar system hardware; the basic theory underlying polarimetric radar data and methodology; analysis, interpretation and application of polarimetric radar variables; and dual meteorological and convective weather applications; specifically, precipitation measurement and hydrometeor identification. Example applications include rain rate estimation, drop size determination, hail identification, tornado detection, snow vs rain delineation, and cloud electrification studies. Prerequisite: AES 571.

AES 673 - LIGHTNING
Semester Hours: 3

An introduction to lightning. Topics include qualitative and quantitative description of lightning discharges; electrification of thunderstorms; temporal and spatial variation of lightning on multiple scales; various types of lightning; basic lightning models; current methods of measuring lightning. Prerequisite: AES 509.

AES 675 - ATMOSPHERIC DATA ASSIMILATION
Semester Hours: 3

Data assimilation methods and concepts including objective analysis and initialization as relevant to numerical weather prediction. Emphasis on a variation of methods, successive correction, optimal interpolation, adjoin and gradient concepts, singular vectors, Kalman filters, and nudging. Prerequisites: AES 541 and AES 551.

AES 676 - REMOTE SENSING OF ENVIRONMENT
Semester Hours: 3

This course pursues both basic and advanced concepts in radiative transfer processes and retrieval algorithms of land surface biophysical variables from remote sensing observations, with an emphasis on the hands-on experience of data preprocessing and information extraction by using ENVI. Prerequisite: AES 514.

AES 680 - NUMERICAL MODELING APPLICATIONS ESS
Semester Hours: 3

This course will provide the physical basis for numerical model applications in the earth-atmosphere system including spatial and temporal scales. Prerequisites: AES 501 and AES 509.

AES 681 - NUMERICAL ATMOSPHERIC MODELING
Semester Hours: 3

Introduction to numerical methods applied to simulation of the atmosphere. Basic numerical solution techniques, along with filtering, radiative parameterizations, thermodynamics, turbulent parameterization, initialization, and coordinate transformation. Prerequisite: AES 551.

AES 690 - SPECIAL TOPICS IN ESS
Semester Hours: 3

Selected topics of interest not included under other courses.

AES 698 - MASTERS CAPSTONE
Semester Hours: 3

An extended research project resulting in a substantive paper that involves the original collection, analysis and/or interpretation of scientific data and/or results. Conducted under the guidance of an advisor. Required for MS ESS non-thesis option.

AES 699 - MASTER'S THESIS
Semester Hours: 1-6

A minimum of six thesis credit hours is required for MS degree.

AES 740 - CLOUD PROCESSES
Semester Hours: 3

Theory and observations of the bulk microphysics and kinematic structures of clouds. Topics include: interactions among dynamical, microphysical and thermodynamic processes within cloud systems, the dynamics of organized convective systems, and remote sensing of clouds and precipitation features. Prerequisites: AES 541 and AES 551.

AES 761 - ATMOSPHERIC RADIATION II
Semester Hours: 3

Advanced topics in atmospheric radiative transfer. Specific topics include Maxwell equations, Mie theory, polarization and radiative transfer in a scattering atmosphere. Prerequisite: AES 561.

AES 770 - SATELLITE REMOTE SENSING II
Semester Hours: 3

Using various satellite data sets and radiative transfer models, this course will train students to calculate and study cloud, aerosol, ocean and land surface properties to assess the radiative energy budget of the earth-atmosphere system. Prerequisite: AES 670.

AES 780 - SEMINAR
Semester Hour: 1

Speakers are invited to report on research relevant to the field of Atmospheric and Earth System Science. Students are expected to attend at least twelve seminars and to write short descriptions of the presentations.

AES 781 - STUDENT SEMINAR
Semester Hour: 1

Guest speakers reports on research relevant to the fields of Atmospheric and Earth System Science. Students are expected to attend weekly seminars, submit a paper based on at least ten talks, and make a 15 minute conference-type presentation on a research topic in atmospheric science selected in agreement with their advisor.

AES 782 - PROFESSIONAL DEVELOPMENT
Semester Hour: 1

Topics concerning professional ethics, writing scientific journal articles, proposals and resumes, preparing budgets, networking, time management, conference presentations, research administration, funding agencies, stress, and burnout will be discussed.

AES 790 - SELECTED TOPICS IN ATMOSPHERIC SCIENCE
Semester Hours: 1-4

Selected topics of interest not included under other courses.

AES 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on a doctoral dissertation.

Atmospheric Science, PhD

The Doctor of Philosophy degree is a research-oriented degree awarded upon the demonstration of scholarly competence. To obtain the Ph.D. degree in Atmospheric Science, each student must satisfy all requirements of the Graduate School, as well as those of the Atmospheric Science Program. Admission to the Ph.D. program in Atmospheric Science is dependent upon satisfactory performance on the Preliminary Examination, which is

administered twice a year. Students entering UAH with an M.S. degree or previous graduate training in Atmospheric Science must pass the Preliminary Examination at an early opportunity. Students are permitted two attempts to pass the Preliminary Examination.

In summary, the five major requirements for the Ph.D. degree in Atmospheric Science are the following:

1. Take the core courses and pass the preliminary examination

Each student must pass the **Preliminary Examination** covering material in the three core courses plus three other AES courses as outlined in the Ph.D. Preliminary Exam policies. The core courses are:

Code	Title	Semester Hours
AES 541	ATMOSPHERIC THERMODYNAMICS & CLOUD PHYSICS	3
AES 551	ATMOSPHERIC FLUID DYNAMICS I	3
AES 561	ATMOSPHERIC RADIATION I	3

It is anticipated that a student will take the exam during the second year of graduate study, but those with a strong background in Atmospheric Science may take the exam within the first year. The Preliminary Examination may be taken only twice. The student must pass all six sections in order to continue toward Ph.D. candidacy.

Supervisory Committee

After a student has passed the Preliminary Examination, a Supervisory Committee will be formed. The committee will consist of the student's academic advisor plus at least four other members. Three of the Committee Members, including the Committee Chair, must be tenured or tenure-track members of the AES faculty. The committee must be approved by the Graduate Dean. The committee will later administer the Qualifying Examination, and with consent of the Graduate Dean, give approval to all aspects of requirements 2-5.

2. Satisfy the residence requirement

According to graduate school policy, residence may be established through either:

1. being enrolled as a full-time student (at least nine graduate semester hours) either for one continuous academic year, or for Spring and Fall semesters in the same calendar year, or
2. being enrolled in at least six semester hours of graduate course work in at least three of four consecutive semesters.

3. Complete an acceptable Program of Study (POS)

Students must formulate an appropriate POS, in consultation with a faculty advisor and chair, before the end of the second semester. Each POS, individualized to meet the student's needs and requirements of the program, will stress breadth, depth, and research competence, and relate the major area to its applications. Any prerequisites for courses on the POS must be fulfilled before attempting the courses.

- Minimum degree requirements of this POS will include at least 48 semester hours of graduate level course work. These include the core courses needed to prepare for the Preliminary Examination and courses required in a major area of concentration that will prepare the student to conduct original research. While required, supporting courses, AES 509, AES 780 , AES 781 , and AES 782 are not included in the minimum degree requirements of 48 semester hours.
- Students can transfer up to 24 semester hours of course work from their M.S. program.
- Students can transfer an additional 6 semester hours of course work, including, with approval, special topics courses but not including thesis semester hours.
- 50 percent of the minimum degree requirements (48 semester hours) must be from 600 level or higher courses.
- A minimum of 18 semester hours of doctoral dissertation (AES 799) is required.
- Students must register for a total of three semester hours of Seminar and Professional Development. (AES 780 , AES 781 AES 782)
- Students must maintain a cumulative GPA of at least 3.000.

4. Pass the Qualifying Examination

Once the Program of Study has been submitted and the Ph.D. Student Advisory Committee (SAC) has been formed, the next steps are to submit a written dissertation proposal to the SAC and then make an oral presentation (usually two to three weeks later). This will be followed by the Qualifying Examination, which will cover the major areas of study and the student's proposal for the dissertation topic. It will have both written and oral components and will be prepared and graded by the SAC. This examination may be taken at most twice.

5. Complete and defend a research dissertation

Each student must complete and successfully defend a research dissertation, the results of which are publishable in a nationally recognized journal. The dissertation, which must comply with the regulations set forth in the Graduate School's Thesis and Dissertation Manual, must be approved by the

student's supervisory committee, the chair of the Atmospheric and Earth Science Department, the Dean of the College of Science, and the Dean of the Graduate School. A significant portion of the dissertation must be submitted for publication in an approved journal.

Additional Information

All requirements for the Ph.D. must be completed in no more than five years after the student has passed the qualifying examination.

The atmospheric science program does not require knowledge of a foreign language, but it does require proficiency in both spoken and written English.

Atmospheric Science, MS

- To obtain the M.S. degree in Atmospheric Science, each student must satisfy all requirements of the School of Graduate Studies, as well as those of the Atmospheric Science Program.
- Students must formulate an appropriate Program of Study (POS), in consultation with a faculty advisor and chair, **before the end of the second semester**.
- Students must maintain a cumulative GPA of at least 3.000.

Option 1 - Thesis

Minimum degree requirements under this plan include completion of at least 24 credit hours of graduate course work and at least six credit hours of thesis research. At least 50 percent of the required 24 semester hours must be from 600 level (or higher) courses. Students are also required to take six credit hours of supporting courses. The supporting courses do not count toward the minimum degree requirements.

Code	Title	Semester Hours
Required Core Courses [1,2]		
AES 541	ATMOSPHERIC THERMODYNAMICS & CLOUD PHYSICS	3
AES 551	ATMOSPHERIC FLUID DYNAMICS I	3
AES 561	ATMOSPHERIC RADIATION I	3
Elective Courses		
Select 12 semester hours from 600 level (or higher) courses		12
Select 3 semester hours from 500 or 600 level courses and may be outside of AES only with advisor's approval		3
Required Supporting Courses		
AES 509	SCIENTIFIC PROGRAMMING FOR EARTH & ATMOSPHERIC SCIENTISTS	3
AES 780	SEMINAR	1
AES 781	STUDENT SEMINAR	1
AES 782	PROFESSIONAL DEVELOPMENT	1
Thesis Credits		
AES 699	MASTER'S THESIS	1-6
Total Semester Hours		**31-36**

1 Students must earn a B or above in core courses.

2 Students who have earned a B or better in the undergraduate equivalent AES 509, AES 541, AES 551, AES 561 at UAH do not have to re-take the course at the graduate level. However, their Program of Study must include alternative semester hours at the appropriate level approved by their advisor and chair of the department.

Additional Information

In Option 1, the student must write and defend a thesis. The thesis must show evidence of the student's capability for research, independent thought and analysis in atmospheric science and must be written in fluent, acceptable English. During the second semester, the student, with the guidance of their advisor, should form a supervisory committee. Student must submit a five-page thesis proposal to be approved by the advisor and committee by the **end of the third full semester.**

Option 2 - Non-Thesis

Minimum degree requirements under this plan include completion of at least 33 credit hours of graduate course work. At least 50 percent of the required 33 semester hours must be from 600 level (or higher) courses. In addition, all M.S. students are required to take six credit hours of supporting courses. The supporting courses do not count toward the minimum degree requirements.

Code	Title	Semester Hours
Required Core Courses [1,2]		
AES 541	ATMOSPHERIC THERMODYNAMICS & CLOUD PHYSICS	3
AES 551	ATMOSPHERIC FLUID DYNAMICS I	3
AES 561	ATMOSPHERIC RADIATION I	3
Elective Courses		
Select 18 semester hours from 600 level (or higher) courses		18
Select 6 semester hours from 500 or 600 level courses and may be outside of AES only with advisor's approval		6
Required Supporting Courses		
AES 509	SCIENTIFIC PROGRAMMING FOR EARTH & ATMOSPHERIC SCIENTISTS	3
AES 780	SEMINAR	1
AES 781	STUDENT SEMINAR	1
AES 782	PROFESSIONAL DEVELOPMENT	1
Total Semester Hours		**39**

1. Students must earn a B or above in core courses.
2. Students who have earned a B or better in the undergraduate equivalent AES 509, AES 541, AES 551, AES 561 at UAH do not have to re-take the course at the graduate level. However, their Program of Study must include alternative semester hours at the appropriate level approved by their advisor and chair of the department.

Comprehensive Examination/Thesis Defense

A final comprehensive examination is required of all candidates for a master's degree; this examination may be written or oral, or both. In accordance with the *Graduate School Dates & Deadlines*, a written notice of the time and place of the examination/defense must be sent to the Graduate Dean. After approval by the Graduate Dean, the Department Chair sends a copy of the written *Notification of Oral Examination/Defense* to the candidate and each member of the committee. A student may take the Comprehensive Examination only twice.

- **Thesis** candidates will be examined *primarily* on the thesis by a committee of at least three faculty members appointed by the Department Chair and approved by the Graduate Dean.
- **Non-Thesis** candidates will be examined on course work. Three weeks before the exam, the advisor/chair will email two "lead-in" questions about the student's course work from each committee member. This will be the starting point for the oral exam. The committee members may also question further during the exam. Students who pass all sections of the Ph.D. Preliminary Exam are not required to take the M.S. Comprehensive Exam.

M.S. Supervisory Committee

The committee must consist of a minimum of three members and be approved by the Department Chair. Two of the three members, including the Committee Chair, must be full-time, tenured or tenure-earning faculty members in the department. The other member may be nominated to the Affiliate Graduate Faculty or be a current faculty member from another UAH department.

Paperwork

- Students must formulate an appropriate POS, in consultation with a faculty advisor and chair, before the end of the second semester.
- Application for graduate degree according to the *Graduate School Dates & Deadlines*.
- Notification of Oral Examination/Defense according to the *Graduate School Dates & Deadlines*.

Earth System Science

National Space Science and Technology Center
Room 4044
Telephone: 256.961.7877
Email: aes@uah.edu

Chair: John Mecikalski, P (https://www.uah.edu/science/departments/atmospheric-science/faculty-staff/john-mecikalski/)h.D.

The Atmospheric and Earth Science Department offers the following graduate degree programs:

Master of Science - Earth Systems Science (p. 188)

Admission Requirements

Refer to the appropriate section of the Graduate Catalog for general admission and degree requirements. Students should have an appropriate foundation with at least two semesters of calculus, two semesters of physics, an introductory course in computer programming, and preferably chemistry before entering the program. Please consult the Department for guidance.

Program Objective

The M.S. in Earth System Science program specifically enables students to gain not only an understanding of the physics of the climate system and the environment but also a hands-on knowledge of how data and information are used to aid decision makers. Graduates will be successful in writing or presenting a scientific research paper in a peer-reviewed scientific journal, book chapter, or at a national or international scientific conference or workshop. The program's objective is to produce graduates who successfully obtain professional employment in the Earth System Science field within one year of graduation.

Learning Outcomes

Students will demonstrate

- knowledge of the reviewed literature in the earth system sciences that is relevant to their specific research,
- effective use of remotely sensed environmental data, image processing and Geographic Information Systems (GIS) toward decision-making or policy-related applications in the earth system sciences, and
- effective oral communication skills in reporting the results of their scientific research.

Master's Program in Earth System Science

- Earth System Science, MS (p. 188)

Earth System Science, MS

Degree Requirements

- To earn a master’s degree in Earth System Science (ESS), each student must satisfy all requirements of the School of Graduate Studies and of the Atmospheric Science Department.
- Students must formulate an appropriate Program of Study (POS), in consultation with a faculty advisor and chair, **before the end of the second semester.**
- Students must maintain a cumulative GPA of at least 3.000.

Option 1 - Thesis

Minimum degree requirements under this plan include completion of at least 24 credit hours of core (nine credit hours) and elective (15 credit hours) course work and at least six credit hours of thesis research. At least 50 percent of the required 24 semester hours must be from 600 level (or higher) courses. In addition, all M.S. in ESS students are required to take six credit hours of supporting courses, which do not count toward minimum degree requirements.

Code	Title	Semester Hours
Required Core Courses [1]		
AES 507	ENVIRONMENTAL THREATS, PUBLIC POLICY, & DECISION MAKING	3
AES 514	GEOSPATIAL APPLICATIONS	3
AES 630	PHYSICAL CLIMATOLOGY	3
Required Supporting Courses		
AES 508	PYTHON FOR ID ESS APPLICATIONS	3
or AES 509	SCIENTIFIC PROGRAMMING FOR EARTH & ATMOSPHERIC SCIENTISTS	
AES 780	SEMINAR	1
AES 781	STUDENT SEMINAR	1
AES 782	PROFESSIONAL DEVELOPMENT	1
Elective Courses		
Select 15 semester hours of electives [4,5]		15

Thesis Credits		
AES 699	MASTER'S THESIS	1-6
Total Semester Hours		**31-36**

1 Students must earn a B or above in core courses.
2 Students who have earned a B or better in the undergraduate equivalent of AES 507, AES 508 (or AES 509) and AES 514 at UAH do not have to re-take the course at the graduate level. However, their Program of Study must include alternative semester hours to replace AES 507 and AES 514 at an appropriate level approved by their advisor and chair of the department.
3 If a student has advanced GIS experience, the AES 514 core may be replaced with an advanced course at the discretion of the Department Chair.
4 9 of these Elective semester hours must be from 600 level (or higher) courses.
5 Three Elective semester hours **may be** outside of the ESS/ATS only with advisor's approval.

Additional Information

One of the goals of this program is to train the student in transitioning research and observational products related to ESS into public policy and decision-making arenas. Therefore, it is necessary that the student spend time working with a decision-making organization. The student must submit a five-page thesis proposal to be approved by the advisor and committee by the **end of the third full semester**.

Option 2 - Non-Thesis

Minimum degree requirements under this plan include completion of at least 30 semester hours of graduate course work, which includes core (12 credit hours) and elective courses (18 credit hours). At least 50 percent of the required 30 credit hours must be from 600 level (or higher) courses. Students are also required to take six credit hours of supporting courses. The supporting courses do not count toward minimum degree requirements.

Code	Title	Semester Hours
Required Core Courses [1]		
AES 507	ENVIRONMENTAL THREATS, PUBLIC POLICY, & DECISION MAKING	3
AES 508	PYTHON FOR ID ESS APPLICATIONS	3
or AES 509	SCIENTIFIC PROGRAMMING FOR EARTH & ATMOSPHERIC SCIENTISTS	
AES 514	GEOSPATIAL APPLICATIONS	3
AES 632	ENERGY, CLIMATE, ENVIRONMENT	3
Elective Courses		
Select 3 semester hours from 500 or 600 level courses within AES		3
Select 3 semester hours from 600 level courses within AES		3
Select 3 semester hours from 500 or 600 level courses and may be outside of AES [4]		3
Select 9 semester hours from 600 level courses and may be outside of AES [4]		9
Required Supporting Courses		
AES 780	SEMINAR	1
AES 781	STUDENT SEMINAR	1
AES 782	PROFESSIONAL DEVELOPMENT	1
AES 698	MASTERS CAPSTONE	3
or AES 690 (with approval)		
Total Semester Hours		**36**

1 Students must earn a B or above in core courses.
2 Students who have earned a B or better in the undergraduate equivalent AES 507, AES 508 (or AES 509), and AES 514 at UAH do not have to re-take the course at the graduate level. However, their Program of Study must include alternative semester hours at the appropriate level approved by their advisor and chair of the department.
3 If a student has advanced GIS experience, the AES 514 core may be replaced with an advanced course at the discretion of the Department Chair.
4 Course selection from outside the department and colleges must be done with approval and guidance from faculty mentors and the department chair; faculty mentors will guide the student to pursue a coherent suite of complementary courses outside AES.

Additional Information

Non-thesis students will pursue approved external internship programs with the help of their mentor; in the event that a student does not receive an external internship, they will be required to do a capstone project with an ATS faculty member or approved ESSC scientist/researcher.

M.S. Supervisory Committee

The committee must consist of a minimum of three members and be approved by the Department Chair. Two of the three members must be full-time, tenured or tenure-earning, or emeritus faculty members in the department. The other member must be from a decision-making/end-user organization. The student must work closely with the advisor and committee members to select a thesis topic. Advisors have the responsibility to shape the research and ensure that a thesis can be written and defended within the time needed for graduation.

Comprehensive Examination/Thesis Defense

A final comprehensive examination is required of all candidates for a master's degree. In accordance with the *Graduate School Dates & Deadlines*, a written notice of the time and place of the examination/defense must be sent to the Graduate Dean. After approval by the Graduate Dean, the Department Chair sends a copy of the written Notification of Oral Examination/Defense to the candidate and each member of the committee. The candidate will be examined primarily on the thesis but they may also be tested on relevant course work. The examination is conducted by a committee of at least three faculty members appointed by the Department Chair and approved by the Graduate Dean. The examination must be given at least six weeks before the end of the semester in which degree requirements are expected to be completed, and the results reported within two working days to the Graduate Dean. A student may take the examination only twice.

- **Thesis** candidates will be examined *primarily* on the thesis by a committee of at least three faculty members appointed by the Department Chair and approved by the Graduate Dean.
- **Non-thesis** students will write up a Masters-level research capstone project, present their findings in a formal presentation, and respond to questions from their faculty mentor, other faculty, and the public; successful and approved completion of this, as determined by the faculty mentor and department chair, will result in a pass for the non-thesis option.

Paperwork

- Students must formulate an appropriate POS, in consultation with a faculty advisor and chair, before the end of the second semester.
- Application for Graduate Degree according to *Graduate School Dates & Deadlines*.
- Notification of Oral Examination/Defense according to *Graduate School Dates & Deadlines.*

Geographic Information Systems & Remote Sensing Graduate Certificate

The Atmospheric and Earth Science (AES) Department offers a Graduate GIS & Remote Sensing Certificate. A set of four graduate courses (12 credits) comprise the Graduate Certificate, which that will prepare students for careers directly in the Geographic Information Systems (GIS) field, geospatial intelligence with remote sensing, or give them GIS experience as a supplemental technical skillset that can be applied across many disciplines and career fields. Given the popularity of GIS-based remote sensing and geospatial analysis in the Huntsville Area and across the U.S., the undergraduate certificate will also prepare students to recognize patterns and apply that information to larger processes.

Code	Title	Semester Hours
Required Courses		
AES 508	PYTHON FOR ID ESS APPLICATIONS	3
AES 514	GEOSPATIAL APPLICATIONS	3
AES 515	ADVANCED TOPICS IN GIS	3
AES 676	REMOTE SENSING OF ENVIRONMENT	3
Total Semester Hours		**12**

Biological Sciences

369A Shelby Center
Telephone: 256.824.6260
Email: biology.admin@uah.edu

Chair: Dr. Paul Wolf (https://www.uah.edu/science/departments/biology/faculty-staff/paul-wolf/)

The Biological Sciences department offers the following graduate degree program:

Master of Science - Biological Sciences (p. 194)

Admission Requirements

In addition to fulfilling admission requirements set by the Graduate School, applicants must also:

1. Have taken the general GRE exam and TOEFL when applicable
2. Have a Biology degree or related course work
3. Have at least one of either an advanced (upper division): biochemistry, cell biology, ecology, evolution, genetics, molecular biology or physiology course
4. Have a minimum cumulative GPA of 3.000 as well as in the major area of concentration

Applicants demonstrating the potential for graduate study in the biological sciences but having some deficiencies in their previous academic work may be admitted on a conditional basis. See the Biological Sciences (http://www.uah.edu/science/departments/biology/) web page for application information.

Program Objective

Faculty members of the Master of Science (M.S.) Graduate Program in the Department of Biological Sciences seek outstanding students to train, mentor, and assist in reaching their full potential as scientists and future leaders in science and society. Graduates have enjoyed exciting and fulfilling careers in academia and industry, including both government and the private sector. The M.S. Graduate Program in Biological Sciences offers three plans of study with emphases in cell biology, genetics, genomics, molecular biology, microbiology, physiology, ecology, and evolutionary biology. Graduate research and coursework are tailored to each individual student. Formal coursework involves traditional lectures, laboratories, discussions, seminars, and field studies. Graduate students also have access to several additional courses in other departments and at Alabama A&M University to further develop skill sets that complement their research and career interests.

Learning Outcomes

Students will demonstrate their ability to:

- Utilize the scientific method to resolve biological problems
- Write a scholarly document
- Prepare and deliver an effective oral scientific presentation

Master's Program in Biological Sciences

- Biological Sciences, MS (p. 194)

BYS 501 - INTRODUCTION TO BIOLOGY GRADUATE STUDIES
Semester Hour: 1

This course exposes new graduate students to the resources, skills, and approaches to be successful in independent research and graduate studies in the biological sciences. In addition, students will receive introductory training in developing research questions; study design, data analysis, searching and critically reviewing the scientific literature, oral and written scientific communication, proposal and grant writing, teaching and mentoring, ethical conduct of research and behavior, time management, and career planning.

BYS 505 - PSYCHOPHARMACOLOGY
Semester Hours: 3

Introduction to drug classification and action with emphasis on physiological and psychological interactions. Same as PY 505.

BYS 517 - PRINCIPLES OF PLANT PHYSIOLOGY
Semester Hours: 4

The objectives in the development of the plant physiology course are to provide students with opportunities to: (1) study the biological functions of plants from the whole organism to the cellular level; (2) to gain an understanding of the complexity of plant genetics, stress response pathways (hormones) and nutritional requirements of plants; (3) to explore the symbiotic relationship of plants and the mycorrhizae and (4) to appreciate how dependent human beings are on plants from those in our forests and environment, to those in agricultural production and beyond. Students will develop an invidiualized research proposal and will also participate in class experimentation of tissue culture techniques, effects of plant grown regulators, phototropic response(s) on growth and development as well as other primary topics throughout the semester.

BYS 519 - GENE STRUCTURE & FUNCTION
Semester Hours: 3

Advanced studies of macromolecular structure and biological function of proteins and nucleic acids involved in the passage of genetic information and cellular response. Structural significance of viruses and molecular evolution included.

BYS 523 - PRINCIPLES OF VIROLOGY/A&M
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Principles of viral infectivity, multiplication, and chemical constitution; laboratory techniques for their isolation, cultivation, identification, and enumeration.

BYS 524 - MYCOLOGY/A&M
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Lines of phycomycetes using representative species; various series of actinomycetes; representative pathogenic (crop and vegetative pathogens) and nonpathogenic heterobasidiomycetideae organisms; order and families of homobasidiomycetidae. Ontogenetics, cellular, and structural study applied to all divisions, classes, series, orders, and families.

BYS 526 - MICROBIAL ECOLOGY
Semester Hours: 4

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Relationship of soil and aquatic microorganisms and their importance in ammonification, nitrification, and other biological processes.

BYS 531 - BIOLOGICAL DATA SKILLS
Semester Hours: 3

This course covers a range of computational skills needed specifically for biologists who do not have any training in compuer science. The course focuses on command line tools, basic programming in Python, and various aspects of data handling including, data curation, organization, storage, querying, and archiving. The course will include a project that ties together skills that are useful for individual students.

BYS 535 - ADVANCED MICROBIOLOGY
Semester Hours: 3

Aspects of microbial behavior, development, morphogenesis or physiology.

BYS 537 - PSYCHOBIOLOGY STRESS & ILLNESS
Semester Hours: 3

Overview of physiological stress responses and their influence on health, behavior, and illness. Same as PY 536.

BYS 542 - NUTRITIONAL PHYSIOLOGY
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Advanced laboratory dealing with modern techniques of molecular biology and biochemistry.

BYS 543 - MOLECULAR BIOLOGY OF THE CELL
Semester Hours: 3

Advanced study of cell structure and function of macromolecules (lipids, proteins, carbohydrates and nucleotides). In depth literature readings on subcellular organelles, metabolic pathways, cell cycle, cancer, and cell differentiation.

BYS 547 - BIOCHEMISTRY I
Semester Hours: 3

Structural chemistry and function of biomolecules, mechanisms of biochemical reactions, and enzyme kinetics. Same as: CH 561.

BYS 548 - BIOCHEMISTRY II
Semester Hours: 3

Energy transduction, metabolism, biosynthesis of macromolecular precursors, storage, transmission, and expression of genetic information. Same as CH 562. Prerequisites: BYS 547 or CH 561.

BYS 556 - ADVANCED MOLECULAR TECHNIQUES
Semester Hours: 3

Laboratory techniques in molecular biology including current methodology in genomics, proteomics, and RNA analysis. Prerequisite: BYS 519 with concurrency.

BYS 560 - ENVIRONMENTAL BIOLOGY/A&M
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Principles of interaction between living systems and their resources. Current problems in management of natural resources including new approaches in management of pest populations.

BYS 561 - HERPETOLOGY
Semester Hours: 4

Classification, diversity, anatomy function, ecology, behavior, and evolution of amphibians and reptiles. Laboratory and field trips devoted to anatomy and identification, with an emphasis on Alabama and southeastern U.S. species.

BYS 562 - COMMUNITY ECOLOGY
Semester Hours: 4

Detailed consideration of ecological principles and concepts, as well as biotic and abiotic factors relevant to development of communities and ecosystems. Field trips required.

BYS 563 - POPULATION ECOLOGY
Semester Hours: 4

Distribution, population dynamics, and behavior of populations in relation to environmental factors. Field trips required.

BYS 564 - LIMNOLOGY
Semester Hours: 3

Fresh-water environments and organisms exemplified by lakes, ponds, and streams in North Alabama.

BYS 566 - ORNITHOLOGY
Semester Hours: 4

An examination of birds, including classification, diversity, anatomy, function, ecology, behavior, and evolution. Laboratory and field trips devoted to anatomy and identification, with an emphasis on Alabama and southeastern U.S. species.

BYS 567 - ANIMAL BEHAVIOR
Semester Hours: 3

This course examines the role of animal behavior in survival and reproduction. It emphasizes the genetic, morphological, and physiological basis of behavior. Particular emphasis is placed on the mechanisms underlying behavior and their evolutionary significance.

BYS 601 - BIOINFORMATICS I
Semester Hours: 3

Practical use in bioinformatics and X-ray crystallography.

BYS 602 - BIOINFORMATICS II
Semester Hours: 3

Practical use in bioinformatics and applied genomics.

BYS 610 - BIOLOGY GRADUATE INTERNSHIP
Semester Hours: 1-5

This course enables a student to get UAH credits for a paid or unpaid internship in a field related to biology. Arrangements must be made between the internship supervisor and the UAH instructor.

BYS 619 - MICROBIAL GENETICS
Semester Hours: 3

Transmission, expression, and evolution of genes in microorganisms. Studies of chromosomes, plasmids, transposons, bacteriophages, and other genetic elements.

BYS 630 - IMMUNOLOGY
Semester Hours: 4

Innate, humoral, and cell-mediated immunity. Immune deficiencies and hypersensitivities. Autoimmunity, transplantation, and tumor immunology.

BYS 631 - MEDICAL PHARMACOLOGY/A&M
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Drug-receptor interaction, kinetics of drug absorption, distribution and elimination, and discussion of drugs affecting different systems. Pharmacogenetics, toxicity, mutagenesis, teratogenesis, carcinogenesis, and drug interactions. Mechanism of action of drugs, in relation to their use as therapeutic agents in medicine.

BYS 690 - SEMINAR
Semester Hour: 1

Student reports on current journal articles, research, or assigned readings. Graduate students should attend whether enrolled for credit or not. May be taken up to three times for credit.

BYS 691 - SPECIAL TOPICS
Semester Hours: 1-4

Directed readings and/or written reports on topics of individual student interest carried out under the supervision of an instructor. Prerequisite: permission of instructor required before registration.

BYS 692 - RESEARCH
Semester Hours: 2-4

Individual investigations of biological problems under supervision of a graduate faculty member. Permission of instructor required before registration.

BYS 699 - MASTER'S THESIS
Semester Hours: 1-6

Required each semester student is working on and receiving direction on master's thesis. Minimum of six hours required for M.S. thesis students.

Biological Sciences, MS

Program Requirements

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General requirements of the Graduate School under Plan I, Plan II, or Plan III must be satisfied.
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Plan I – Master of Science with Thesis

Students will complete coursework (24 credit hours) and perform original research (a minimum of six thesis research credit hours) that will be described in their research thesis under the direction of a research advisor. There are no required courses in the Plan I track. The program of study (i.e., coursework) will be developed with your research advisor to meet your education and specific career goals. Students will prepare and defend a thesis proposal within their first year in the graduate program. Students will complete a written thesis then an open seminar followed by defense to their committee typically by the end of their second year in the graduate program.

Plan II – Master of Science without Thesis

Students will complete an approved program of coursework (minimum of 33 credit hours), complete a written proposal and write a Master's report under the direction of an advisor. There are no required courses in the Plan II track. The report is usually in the form of a literature review or survey about a topic agreed upon with the advisor. The presentation is not open to the UAH community, but presented only to a supervisory committee.

Plan III – Master of Science with Education (Two Programs Available)

1. **Traditional Program** - Students with existing Alabama Class B certification will complete an approved program of coursework without specialization in the Department of Biological Sciences (24 credit hours) and in the College of Education (12 credit hours), complete a written comprehensive final examination, and write and present a Master's report under the direction of an advisor. There are no required courses in this Plan III track. The report is usually in the form of a literature review or survey about a topic agreed upon with the advisor. The presentation is not open to the UAH community, but only presented to a supervisory committee. The written examination is comprehensive in nature with questions based on coursework taken in the graduate program. Graduates will be recommended for Alabama Class A teaching certification.
2. **Nontraditional Fifth Year Program** - Students with an accredited baccalaureate degree other than teacher education seeking initial certification (those that do not have a Class B baccalaureate level teaching certification) will complete coursework in the Department of Biological Sciences (24 credit hours) and in the College of Education (27 hours, including an internship), complete a written comprehensive final examination, and write and present a Master's report under the direction of an advisor. There are no required courses in this Plan III track. The report is usually in the form of a literature review or survey about a topic agreed upon with the advisor. The presentation is not open to the UAH community, but only presented to a supervisory committee. The written examination is comprehensive in nature with questions based on coursework taken in the graduate program. Students will also be required to take a one-hour course, "Introduction to Education," prior to admission to the Teacher Education Program. Graduates will be recommended for Alabama Class A teaching certification.

Chemistry

215 Materials Science Building
Telephone: 256.824.6153
Email: chem.admin (chem.admin@uah.edu)@uah.edu (jeffrey.champoux@uah.edu)

Chair: Dr. Bernhard Vogler (https://www.uah.edu/science/departments/chemistry/chemistry-faculty-staff/bernhard-vogler/)

The Chemistry department offers the following graduate degree program:

Master of Science - Chemistry (p. 199)

Doctor of Philosohpy - Chemistry (p. 201)

Master of Science - Chemistry

Admission Requirements

General requirements of the Graduate School must be satisfied. In addition, students admitted to the graduate chemistry program are assumed to have training equivalent to the chemistry B.S. degree recommended by the American Chemical Society (ACS). The degree includes lecture and laboratory work in organic chemistry, physical chemistry, inorganic chemistry, analytical chemistry, biochemistry, polymer chemistry, and materials chemistry. Graduation from an undergraduate program not adhering to ACS standards does not preclude entrance into the UAH program. Students should realize, however, that if deficiencies exist, some additional undergraduate courses might be required. The time required to complete the M.S. degree may then be proportionately increased.

Program Objective

The Department of Chemistry is to provide high-quality education in all aspects of chemistry. Graduates of the Master of Science program will present their work in well-respected journals with significant impact. Our second objective is to educate our students in chemistry to obtain either satisfactory employment or enrollment in a graduate or professional degree program.

Learning Outcomes

Students will demonstrate:

- Ability to effectively present chemical knowledge in writing
- Ability to deliver an effective oral presentation of their research
- An excellent understanding of the basic concepts, methods, terminology, and theories of modern chemistry related to their research interests

Chemistry PhD Program

Admission Requirements

In addition to fulfilling admission requirements (https://www.uah.edu/admissions/graduate/) set by the Graduate School, applicants must also have:

- A bachelor's degree in chemistry, chemical engineering or materials science or in a closely related field from an accredited college or university;
- Candidates who apply for the *Executive* path must have a Master’s of Science degree in Chemistry or in a related field and/or three years of experience in the chemical industries;
- A minimum grade point average (GPA) of 3.000 overall;
- Three letters of reference;
- A personal statement;
- For international students, language proficiency as outlined on the Graduate Admissions for International Students (http://catalog.uah.eduwebpagehttps://www.uah.edu/admissions/graduate/apply-for-admission/international-students/#:~:text=English%20Language%20Proficiency%C2%A0Scores) webpage must be shown;
- An entrance interview conducted in person or via Zoom, or a comparable platform.

Applicants may be admitted conditionally if they do not meet admission requirements but indicate the potential for success in the Chemistry PhD program. Applicants should have knowledge from coursework in the areas of organic, inorganic, physical, analytical chemistry and biochemistry, with the respective hands-on (not virtual) laboratory experience in the above-indicated subsections of chemistry. Students with deficiencies in any of these areas may be admitted conditionally.

Application Process

- **Applicants must apply by January 31** to be admitted for the Fall semester in the same year and by **August 31** to be admitted for the Spring semester of the following year.
- **An interview** in person or via Zoom, or a comparable platform, will be arranged for the applicant throughout the month of February (September for Spring admission), where the applicant is expected to describe their chemistry education and potential research experience.
- Applicants should obtain a response to their application by **April 1** (**October 15** for Spring admission).
- The applicant’s decision on acceptance is **due no later than April 30 (October 31** for Spring admission).

Available Assistantships

The UAH Graduate School (https://www.uah.edu/graduate/) has information about:

- Teaching Assistantships
- Research Assistantships
- Fellowships

Graduate Teaching Assistants are expected to teach Chemistry undergraduate laboratory courses.

Applicants interested in applying for an assistantship may upload their assistantship application (https://www.uah.edu/admissions/graduate/financial-aid/assistantships/) under the “Documents” section of the application. Providing GRE scores with an application package is optional but can be advantageous to securing an assistantship.

Master's Program in Chemistry

- Chemistry, MS (p. 199)

Chemistry PhD Program

- Chemistry, PhD (p. 201)

CH 500 - TOPICS IN CHEMISTRY
Semester Hours: 1-3

Advanced laboratory research in one of the departmental research groups. The student works on an independent or group research project. Completion of the course requires an appropriate written and oral report. Prerequisites: Approval of instructor.

CH 521 - CHEMICAL INSTRUMENTATION
Semester Hours: 3

Use of basic instrumentation in NMR, mass spectrometric, chromatographic, and spectrophotometric analysis.

CH 522 - CHEMICAL INSTRUMENTATION LABORATORY
Semester Hour: 1

Complements the lecture material for CH 521. Introduction to modern analytical instrumentation including IR, UV and atomic absorption spectrophotometers, nuclear magnetic resonance, electroanalytical equipment, and gas and liquid chromatographs. Prerequisite with concurrency: CH 521.

CH 549 - SPECTROSCOPY & MOLECULAR STRUCTURE
Semester Hours: 3

Intermediate level treatment of principles of spectroscopy and their application to determination of molecular structure.

CH 553 - INTRO QUANTUM MECHANICS I
Semester Hours: 3

Waves and particles; Bohr's model; de Broglie waves, wave-packets, uncertainty principle; quantum mechanics postulates; Schroedinger equation; systems in 1, 2 & 3 dimensions; hydrogen atom. Same as PH 551, OSE 555, and MTS 651.

CH 554 - INTRO QUANTUM MECHANICS II
Semester Hours: 3

Angular momentum and spin; atomic structure and spectrum; time-independent perturbation theory, variational methods; time-dependent perturbation theory and interactions of light with matter; scattering theory; electronic structure of solids; relativistic quantum mechanics. Same as: PH 552, MTS 652. Prerequisite: PH 551 or CH 553.

CH 561 - BIOCHEMISTRY I
Semester Hours: 3

Structural chemistry and function of biomolecules, mechanisms of biochemical reactions, enzyme kinetics, and energy transfer. Same as: BYS 547.

CH 562 - BIOCHEMISTRY II
Semester Hours: 3

Metabolism, biosynthesis of macromolecular precursors, storage, transmission, and expression of genetic information, and molecular physiology. Same as BYS 548. Prerequisites: CH 561 or BYS 547.

CH 600 - ADVANCED INORGANIC CHEMISTRY
Semester Hours: 3

Survey with emphasis on structure and reactivity of inorganic compounds.

CH 602 - CHEMISTRY OF COORDINATION COMPOUNDS
Semester Hours: 3

Modern bonding theory and stereochemistry of coordination compounds.

CH 621 - METHODS OF CHEMICAL ANALYSIS
Semester Hours: 3

Literature, seminar course. Theory and methodology of various techniques of chemical analysis.

CH 631 - SYNTHETIC ORGANIC CHEMISTRY
Semester Hours: 3

Survey of certain reactions that enjoy widespread application to the synthesis of organic compounds.

CH 632 - PHYSICAL ORGANIC CHEMISTRY
Semester Hours: 3

Reactive intermediates, structure-activity relationships, reaction mechanisms and techniques used to determine them.

CH 633 - ORGANIC STRUCTURE DETERMINATION
Semester Hours: 3

Structure determination of organic molecules using spectroscopic methods, especially NMR, IR, and MS. Emphasis on the theory and interpretation of many NMR methods useful in chemistry research.

CH 634 - MOLECULAR MODELING
Semester Hours: 4

Molecular modeling methods, such as molecular mechanics, molecular docking, molecular orbital theory, and density functional theory, will be used to investigate conformational properties of organic compounds, molecular interactions between biological macromolecules and organic ligands, electronic structure of organic and inorganic compounds, frontier molecular orbitals, pericyclic reactions, and reactive intermediates. Extensive computational laboratory work included.

CH 635 - CHEMICAL TOXICOLOGY
Semester Hours: 3

An introduction to the principles of chemical toxicology, including the effects of drugs, environmental pollutants, natural toxins and venoms, and other potentially hazardous chemicals at the physiological, cellular, and molecular level.

CH 640 - ADVANCED CHEMICAL THERMODYNAMICS
Semester Hours: 3

First, second, and third laws of thermodynamics. Thermodynamic functions. Applications to thermal properties of gases, liquids, solids, and solutions. Chemical reactions, phase transitions, and electrochemistry.

CH 641 - STATISTICAL THERMODYNAMICS
Semester Hours: 3

Principles leading to the development of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. Thermodynamic properties calculated from partition functions.

CH 642 - ADVANCED CHEMICAL DYNAMICS
Semester Hours: 3

Non-equilibrium thermodynamics, macroscopic and microscopic theories of diffusion, chemical reaction rate laws and mechanisms, transition state theory, gas phase molecular dynamics, electrical conduction in electrolyte solutions, electrode kinetics. Prerequisite: CH 640.

CH 643 - QUANTUM CHEMISTRY
Semester Hours: 3

Application of quantum theory to the chemical bond.

CH 644 - CHEMICAL ELECTRODYNAMICS
Semester Hours: 3

Maxwell's equations applied to electrodynamic problems in chemistry. Theory of dielectrics, dipole moments, Beer's law, Landolt's rule, light scattering, magnetic properties, quantum theory of radiation.

CH 645 - POLYMER PHYSICAL CHEMISTRY
Semester Hours: 3

Introduction to structure, properties and processing of polymers. Physical behavior of polymers, structure-property relationships, polymer characterization, thermodynamics of polymer solutions and melts, mechanical evaluation of polymers. Same as MTS 747.

CH 646 - THERMODYNAMICS OF MATERIALS
Semester Hours: 3

Fundamental thermodynamic review, phase equilibrium, chemical reaction equilibrium, free energy, binary and ternary phase transformations, solution models and selected topics. Same as CHE 646 and MTS 646.

CH 647 - ADVANCED BIOPHYSICAL CHEMISTRY I
Semester Hours: 3

Topics include: computer data analysis and simulation, first and second laws of thermodynamics, free energy and equilibrium, calorimetry, protein stability, binding and interactions, solution thermodynamics, electrolytes.

CH 648 - ADVANCED BIOPHYSICAL CHEMISTRY II
Semester Hours: 3

Advanced biophysical chemistry, including biochemical reaction kinetics, enzyme catalysis, quantum mechanics, statistical thermodynamics, spectroscopy, including UV-VIS, fluorescence, circular dichroism, NMR, and Structure determinations. An emphasis is placed on the current research literature.

CH 649 - POLYMER SYNTHESIS & CHARACTERIZATION
Semester Hours: 3

Same as MTS 649.

CH 650 - PRINCIPLES OF THE LIQUID/SOLID INTERFACE
Semester Hours: 3

Applies principles in thermodynamics & kinetics to characterize surfaces & surface phenomena. Fundamental properties of gas-liquid, liquid-liquid, solid-liquid and solid-gas interfaces and phenomena at these interfaces. Same as MTS 650 and CHE 650.

CH 699 - MASTER'S THESIS
Semester Hours: 3-6

Required each semester a student is enrolled and receiving direction on a masters thesis. Minimum of two terms is required. (A maximum of six hours may be applied towards the degree).

CH 700 - CURRENT TOPICS IN CHEMISTRY
Semester Hours: 1-3

Advanced laboratory research in one of the departmental research groups. The student works on an independent or group research project. Completion of the course requires a written and an oral report. Prerequisite: approval of instructor.

CH 705 - SELECTED TOPICS IN INORGANIC CHEMISTRY
Semester Hours: 3

Prerequisites: CH 600 and approval of instructor.

CH 721 - SELECTED TOPICS IN ANALYTICAL CHEMISTRY
Semester Hours: 3

Prerequisites: CH 621 and approval of instructor.

CH 735 - SELECTED TOPICS IN ORGANIC CHEMISTRY
Semester Hours: 3

Prerequisites: CH 632 and approval of instructor.

CH 745 - SELECTED TOPICS IN PHYSICAL CHEMISTRY
Semester Hours: 3

CH 746 - SOLID STATE CHEMISTRY
Semester Hours: 3

Chemical properties of solids. Includes phase equilibria, chemical bonding in ionic and covalent crystals, thermodynamics of atomic defects, ionic conductivity in solids, corrosion, & introduction to surfaces and adsorption.

CH 765 - SELECTED TOPICS IN BIOCHEMISTRY
Semester Hours: 3

Prerequisites: approval of instructor.

CH 780 - CHEMISTRY SEMINAR
Semester Hour: 1

Required during each semester of residence.

CH 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9

Chemistry, MS

General requirements of the Graduate School under Plan I or Plan II must be satisfied.

Plan I – Master of Science with Thesis

Up to 12 semester hours of the course requirements may be accepted as transfer credits from graduate work done in other Chemistry programs.

Code	Title	Semester Hours
Fields		
Select one course from each of the following fields:		12
Analytical:		
CH 521	CHEMICAL INSTRUMENTATION	
CH 549	SPECTROSCOPY & MOLECULAR STRUCTURE	
CH 621	METHODS OF CHEMICAL ANALYSIS	
CH 633	ORGANIC STRUCTURE DETERMINATION [1]	
Inorganic:		
CH 600	ADVANCED INORGANIC CHEMISTRY	
Organic:		
CH 631	SYNTHETIC ORGANIC CHEMISTRY	
CH 632	PHYSICAL ORGANIC CHEMISTRY	
CH 633	ORGANIC STRUCTURE DETERMINATION [1]	
CH 634	MOLECULAR MODELING	
Physical Chemistry:		
CH 640	ADVANCED CHEMICAL THERMODYNAMICS	
CH 641	STATISTICAL THERMODYNAMICS	
CH 642	ADVANCED CHEMICAL DYNAMICS	
CH 643	QUANTUM CHEMISTRY	
CH 646	THERMODYNAMICS OF MATERIALS	
CH 647	ADVANCED BIOPHYSICAL CHEMISTRY I	
CH 648	ADVANCED BIOPHYSICAL CHEMISTRY II	
Select one course from one of the following fields:		3
Biochemistry:		
CH 561	BIOCHEMISTRY I	
CH 562	BIOCHEMISTRY II	
Polymer:		
CH 645	POLYMER PHYSICAL CHEMISTRY	
Select one course from your field of study		3
Select two additional courses of choice		6
Total Semester Hours		**24**

[1] CH 633 can only be applied to one area: Organic or Analytical Chemistry

Plan II – Master of Science without Thesis

Graduate students entering Plan II must qualify by meeting one of the following preliminary examination requirements:

a. Passing ACS exams in biochemistry, inorganic chemistry, organic chemistry or physical chemistry.
b. Having previously passed at least two sections of the Materials Science Program Exam I.
c. Having previously passed the Biotechnology Science and Engineering Preliminary Exam.

Code	Title	Semester Hours
Fields		
Select one course from each of the following fields:		12
Analytical:		
CH 521	CHEMICAL INSTRUMENTATION	
CH 549	SPECTROSCOPY & MOLECULAR STRUCTURE	
CH 621	METHODS OF CHEMICAL ANALYSIS	
CH 633	ORGANIC STRUCTURE DETERMINATION [1]	
Inorganic:		
CH 600	ADVANCED INORGANIC CHEMISTRY	
Organic:		
CH 631	SYNTHETIC ORGANIC CHEMISTRY	
CH 632	PHYSICAL ORGANIC CHEMISTRY	
CH 633	ORGANIC STRUCTURE DETERMINATION [1]	
CH 634	MOLECULAR MODELING	
Physical Chemistry:		
CH 640	ADVANCED CHEMICAL THERMODYNAMICS	
CH 641	STATISTICAL THERMODYNAMICS	
CH 642	ADVANCED CHEMICAL DYNAMICS	
CH 643	QUANTUM CHEMISTRY	
CH 646	THERMODYNAMICS OF MATERIALS	
CH 647	ADVANCED BIOPHYSICAL CHEMISTRY I	
CH 648	ADVANCED BIOPHYSICAL CHEMISTRY II	
Select one course from one of the following fields:		3
Biochemistry:		
CH 561	BIOCHEMISTRY I	
CH 562	BIOCHEMISTRY II	
Polymer:		
CH 645	POLYMER PHYSICAL CHEMISTRY	
Select at least 18 semester hours in graduate coursework in chemistry or related fields		18
Total Semester Hours		**33**

[1] CH 633 can only be applied to one area: Organic or Analytical Chemistry

At least 18 semester hours out of the 33 total semester hours must be in Chemistry.

Plan II requires a program of study drawn up by the student and the Chemistry M.S. degree program advisor. Students must also complete two credit hours of CH 780. Plan II is not recommended for students seeking employment as industrial laboratory chemists because it does not require any experimental work.

Non-Traditional Fifth-Year Program Leading to the M.S. in Chemistry Plus a Class A Alabama High School Teacher's Certificate

Those who have a B.A. or B.S. degree with a major or its equivalent in Chemistry as determined by the Department of Chemistry, who have not taken more than twelve semester hours in teacher education (graduate or undergraduate), and who are interested in obtaining Class A (master's level) certification for secondary school teaching, should consider the Non-Traditional Fifth-Year Program. Contact the College of Education for preliminary advisement on admission and general program requirements. See the description in the Education section for more details.

Chemistry, PhD

Chemistry PhD Program

The Chemistry PhD program was implemented at the University of Alabama in Huntsville (UAH) in the Fall semester of 2023. Students can pursue one of three different paths within the program: (1) doctoral degree in Chemistry, *Academic* path, (2) doctoral degree in Chemistry, *Entrepreneur* path and (3) doctoral degree in Chemistry, *Executive* path. The different paths, including class requirements, are described here (p. 201).

Academic path: A total of 48 semester hours of graduate course work and a minimum of 18 semester hours of dissertation research are required. Students who hold a MS degree in Chemistry or a related field are allowed to transfer up to 24 credit hours of applicable course work. Decisions on which credits are transferable are made by the department admissions committee.

Entrepreneur path: A total of 48 semester hours of graduate course work and a minimum of 18 semester hours of dissertation research are required. The 48 semester hours of course work include 18 hours of business coursework and will provide the student with a Graduate Certificate in Technology and Innovation Management. Students who hold a MS degree in Chemistry or a related field are allowed to transfer up to 24 credit hours of applicable course work. Decisions on which credits are transferable are made by the department admissions committee.

Executive path: A total of 57 semester hours of graduate course work and a minimum of 18 semester hours of dissertation research are required. The 57 semester hours of course work include 36 hours of business coursework and will provide the student with a Master of Business Administration (MBA) degree. Students are allowed to transfer up to 24 credit hours of applicable course work. Decisions on which credits are transferable are made by the department admissions committee.

Students are expected to take a minimum of nine credit hours of didactic classes and seminars in the Fall and Spring semesters of the first year. Students are also expected to decide on their research topic and identify a doctoral advisor within the first year. The advisor and the student will develop a Program of Study, which will be submitted to the Graduate School for approval by the Graduate Dean no later than the end of the second semester. After a research topic has been formulated between the advisor and the student, a PhD committee is assembled that consists of the doctoral advisor and an additional four faculty members. The members of the committee can hold appointments in departments other than Chemistry but will have an intricate understanding of the research subject. Committee members can be chosen from other universities as long as they are registered as graduate faculty at UAH.

Students are expected to pass the Qualifying exam after acquiring 18 hours of Chemistry course work, but no later than in the fourth semester. The Qualifying exam consists of a research proposal, typically following the NSF proposal guidelines that lays out the scientific background and proposed experimental approach to the research topic. The student will defend the research proposal in front of the PhD committee. Upon the successful defense of the proposal, the student is expected to start taking research hours and to continue to take didactic hours. In case the student fails the defense of the research proposal, a second chance will be given in the following semester. The student will also be given the option of leaving the program with a non-thesis MS degree in Chemistry upon completing 33 hours of didactic classes.

All requirements for the doctoral degree must be completed in no more than five years after the student has passed the Qualifying Examination. The student is encouraged to publish at least one publication in the course of the research work and prior to defending the PhD. The dissertation must be defended publicly.

The Chemistry PhD is unique in that it has 3 pathways: Academic **(**p. 201**), Entrepreneur, and** Executive **(**p. 202**).**

Across all options, the core will include 21 credit hours of coursework, including 12 credit hours of chemistry courses selected from analytical, inorganic, organic, physical, biochemistry, and polymer science; 6 hours of CH 700; and 3 hours of chemistry electives.

Students in all pathways will be expected to participate in CH 780 each semester, though credits will not count toward degree requirements. Per UAH policy, a minimum of 18 credit hours of dissertation CH 799 must be completed.

Academic path (66 hours total)

The Academic Path option consists of coursework and research comparable to traditional PhD programs. In this option, students complete the following.

12 credit hours of chemistry courses selected from analytical, inorganic, organic, physical, biochemistry, and polymer science

15 hours of additional chemistry courses, including 6 hours of CH 700

21 hours of elective graduate courses in support of student's research

18 hours of dissertation CH 799

It is recommended that students also complete three related business courses: New Ventures Strategies MGT 505, Technology & Innovation Management MGT 601, and New Product Development MKT 604.

Entrepreneur Path (p.) (66 hours)

The Entrepreneur Path option is an integration of business and management courses. It is ideal for students interested in employment with small and medium enterprises or start#ups. In this option, students complete:

12 credit hours of chemistry courses selected from analytical, inorganic, organic, physical, biochemistry, and polymer science

15 hours of additional chemistry courses, including 6 hours of CH 700: Current Topics in Chemistry

3 hours of chemistry electives

18 credit hours of business coursework, including those in the integrated Graduate
Certificate in Technology & Innovation Management

#18 hours of dissertation CH 799

Executive path (75 hours, including MBA)

The Executive Path option is an integration of business and management courses supporting the student's research. It is ideal for students with interests in employment with large multinational companies, as well as career development for existing employees. In this option, students complete:

12 credit hours of chemistry courses selected from analytical, inorganic, organic, physical, biochemistry, and polymer science

#6 hours of CH 700 Current Topics in Chemistry

3 hours of chemistry electives

#36 credit hours for the certified Masters of Business Administration (MBA)

18 hours of dissertation CH 799

Other Requirements:

Students must identify a research field and advisor; pass the qualifying examination; pass the annual examinations; and complete and defend a research dissertation.

Analytical

Code	Title	Semester Hours
CH 521	CHEMICAL INSTRUMENTATION	3
CH 549	SPECTROSCOPY & MOLECULAR STRUCTURE	3
CH 621	METHODS OF CHEMICAL ANALYSIS	3
CH 633	ORGANIC STRUCTURE DETERMINATION	3

Inorganic

Code	Title	Semester Hours
CH 600	ADVANCED INORGANIC CHEMISTRY	3
CH 602	CHEMISTRY OF COORDINATION COMPOUNDS	3

Organic

Code	Title	Semester Hours
CH 631	SYNTHETIC ORGANIC CHEMISTRY	3
CH 632	PHYSICAL ORGANIC CHEMISTRY	3
CH 633	ORGANIC STRUCTURE DETERMINATION	3

Physical

Code	Title	Semester Hours
CH 640	ADVANCED CHEMICAL THERMODYNAMICS	3
CH 641	STATISTICAL THERMODYNAMICS	3
CH 642	ADVANCED CHEMICAL DYNAMICS	3
CH 643	QUANTUM CHEMISTRY	3
CH 644	CHEMICAL ELECTRODYNAMICS	3
CH 647	ADVANCED BIOPHYSICAL CHEMISTRY I	3
CH 648	ADVANCED BIOPHYSICAL CHEMISTRY II	3

Biochemistry

Code	Title	Semester Hours
CH 561	BIOCHEMISTRY I	3
CH 562	BIOCHEMISTRY II	3
CH 635	CHEMICAL TOXICOLOGY	3

Polymer

Code	Title	Semester Hours
CH 645	POLYMER PHYSICAL CHEMISTRY	3
CH 649	POLYMER SYNTHESIS & CHARACTERIZATION	3

Code	Title	Semester Hours
CH 700	CURRENT TOPICS IN CHEMISTRY	1-3

Innovative Strategies (new courses coming soon!)

Code	Title	Semester Hours
CH 660		
CH 661		
CH 662		

Graduate Certificate in Technology and Innovation Management

Code	Title	Semester Hours
MGT 505	NEW VENTURES STRATEGIES	3
MGT 601	TECHNOLOGY & INNOVATION MANAGEMENT	3
MGT 629	LEADERSHIP: THEORY & PRACTICE	3
MGT 631	HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR	3
MGT 640	PRINCIPLES OF PROJECT MANAGEMENT	3

Master of Business Administration

Code	Title	Semester Hours
ACC 600	FOUNDATIONS OF ACCOUNTING FOR MANAGERS AND ENGINEERS	3
ACC 602	MANAGERIAL ACCOUNTING	3
ECN 600	FOUNDATIONS OF ECONOMICS	3

ECN 626	MANAGERIAL ECONOMICS AND TECHNOLOGY	3
FIN 601	FINANCIAL DECISIONS UNDER UNCERTAINTY	3
MGT 622	MANAGING HUMAN CAPITAL	3
MGT 629	LEADERSHIP: THEORY & PRACTICE	3
MKT 601	MARKETING STRATEGY & ANALYSIS	3
MSC 600	QUANTITATIVE METHODS	3
MSC 605	OPERATIONS MANAGEMENT	3
MGT 698	STRATEGIC MANAGEMENT	3
Choose one of the following		
MSC 622	ANALYTICS FOR MANAGERS	3
MGT 601	TECHNOLOGY & INNOVATION MANAGEMENT	3
MKT 604	NEW PRODUCT DEVELOPMENT	3
IS 601	MANAGEMENT OF INFORMATION TECHNOLOGY	3

Computer Science

N300 Olin B King Technology Hall
Telephone: 256.824.6088
Email: info@cs.uah.edu

Chair: Dr. Letha Etzkorn (https://www.uah.edu/science/faculty-staff/letha-etzkorn/)

The Computer Science department offers the following graduate degree programs:

- Master of Science in Computer Science (p. 212)
- Master of Science in Computer Science - Data Science Concentration (p. 213)
- Ph.D. in Computer Science (p. 211)

The Computer Science department offers the following interdisciplinary graduate degree programs:

- Master of Science in Software Engineering (interdisciplinary) (p. 213)
- Master of Science in Cybersecurity (interdisciplinary) (p. 150)
- Certificate in Modeling & Simulation (interdisciplinary) (p. 215)

Learning Outcomes

- Graduates will have advanced knowledge of computer systems.
- Graduates will be proficient in the development and usage of software systems and tools.
- Graduates are able to develop solutions based on advanced algorithmic principles.

General Requirements

Prospective students should apply well in advance (at least eight weeks for United States residents and six months for international students) of the date of proposed entrance.

All applicants for graduate programs in Computer Science must apply through the Graduate School. Visit the Graduate School for more information. All applicants are also subject to the additional requirements below.

Admission Requirements

Requirements for admission to the computer science graduate degree program are in addition to those of the Graduate School. Scores from the GRE basic test are required for admission to the program. Transcripts will be reviewed and deficiencies in computer science background may result in the need to take one or more broadening courses. The MAT or GMAT is not an acceptable substitute for the GRE.

Requirements for admission to a graduate certificate program are the same as requirements for admission to the Computer Science M.S. program. Students must also satisfy the breadth requirements described below. Students in a certificate program are required to maintain a 3.000 GPA.

Students applying for the master's program are expected to have an undergraduate background in Computer Science. Those students who do not have such a background must satisfy the breadth requirements described below. In particular, students in the M.S. in Computer Science program who have not had an undergraduate course in programming languages must take CS 424 or CS 524.

The admission policies for the Ph.D. program in computer science follow the general policies of the Graduate School and Computer Science Department as described above. An applicant's admission request will be reviewed in light of preparatory coursework, GRE scores, any supporting information, and general expectation of completing the degree. Students requiring a large amount of prerequisite coursework will not normally be admitted to the program until the courses have been completed. Graduate admission requests for the Ph.D. program will be reviewed once per semester by a departmental admissions committee. Applicants are required to submit supporting recommendation letters and an indication of research interests and study plans. Specific requirements are available from the Computer Science Department office. Requests for admission will be evaluated according to the following guidelines.

Unconditional Admission

Students applying to the M.S. program will be given unconditional admission if they meet all the requirements of the School of Graduate Studies and of the Computer Science Department including the breadth requirements listed below.

Unconditional admission to the Ph.D. program will be given to applicants who meet all of the requirements of the School of Graduate Studies and Computer Science Department. Students showing exceptional promise who desire to pursue the Ph.D. full-time may be admitted to the program after completing a bachelor's degree in Computer Science.

Conditional Admission

Conditional admission will be recommended for applicants who do not meet all of the requirements of the School of Graduate Studies and the Computer Science Department, but show high potential for completing the degree requirements.

Breadth Requirements

The breadth requirements can be satisfied in one of the following ways:

- Completion of the course at UAH with a grade of B or better;
- Completion of an equivalent course at another institution with a grade of B or better;
- Testing out of the course, where permitted by departmental policy

Applicants to graduate programs in Computer Science must satisfy the following breadth requirements before admission to the program:

Code	Title	Semester Hours
Mathematics		
MA 171	CALCULUS A	4
MA 172	CALCULUS B	4
MA 244	INTRODUCTION TO LINEAR ALGEBRA	3
MA 385	INTRODUCTION TO PROBABILITY AND STATISTICS	3
Computer Science		
CS 121	COMPUTER SCIENCE I *	3
CS 214	INTRO DISCRETE STRUCTURE	3
CS 221	COMP SCI II: DATA STRUCTURES *	3
CS 309	COMPUTER ORG & SWTCHNG THRY	3
CS 317	INTRO DESIGN/ANALYSIS OF ALG	3
CS 321	INTRO OBJECT-ORIENTED PROG JAV *	3
CS 413	INTRO DIGITAL COMP ARCHITECTUR	3
CS 490	INTRO TO OPERATING SYSTEMS	3
Total Semester Hours		**38**

* An introductory sequence covering Object-Oriented Programming and Data Structures in C/C++/Java.

- Computer Science, MSCBS (p. 150)
- Computer Science, PhD (p. 211)

CS 513 - INTENSIVE COMP ARCH & OS
Semester Hours: 4

Combinational circuits and sequential circuits. Computer hardware organization including CPU, instruction representation Assembly language. Floating point. Register transfer. Pipelining, memory systems including cache. Digital arithmetic, I/O units. Scheduling, file management, processes, threads, virtual machines, hypervisors. Prerequisites: MA 172 or equivalent and (CS 521 or CS 221 or CPE 212 or equivalent).

CS 517 - INTENSIVE COMPUTING THEORY
Semester Hours: 4

Intensive introduction to computing theory selected core topics from the undergraduate Computer Science curriculum, including Boolean algebra, digital logic, proof methods, recursion and recurrences, graphs and trees, iterative and recursive algorithms, sorting and searching algorithms, and divide- and-conquer algorithms. Prerequisites: MA 172 or equivalent and (CS 521 or CS 221 or CE 211 or equivalent).

CS 521 - INTENSIVE INTRODUCTION TO PROGRAMMING AND SOFTWARE ENGINEERING
Semester Hours: 4

A comprehensive, intensive introduction to programming, data structures, software engineering, and problem solving fundamentals. Primary language used in this course is C++, with an intro to other widely used languages, such as Java and Python. No credit for students who have taken data structures. No credit for CS gradaute students. Prerequisite: MA 172.

CS 524 - PRINCIPLES PROGRAMMING LANG
Semester Hours: 3

Comparison of principles and paradigms of modern programming languages. How different programming languages implement lexical, syntax, and semantic analysis, including the design of compilers. Formal grammars, BNF notation, parse trees, abstract data types. No credit for student who have taken CS 424. Prerequisite: CS 317 or CS 517.

CS 526 - PROG TRANS & COMPILER CONSTR
Semester Hours: 3

Language representation; grammar classification; lexical analysis technique and tools; parsing technique and tools; compile-time and run-time symbol table design; code generation and optimization; error diagnostics. Compiler writing tools. Prerequisite: CS 317 or CS 517; (CS 424 or CS 524 and CS 403 recommended).

CS 530 - SURVEY ARTIFICIAL INTELLIGENCE
Semester Hours: 3

Survey of Artificial Intelligence (AI). AI crosses many disciplines, to make computational systems behave intelligently. This course provides a broad intro of AI sub-domains, including search, knowledge representation, reasoning, & machine learning. No credit for students who have taken CS 430. Prerequisite: CS 317 or CS 517; (CS 424 or CS 524 recommended).

CS 543 - INTRO TO MULTIMEDIA SYSTEMS
Semester Hours: 3

Multimedia authoring, color models for image and video, introduction to image and video compression, digital audio, multimedia networks, multimedia synchronization, multimedia retrieval. Students may not receive credit for both CS 443 and CS 543. Prerequisite: CS 317 or CS 517; (CS 490 recommended).

CS 545 - INTRO COMPUTER GRAPHICS
Semester Hours: 3

Introduces underlying theory and mechanics of interactive computer graphics. Basic modeling, rasterization, 2D/3D transformations, and viewing. 3D graphics rudiments. Some hardware and historical perspectives. Many programs. No credit for students who have taken CS 445 Prerequisites: (CS 221 or CS 517) and MA 244.

CS 546 - ADVANCED COMPUTER GRAPHICS
Semester Hours: 3

High resolution 3D graphics, including advanced topics in viewing, vertex processing, fragment processing, local and global illumination and shading, 3D modeling (including curve and surface representation), texture mapping, and some coverage of solid modeling and color theory. Game production pipeline. Hierarchical issues, visibility, and 3D processing algorithms may also be covered. A significant number of programming projects are involved, with some different program requirements and additional theoretical expectations for CS 546 students. (Same as CS 456; no credit for both). Prerequisite: CS 445 or CS 545.

CS 547 - GAME ENGINES & LEVEL DEV
Semester Hours: 3

(Same as CS 447) This course provides the opportunity for students to produce fully functional games from beginning to end with team members. Along the way, students work on homework/projects involving design document creation, prototyping and gameplay/implementation. Also, game software as artistic content has led to collaborations between engineers and artists. In this course, students focus on not only game engineering development but also art asset generation and management. Considers a 3D game design and development using game engines focusing on the fundamental components for developing cross-platform games. The course focus includes design, development, and distribution of computer games. Emphasis also is on user interface and menus, scripting for game programming, game physics, terrain generation, asset management, animation management, special effects, and cross platform game development. Students may not receive credit for both CS 447 and CS 547. Prerequisites: CS 330 and (CS 445 or CS 545).

CS 548 - HUMAN-COMPUTER INTERACTION
Semester Hours: 3

Introduces underlying theory and mechanics of interactive computer graphics. Basic modeling, rasterization, 2D/3D transformations, and viewing. 3D graphics rudiments. Some hardware and historical perspectives. Many programs. Introduction to human-computer interaction and principles of graphical user interface design. Includes examination of interactive environments including windowing systems development tools, multimedia, and visual programming interfaces. Prerequisite: CS 445 or CS 545.

CS 553 - CLIENT/SERVER ARCHITECTURES
Semester Hours: 3

Client/server distributed computing. Web based applications. Students will practice concepts in programs involving leading edge technologies such as AJAX, RESTful and WS-* web services, Enterprise Java Beans, .NET. No credit for students who have taken CS 453 Prerequisite: (CS 307 or CS 321) (CS 370 recommended).

CS 554 - INTRO TO CLOUD COMPUTING
Semester Hours: 3

Different cloud computing paradigms: IaaS, SaaS, PaaS. Open Source cloud software (for ex., OpenStack, CloudStack). RESTful interfaces, AWS interface. Cloud security. Students may not receive credit for both CS 454 and CS 554. Though not required as a prereq, students are recommended to have taken CS 390 or CS 590. Prerequisites: (CS 307 or CS 321 or CPE 353) and (CS 370, or CPS 348, or IS 460 or IS 560).

CS 565 - NETWORK SECURITY
Semester Hours: 3

Fundamentals of network security and cryptography. Examines security at different network layers. Wireless security. Firewalls. Intrusion detection and penetration analysis. Students may not receive credit for both CS 465 and CS 565. Prerequisites: CS 221 or CPE 212.

CS 566 - OFFENSIVE SECURITY
Semester Hours: 3

Theoretical and practical network and web app Penetration Testing with hands on labs for the firve ethical hack phases including reconnaissance, scanning & vulnerability assessment, gaining access and exploitation, maintaining access, covering tracks. Other red-team offensive security approaches.

CS 571 - MOBILE COMPUTING SFTWR ARC&DEV
Semester Hours: 3

Considers application design for the mobile space, focusing on the fundamental requirements for mobile applications that target mobile devices. The course focus includes development, testing, distribution of mobile applications in a cross-platform environment. Emphasis also is on multimedia and entertainment computing and games. This course will also cover various issues in mobile computing from the readings from research literature such as software engineering practices, analysis of social media and general mobile analytics. Prerequisites: CS 221 or CPE 212.

CS 580 - MOBILE DIGITAL FORENSICS
Semester Hours: 3

This course examines digital forensics of mobile devices such as smart phones and tablets in a law enforcement context. Mobile device characteristics that make forensics examinations difficult are discussed. Various forensics tools are critically examined with an eye toward improved tool development. Prerequisites: CS 413 or CS 513 or CPE 323.

CS 581 - MODELING & SIMULATION I
Semester Hours: 3

Discrete event simulation from a computer science perspective. Mathematics of probability distributions applied to simulation. Design, implementation, and application of discrete event simulation software. Application to computer and network system design. Prerequisites: CS 221 and either MA 385 or MA 585 OR ISE 390 or ISE 690.

CS 582 - MODELING & SIMULATION II
Semester Hours: 3

Advanced modeling methods, including Monte Carlo simulation, agent-based modeling, and mathematical modeling, from a Computer Science perspective. Emphasis on implementation, execution, and validation of working computer models using different modeling methods. Prerequisites: CS 481 or CS 581.

CS 585 - INTRO CYBERSECURITY ENGR
Semester Hours: 3

Introduction to cryptography, computer security, security management, auditing, process analysis, software security, evaluation, and testing. Focuses on tools, processes, and methods needed to design, implement, and test systems and to adapt existing systems to survive in a hostile environment. . No credit for students who have taken CS 485 or CPE 449 Prerequisites: CS 370 or CPE 348.

CS 588 - INTRO TO BIG DATA COMPUTING
Semester Hours: 3

Provides big data concepts and characteristics; big data architectural concepts; big data ecosystem. Includes MapReduce framework and programming and coverage of big data applications. No credit for students who have taken CS 488 Prerequisites: CS 317 or CS 517.

CS 590 - PROGRAMMING ENVIRON W/UNIX
Semester Hours: 3

Strategies for design and development of systems and programs in the UNIX environment. Emphasis: automated tool and system development using UNIX tools. Advanced shell concepts including control flow and interrupt handling. Process and inter-process communication. Prerequisites: CS 221; (CS 390 recommended).

CS 595 - INDEPENDENT STUDY
Semester Hours: 3

Individual directed study under the supervision of an instructor. Must have approval of the instructor.

CS 596 - SPECIAL TOPICS
Semester Hours: 3

Individual directed study under the supervision of an instructor. Must have approval of the instructor.

CS 600 - INTERNSHIP IN COMPUTER SCIENCE
Semester Hour: 1

Work experience in Computer Science or a related field in a business or government agency; conducted under the direction of the agency supervisor and approved by a member of the CS faculty. A substantial report must be produced and approved by the supervisor and the faculty member.

CS 603 - FORMAL LANG/AUTOMAT THRY
Semester Hours: 3

Formal definition of programming languages. Formal grammars: regular, context-free, context sensitive, and phrase-structure. Automata: finite-state, pushdown, linear-bounded automata, Turing Machines. Relationship between formal languages and automata.

CS 613 - COMPUTER ARCHITECTURES
Semester Hours: 3

Organization, operation, and analysis of advanced computer architectures. Topics include advanced pipelining approaches, multi-processor architectures, instruction set architectures, memory hierarchy design, hardware and software-based performance optimization, and system performance measurement. Prerequisite: CS 513.

CS 617 - DES & ANALY OF ALGORITHM
Semester Hours: 3

Strategies of algorithm synthesis and analysis. Classical algorithm categories such as: divide-and-conqurer, greedy method, dynamic programming, search and traversal. Computational complexity; theoretical results from lower- and upper-bound studies, NP-hard, and NP-complete problems. Prerequisite: CS 517.

CS 630 - ARTIFICIAL INTELLIGENCE I
Semester Hours: 3

Comparing and evaluating different approaches to the architecture and development of intelligent systems. Computationally efficient solutions for intelligent systems. Prerequisite: CS 530.

CS 637 - DEEP LEARNING
Semester Hours: 3

Deep learning, a branch of machine learning focuses on modern neural networks. Deep learning extracts layered data representations to maximize task performance. Requires advanced algorithm and programming knowledge and a strong mathematical background in calculus, linear algebra, and probability & statistics. Several programming projects. Prerequisites: (CS 317 or CS 517) and MA 244 and (MA 385 or ISE 390).

CS 640 - MACHINE LEARNING
Semester Hours: 3

Discriminant analysis, maximum likelihood decisions, deterministic and nondeterministic approaches for trainable classifiers, preprocessing and feature extraction, clustering, syntatic pattern recognition. Pattern recognition in image analysis. Prerequisites: (CS 317 or CS 517) and MA 244 and (MA 385 or ISE 390).

CS 641 - DATA MINING
Semester Hours: 3

Data preprocessing, distance measures, classification with decision trees, Bayesian classifiers, neural networks, support vector machines, frequent item set analysis, association rule generation, clustering methods. Prerequisites: (CS 317 or CS 517) and MA 244 and (MA 385 or ISE 390).

CS 642 - COMP PROC/DIGITAL IMAGES
Semester Hours: 3

Introduction to image processing systems; sensing, sampling and quantization; image transforms; image enhancement and restoration; image segmentation, and description; image correlation; image sequence analysis; practical applications of image processing. Prerequisites: (CS 317 or CS 517) and MA 244, MA 385.

CS 646 - COMPUTER GEOMETRY MODELING
Semester Hours: 3

Numerical and computer representation of curves and surfaces. Solid geometry modeling. Geometric data management. Curve and surface design, including cubic-B-splines, especially Bezier curves/surfaces. Interpolation methods. Graph-based and Boolean models. Applications to robotics, graphics, CAD. Prerequisite: CS 545.

CS 650 - SOFT'W ENGINEERING PROC
Semester Hours: 3

The process of developing complex software products. Includes software life cycles, phases of development and disciplines such as CM, QA, V&V, and T&E. Issues of professionalism and the ethical use of computers. Background in algorithms and programming languages assumed. Prerequisite: CS 317 or CS 517 or CS 521.

CS 652 - OBJECT-ORIENTED DESIGN
Semester Hours: 3

A survey of formal and informal techniques and methodologies for software analysis, requirements, architecture and design. Emphasis is on effective development processes. Comparison of different approaches, considering their advantages and disadvantages. Prerequisite: CS 650.

CS 656 - SOFTWARE TESTING
Semester Hours: 3

Advanced software testing techniques, including white box, black box, integration testing, and system testing. Other topics may include test data adequacy, test data selection, and output oracle, including functional, structural, and fault-based testing methods. Prerequisite: CS 650.

CS 658 - SOFTWARE PROC & PROD IMPROVEMT
Semester Hours: 3

Software quality assurance as an umbrella activity. Use of process, project, quality and product metrics to gain insight into the software development activity. Use of metrics to drive incremental process improvement techniques. Examination of CASE tools and how they affect the software process. Prerequisite: CS 490 or CS 513.

CS 670 - WIRELESS SENSOR NETWORKS
Semester Hours: 3

Detailed analysis of the organization and operation of wireless sensor networks. Node and network architecture, link-layer protocols, naming and addressing, topology control, routing protocols, data-centric and content-centric networking, transport layer and quality of service. Prerequisites: CS 370 or CPE 348, minimum grade of C-.

CS 681 - MALWARE ANALYSIS
Semester Hours: 3

The goal of this course is to introduce the students to malware analysis. Malware analysis involves both static and dynamic analysis as well as obfuscation techniques. This course assumes basic knowledge of reverse engineering/static analysis. After completing the course a student should be able to statically analyze a malware even if advanced obfuscation techniques are used. Further, the student should be able to setup a sandboxed environment for dynamic analysis and it to dynamically analyze the malware and draw conclusions about the purpose, nature and exploit used by the malware. Prerequisite: CPE 457 or CPE 557 (minimum grade of C-).

CS 685 - APPLIED CRYPTOGRAPHY
Semester Hours: 3

Principles and concepts of applied cryptography. Classical cipher's, advanced encryption standard, public-key cryptography and RSA, key exchange and Diffie-Hellman, hashing, authentication, digital signatures, and other cryptography-related issues. Prerequisites: CS 370 or CPE 348.

CS 687 - DATABASE SYSTEMS
Semester Hours: 3

Basic concepts of database systems. Use of semantic models in database design. Data models with an major focus on the relational and object-oriented models. Relational query languages and normal forms. Database management system design issues. Security and integrity issues. Prerequisite: CS 617.

CS 690 - ADVANCED OPERATING SYSTEMS
Semester Hours: 3

Issues related to shared memory multiprocessors, multicore computers, clusters, grids and clouds. Concurrency and distributed process coordination. Introduction to network communication issues and systems such as client-server, peer-to-peer, and transaction based. Prerequisite: CS 513.

CS 692 - CYBERSECURITY CAPSTONE
Semester Hours: 3

A capstone course emphasizing the integration of various principles, theories, and techniques for developing, implementing and using cybersecurity strategies and applications in organizations. Includes readings, lectures, situation analysis, cases, and the completion of a major practical project. Normally taken in the last semester of a student's program. Minimum grade B required. Prerequisites: (IS 501 or CS 585 or CPE 549) and IS 550.

CS 695 - INDEPENDENT STUDY
Semester Hours: 3

Individual directed study under the supervision of an instructor. Must have instructor approval.

CS 696 - SELECTED TOPICS IN CS
Semester Hours: 3

Course offered by an instructor in a specialized area of computer science. Must have instructor approval.

CS 699 - MASTER'S THESIS
Semester Hours: 6

Must have instructor approval. Required each semester a student is working and receiving direction on a master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

CS 717 - ADV ALGORITHM DES/ANALYSIS
Semester Hours: 3

Parallel algorithms, combinatorial algorithms, approximation algorithms for NP-complete problems, computational complexity. Distribution of algorithms across complex architectures. Prerequisite: CS 617.

CS 790 - OPERATING SYSTEMS SEMINAR
Semester Hours: 3

Advanced research topics in operating system theory and practice. Students will read and discuss classic and current papers in the literature. Each student will present reports in class and prepare a substantial research paper. Prerequisite: CS 690.

CS 795 - INDEPENDENT STUDY
Semester Hours: 3

Individual directed study under the supervision of an instructor. Must have instructor approval.

CS 796 - ADVANCED SELECTED TOPICS
Semester Hours: 3

Course offered by an instructor in a specialized area of computer science. Must have instructor approval.

CS 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation. Maximum of 18 hours credit toward degree.

Certificates in Computer Science

Data Science Certificate (p. 214)

Modeling and Simulation Certificate (p. 215)

Software Engineering Certificate

Computer Science, PhD

Degree Requirements and Restrictions

The general requirements for the Ph.D. degree comply with those of the UAH Graduate School. The requirements include a preliminary examination, completion of coursework, a qualifying examination, completion of significant research documented in a dissertation, and the dissertation defense.

Major/Minor Subjects

A minimum of 54 hours of graduate course credit plus a minimum of 18 dissertation credit hours is required for the Ph.D. in Computer Science. The Program of Study (POS) will be approved by the student's supervisory committee. Coursework grade requirements are the same as for the M.S. degree. Coursework taken as part of a graduate degree program at another institution may be applied to the degree with permission of the student's Supervisory Committee.

The program must include the courses described below and must have a coherent area of emphasis, of which at least six credit hours must be at the 700 level. At least nine credit hours of graduate level mathematics must also be included in the program.

Code	Title	Semester Hours
CS 524	PRINCIPLES PROGRAMMING LANG	3
CS 603	FORMAL LANG/AUTOMAT THRY	3
CS 613	COMPUTER ARCHITECTURES	3
CS 617	DES & ANALY OF ALGORITHM	3
CS 650	SOFT'W ENGINEERING PROC	3
CS 690	ADVANCED OPERATING SYSTEMS	3
Total Semester Hours		**18**

Additional Information

Preliminary Examination

Ph.D. students will be required to take a preliminary examination, consisting of (1) a written test covering fundamental concepts in Computer Science and (2) an evaluation by the graduate faculty of the student's overall academic potential.

The examination must be taken within a year after admission to the Ph.D. program, or at the earliest opportunity upon completion of the core coursework. Successful completion of the examination will provide evidence of the student's ability to continue in pursuit of the Ph.D. degree. The examination can be taken no more than twice.

Admission to Candidacy

To be admitted to candidacy for the Ph.D. degree, students must first pass the qualifying examination. The qualifying examination can cover any aspect of the student's program and is taken after completion of the student's coursework and upon recommendation of the student's supervisory committee. It is designed to test students' fitness for pursuing research projects in their chosen areas and to test their general knowledge of computer science. As part of the qualifying examination, each student will present a research proposal to the supervisory committee.

Residency Requirements

According to graduate school policy, residence may be established through either (i) being enrolled as a full-time student (at least nine graduate credit hours) either for one continuous academic year, or for Spring and Fall semesters in the same calendar year, or (ii) being enrolled in at least six hours of graduate course work in at least three of four consecutive semesters.

Grade Requirements

A grade of B or better must be earned in each of the core courses. No grade lower than C can be counted toward a Ph.D. Degree.

Courses Outside the Department

The following non-CS courses may be included in a CS Ph.D. program of study: any graduate level mathematics course, any graduate level computer engineering course, and ISE 526, ISE 690, and ISE 790. Those three ISE courses may be counted toward the Ph.D. mathematics requirement.

All non-CS courses must be approved by the Ph.D. advisor, and normally only three courses outside the Computer Science department may be included. Courses other than those listed above may not be included unless part of a cohesive area of study approved in advance by the Ph.D. advisor and the dissertation committee.

Other Requirements for the PhD Degree

- The program must be completed within five years after admission to candidacy.
- The Qualifying Examination may be taken no more than twice.
- CS 799 is required each semester a student is receiving direction on the doctoral dissertation.

For additional requirements, consult the Academic Information (p. 7) Section of this Graduate Catalog.

Dissertation

A public defense of the dissertation is required. Three conference papers or one journal article related to the dissertation work must be published or accepted prior to scheduling the dissertation defense.

Computer Science, MS

Degree Requirements and Restrictions

The Master of Science degree is conferred under Plan I or Plan II.

Plan I

A minimum of 24 semester hours of coursework and the writing of an acceptable thesis is required. At least six hours of thesis credit (CS 699) must be earned. A student must present his/her thesis and pass an oral examination based on the thesis and related coursework. Plan I students must register for CS 699 each term they receive supervision from their advisor.

Plan II - Master of Science without Thesis

A minimum of 33 semester hours of coursework is required.

Course Requirements

The following requirements and restrictions apply to a student in either plan. A grade of B or better must be earned in each of the core courses.

All M.S. students must take three core courses from the options below:

Code	Title	Semester Hours
CS 617	DES & ANALY OF ALGORITHM	3
CS 613	COMPUTER ARCHITECTURES	3
or CS 690	ADVANCED OPERATING SYSTEMS	
CS 650	SOFT'W ENGINEERING PROC	3
or CS 687	DATABASE SYSTEMS	

If a student has not had an undergraduate course in programming languages, CS 524 must be included in the program of study. No more than 50 percent of the hours in the program of study may be 500-level courses. No more than three semester hours of selected topics or independent study courses may be included in a program of study. Exceptions must be recommended by the student's advisor and approved by the department chair. All courses taken as part of the M.S. in Computer Science will normally be Computer Science courses. Any courses outside the Computer Science

department must be approved in advance by a Computer Science advisor. Historically, this has been the advisement practice in Computer Science. This is simply making sure that students are fully aware of the expectations of the Computer Science department, even before meeting with an advisor.

Data Science Concentration

The Data Science Concentration consists of 15 credit hours, taken as follows:

Code	Title	Semester Hours
Computational Statistics/Algorithm Design, must take both courses (6 hours):		
CS 588	INTRO TO BIG DATA COMPUTING	
CS 617	DES & ANALY OF ALGORITHM	
Group A, select 2 courses (6 hours):		
CS 637	DEEP LEARNING	
CS 640	MACHINE LEARNING	
CS 641	DATA MINING	
CS 687	DATABASE SYSTEMS	
Group B, select 1 course (3 hours):		
CS 530	SURVEY ARTIFICIAL INTELLIGENCE	
CS 543	INTRO TO MULTIMEDIA SYSTEMS	
CS 545	INTRO COMPUTER GRAPHICS	
CS 554	INTRO TO CLOUD COMPUTING	
CS 581	MODELING & SIMULATION I	
CS 582	MODELING & SIMULATION II	

Note that a student in the M.S. in Computer Science (CS) program can easily complete this concentration while also completing the M.S. in CS. The M.S. in CS has three core courses (nine hours) where one of these is CS 617, which is a required course for the Data Science certificate. The non-thesis M.S. in CS has eight electives, and the thesis M.S. in CS has five electives; the remaining four courses required for the Data Science concentration may count as four of these elective courses.

The breadth requirements for admission to the M.S. in CS with Data Science Concentration will be the same as for admission to the current M.S. in CS program.

Computer Science, MSSE

Degree Requirements and Restrictions

The Master of Science in Software Engineering (MSEE) is an interdisciplinary program, joint between the Computer Science Department and the Electrical and Computer Engineering Department.

At least half of the hours must be completed in courses numbered 600 or above.

The MSEE is conferred under Plan I or Plan II.

Plan I (Thesis)

A minimum of 24 credit hours of coursework and the writing of an acceptable thesis is required. At least six hours of thesis credit (CS 699) must be earned. Thesis students substitute the two CS 699 courses for the Capstone Course and one elective. Total hours required is 30 hours.

A student must present their thesis and pass an oral examination based on the thesis and related coursework. Plan I students must register for CS 699 each semester that they receive supervision from their advisor.

Plan II (Non-Thesis)

A minimum of 30 credit hours of coursework is required.

Code	Title	Semester Hours
CS 617	DES & ANALY OF ALGORITHM	3
CS 650	SOFT'W ENGINEERING PROC	3
CS 656	SOFTWARE TESTING	3

Choose one of the following:		
CS 613	COMPUTER ARCHITECTURES	
or CS 690	ADVANCED OPERATING SYSTEMS	
or CPE 536	INTERNALS OF MODERN OPER SYS	
or CPE 631	ADV COMP SYSTEMS ARCHITECTURE	
Cybersecurity Requirement		**3**
Choose one of the following:		
CS 585	INTRO CYBERSECURITY ENGR	
or CPE 549	INTRO TO CYBERSECURITY ENGINRG	
Capstone		**3**
CPE 657	SOFTWARE STUDIO	3
Concentration Areas		**6**
Choose two courses within any one concentration:		
Big Data and Data Mining		
CS 530	SURVEY ARTIFICIAL INTELLIGENCE	
CS 554	INTRO TO CLOUD COMPUTING	
CS 588	INTRO TO BIG DATA COMPUTING	
CS 640	MACHINE LEARNING	
CS 641	DATA MINING	
Project Management (ISE 690 is required as one of the two courses)		
ISE 690	STATISTICAL METHODS FOR ENGR	
EM 660	ENGR MGMT THEORY	
MGT 601	TECHNOLOGY & INNOVATION MANAGEMENT	
MKT 604	NEW PRODUCT DEVELOPMENT	
Parallel Programming		
CPE 512	INTRO PARALLEL PROGRAMMING	
CPE 612	PARALLEL ALGORITHMS	
CPE 613	GEN PURPOSE GPU COMPUTING	
Embedded Systems		
CPE 538	REAL TIME & EMBEDED SYSTEMS	
CPE 523	HARDWARE/SOFTWARE CO-DESIGN	
CPE 621	ADVANCED EMBEDDED SYSTEMS	
Advanced Cybersecurity		
CS 580	MOBILE DIGITAL FORENSICS	
CPE 649	ADV CYBERSECURITY ENGINEERING	
CPE 645	COMPUTER NETWORK SECURITY	
or CS 685	APPLIED CRYPTOGRAPHY	
Electives (Must be an approved CS or CPE course)		**6**
Total Semester Hours		**30**

Data Science Certificate

The certificate in Data Science requires 15 graduate credit hours of coursework.

Code	Title	Semester Hours
Computational Statistics/Algorithm Design:		**6**
CS 588	INTRO TO BIG DATA COMPUTING	
CS 617	DES & ANALY OF ALGORITHM	
Group A: choose 2 courses		**6**
CS 637	DEEP LEARNING	
CS 640	MACHINE LEARNING	
CS 641	DATA MINING	

CS 687	DATABASE SYSTEMS	
Group B: choose 1 course		**3**
CS 530	SURVEY ARTIFICIAL INTELLIGENCE	
CS 543	INTRO TO MULTIMEDIA SYSTEMS	
CS 545	INTRO COMPUTER GRAPHICS	
CS 554	INTRO TO CLOUD COMPUTING	
CS 581	MODELING & SIMULATION I	
CS 582	MODELING & SIMULATION II	
Total Semester Hours		**15**

Modeling and Simulation Certificate

The Modeling and Simulation Certificate requires 15 graduate credit hours of coursework.

Code	Title	Semester Hours
Core Courses		
CS 581	MODELING & SIMULATION I	3
CS 582	MODELING & SIMULATION II	3
Groups		
Select two courses from one of the following groups:		6
Object-Oriented Programming and Software Engineering:		
MOD 501	SVY MODELING & SIMULATION	
CS 650	SOFT'W ENGINEERING PROC	
Visualization:		
CS 545	INTRO COMPUTER GRAPHICS	
CS 546	ADVANCED COMPUTER GRAPHICS	
CS 548	HUMAN-COMPUTER INTERACTION	
CS 646	COMPUTER GEOMETRY MODELING	
Information Systems:		
CS 530	SURVEY ARTIFICIAL INTELLIGENCE	
CS 553	CLIENT/SERVER ARCHITECTURES	
CS 630	ARTIFICIAL INTELLIGENCE I	
CS 670	WIRELESS SENSOR NETWORKS	
CS 687	DATABASE SYSTEMS	
Additional Course		
Select one additional course from those listed above, or an approved domain course		3
Total Semester Hours		**15**

Software Engineering Certificate

The Software Engineering certificate requires 18 graduate credit hours of coursework.

Code	Title	Semester Hours
Software Engineering required courses		**3**
CS 650	SOFT'W ENGINEERING PROC	
Five additional courses selected from:		
At least two additional Software Engineering courses from the following:		**6**
CS 553	CLIENT/SERVER ARCHITECTURES	
CS 652	OBJECT-ORIENTED DESIGN	
CS 656	SOFTWARE TESTING	
Three courses selected from the following:		**9**
Statistics Option		

ISE 690	STATISTICAL METHODS FOR ENGR	
Management Option (Select one)		
MGT 601	TECHNOLOGY & INNOVATION MANAGEMENT	
MGT 622	MANAGING HUMAN CAPITAL	
Cybersecurity Option		
CS 585	INTRO CYBERSECURITY ENGR	
Total Semester Hours		**18**

Mathematical Sciences

258A Shelby Center for Science
Telephone: 256.824.6470
Email: mathgrad@uah.edu

Chair: Dr. Toka Diagana (https://www.uah.edu/science/departments/math/math-faculty-staff/toka-diagana/)
Graduate Program Director: Dr. Dongsheng Wu (https://www.uah.edu/science/departments/math/math-faculty-staff/dongsheng-wu/)

The Mathematical Sciences Department offers the following graduate degree programs:

Master of Arts - Mathematical Sciences (https://catalog.uah.edu/grad/colleges-departments/science/mathematical-sciences/mathematical-science-ma/)
Master of Science - Mathematical Sciences (p. 222)
Doctor of Philosophy - Applied Mathematics (p. 221)

Admission Requirements

In addition to fulfilling Graduate School admission requirements, all applicants for graduate study in mathematics or applied mathematics should have completed the equivalent of

- a complete calculus sequence,
- courses in linear algebra,
- abstract algebra,
- introduction to real analysis, and
- six additional semester hours in upper-division undergraduate mathematics courses.

Students deficient in more than two undergraduate courses in mathematics must remove these deficiencies before admission to the mathematics graduate program. Such students should consult the Mathematics Graduate Program Director on how best to remove these deficiencies.

For unconditional admission, applicants must satisfy the requirements of the Graduate School. Only the aptitude portion of the Graduate Record Examination (GRE) is required by the department.

Educational Objectives

The Department of Mathematics provides excellent instruction and resources for the mathematics education of its students, with an objective of producing the next generation of well-educated mathematicians who are critical for the progress of mankind. The Department's second objective is to prepare graduates for careers in government and industry, to teach at the secondary-school or college level, to continue studying mathematics in graduate school, or to be otherwise employed within one year of graduation.

Learning Outcomes

Students will demonstrate:

- Critical thinking skills to construct clear, valid, and succinct proofs
- Knowledge of a variety of technological tools, including computer algebra systems, probability, statistical packages, or computer programming languages
- Good mathematical communication skills, including the ability to convey mathematical knowledge in a variety of settings, both orally and in writing

Master's Programs in Mathematical Sciences

- Mathematical Sciences, MA (p. 222)
- Mathematical Sciences, MS (p. 222)

Doctoral Program in Applied Mathematics

- Applied Mathematics, PhD (p. 221)

MA 502 - INTRODUCTION TO REAL ANALYSIS
Semester Hours: 3

Sequences, limits, continuity, differentiation of functions of one real variable, Riemann integration, uniform convergence, sequences and series of functions, power series, and Taylor series.

MA 503 - INTRODUCTION TO COMPLEX ANALYSIS
Semester Hours: 3

Complex algebra, analytic functions, Cauchy-Riemann equations, exponential, trigonometric, and logarithmic functions, integration, Cauchy integral theorem, Morera's theorem, Liouville's theorem, maximum modulus theorem, residue theory, Taylor and Laurent series, and applications.

MA 506 - METHODS PARTIAL DIFFERENTIAL EQUATIONS
Semester Hours: 3

Survey of theory and methods for solving elementary partial differential equations. Topics include first-order equations and the method of characteristics, second-order equations, reduction to canonical form, the wave equation, the heat equation, Laplace's equation, separation of variables, and Fourier series.

MA 508 - APPLIED LINEAR ALGEBRA
Semester Hours: 3

Fundamental concepts of linear algebra are developed with emphasis on real and complex vector spaces, linear transformations, and matrices. Solving systems of equations, finding inverses of matrices, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors, normal matrices, canonical forms of matrices, applications to systems of linear differential equations, and use of computer software such as MATLAB.

MA 515 - INTRODUCTION TO NUMERICAL ANALYSIS
Semester Hours: 3

Rigorous analysis and derivation of numerical methods for the approximate solution of nonlinear equations; interpolation and integration of functions, and approximating solutions of ordinary differential equations.

MA 520 - INTERMEDIATE DIFFERENTIAL EQUATIONS
Semester Hours: 3

This is a second course in differential equations. Course topics include series solutions for second order differential equations and the method of Frobenious; eigenvalue and eigenvector methods for solving systems of linear first order equations; the qualitative theory of nonlinear equations; boundary value problems and the Sturm-Liouville theory. No credit given to students who have successfully completed MA 524.

MA 524 - DYNAMICAL SYSTEMS I
Semester Hours: 3

Scalar autonomous equations; existence, uniqueness, stability, elementary bifurcations; planar autonomous equations; general properties and geometry, conservative systems, elementary bifurcations linear systems, reduction to canonical forms, stability and instability from linearization. Liapunov functions, center manifolds, Hopf bifurcation.

MA 526 - PARTIAL DIFFERENTIAL EQUATIONS I
Semester Hours: 3

Introduction to the theory for solving partial differential equations. No graduate credit given to students who have completed MA 506 for graduate credit. Topics include second-order equations, reduction to canonical form, well-posedness, the classical equations (wave, heat, and Laplace's) in one and several dimensions, separation of variables, Fourier series, general eigenfunction expansions, Sturm-Liouville theory, first-order linear and quasilinear equations, and shocks. Prerequisite: MA 502.

MA 536 - INTRODUCTION TO P-ADIC ANALYSIS
Semester Hours: 3

Introduction to p-adic analysis. Topics include rings; fields, ideals, congruences, valued fields, non-archimedean valued fields, field of p-adic numbers, field of complex p-adic numbers, ultrametric Banach spaces, p-adic Hibert space, p-adic functions, strictly differentiable functions, Volkenborn Integral, Benoullli numbers, p-adic Gamma function, p-adic Riemann function, and p-adic Zeta function.

MA 538 - METRIC SPACES WITH APPLICATIONS
Semester Hours: 3

Metric spaces, continuous functions, compactness, connectedness, completeness, Arzela-Ascoli theorem, Stone-Weierstrass theorem, Hilbert spaces, contraction mappings, applications to existence and uniqueness of solutions of differential and integral equations. Prerequisites: MA 502.

MA 539 - MULTIDIMENSIONAL ANALYSIS
Semester Hours: 3

Finite-dimensional Euclidean space and sequential approach to its topology, continuous functions and their properties, differentiability and implicit function theorem, Riemann integral, elements of vector calculus, flows and their generating vector fields, introduction to metric spaces. Prerequisite: MA 544.

MA 540 - COMBINATORIAL ENUMERATION
Semester Hours: 3

Counting, pigeonhole principle, permutations and combinations, generating functions, principle of inclusion and exclusion, Polya's theory of counting.

MA 542 - ALGEBRA
Semester Hours: 3

Topics from group theory and ring theory: subgroups, normal subgroups, quotient groups, homomorphisms, isomorphism theorems, ideals, principal ideal domains, Euclidean domains, fields, extension fields, elements of Galois theory.

MA 544 - LINEAR ALGEBRA
Semester Hours: 3

Vector spaces over a field, bases, linear transformations, matrices, determinants, eigenvalues, similarity, Jordan canonical forms, dual spaces, orthogonal and unitary transformations.

MA 562 - INTERMEDIATE FOURIER ANALYSIS
Semester Hours: 3

(Formerly MA 560). Brief review of classical Fourier analysis, Parseval's equality, Gaussian test functions. Introduction to generalized functions, the generalized transform, the generalized derivative, sequences and series of generalized functions, regular periodic arrays of delta functions, sampling, the discrete transform, the fast Fourier transform (other topics as time and interest permit).

MA 565 - INTERMEDIATE MATH MODELING
Semester Hours: 3

Designed for beginning graduate students. No prior experience in formal mathematical modeling is required. In-depth discussion of some types of models from physics, the life sciences, and/or the social sciences, with formulation, analysis, and criticism of the models. Process of and factors involved in formulating a model is of prime importance. Content is divided into approximately one-half deterministic modeling and one-half stochastic modeling.

MA 585 - PROBABILITY
Semester Hours: 3

Course topics include probability spaces, random variables, conditional probability, independence, modes of convergence, and an introduction to sigma-algebras and measurability; distributions, including discrete, continuous, joint and marginal distributions, transformations of random variable, distribution and quantile functions, and convergence in distribution; expected value, including properties of general expected value, mean, variance, covariance, generating functions, and conditional expected value; special models and distributions, including Bernoulli trials and the binomial and negative binomial distributions, the Poisson model and the Poisson and gamma distributions, the normal distribution, finite sampling models and the hypergeometric distribution; the law of large numbers and the central limit theorem.

MA 590 - SELECTED TOPICS IN MATHEMATICS
Semester Hours: 3

Requested selected topics.

MA 607 - MATHEMATICAL METHODS I
Semester Hours: 3

Review of vector calculus and coordinate systems, introduction to tensors, matrices, infinite series, complex variables with applications to calculus of residues, partial differential equations, and Sturm-Liouville theory. Orthogonal functions, gamma functions, Bessel functions, Legendre functions, special functions, Fourier series, integral transform and equations. (Same as PH 607.).

MA 609 - MATHEMATICAL METHODS II
Semester Hours: 3

Continuation of MA 607. (Same as PH 609.) Prerequisite: MA 607.

MA 614 - NUMBER METHODS/LINEAR ALGEBRA
Semester Hours: 3

Norms and vector spaces, matrix factorizations and direct solution methods, stability and conditioning, iterative methods for large linear systems, the algebraic eigenvalue problem. Prerequisites: MA 515 and either MA 508 or MA 544.

MA 615 - NUMBER METHODS PARTIAL DIFFERENTIAL EQUATIONS
Semester Hours: 3

Finite difference methods for parabolic, elliptic, and hyperbolic partial differential equations, error analysis, stability, and convergence of finite difference methods. Prerequisites: MA 515 and (either MA 506 or MA 526) and (either MA 508 or MA 544 or MA 614).

MA 624 - DYNAMICAL SYSTEMS II
Semester Hours: 3

Brief review of linear systems; local theory for nonlinear systems; existence, uniqueness, differentiability, asymptotic behavior, the stable manifold theorem, Hartman-Grobman theorem, Hamiltonian systems; global theory for nonlinear systems; limit sets and attractors, the Poincare map, the Poincare-Bendixson theorem; some aspects of bifurcation theory and chaos; bifurcations at nonhyperbolic fixed points and periodic orbits, homoclinic bifurcations, Melnikov's method, chaos. Prerequisite: MA 524 and either MA 508 or MA 544.

MA 626 - PARTIAL DIFFERENTIAL EQUATIONS II
Semester Hours: 3

Continuation of MA 526. Qualitative results for solutions to the classical equations (energy inequalities, propagation of discontinuities, maximum principles, smoothness of solutions, existence and uniqueness, etc.), non-homogeneous equations, Poisson's equation, Green's functions, and the Cauchy-Kowalewski theorem. Prerequisite: MA 526.

MA 633 - GEOMETRY
Semester Hours: 3

Axioms of incidence and order, affine and metric properties, isometries, similarities, transformation groups, projective planes.

MA 638 - GENERAL TOPOLOGY
Semester Hours: 3

Set theory, logic, well-ordering principle, axiom of choice, topological spaces, product spaces, quotient spaces, continuous functions, connectedness, path connectedness, local connectedness, compactness, local compactness, countability and separation, generalized products, Tychonoff theorem.

MA 640 - GRAPH THEORY
Semester Hours: 3

Graphs, subgraphs, trees, connectivity, Euler tours, Hamilton cycles, matchings, edge colorings, independent sets, vertex colorings, planar graphs, Kuratowski's theorem, four color theorem, directed graphs, networks, cycle, and bond spaces. Prerequisite: MA 540 or MA 542.

MA 643 - GROUP THEORY
Semester Hours: 3

MA 644 - MATRIX THEORY
Semester Hours: 3

Functions of matrices, invariant polynomials, elementary divisors, similarity of matrices, normal forms of a matrix, matrix equations, generalized inverses, non-negative matrices, localization of igenvalues. Prerequisites: MA 508 or MA 503 or MA 544.

MA 645 - COMBINATORIAL DESIGN
Semester Hours: 3

Systems of distinct representatives, difference sets, coding theory, block designs, finite geometries, orthogonal Latin squares, and Hadamard matrices. Prerequisite: MA 540 and MA 544.

MA 650 - THEORY OF DISTRIBUTIONS & FOURIER ANALYSIS
Semester Hours: 3

Topics include Hilbert spaces, convolution, regulaziation, Fourier series, Fourier transform, Fourier transform of the torus, Melin transform, Hankel transform, Laplace, transform, test functions, distributions, derivatives of distributions, elementary operations on distributions, convergence of distributions, fundamental solutions to partial differential equations such as the heat, wave, Schrodinger, and telegraph equations.

MA 653 - REAL ANALYSIS I
Semester Hours: 3

Countable sets, characterization of open and closed sets, Heine-Borel theorem, Riemann integral, Lebesgue measure and outer measure, measurable functions, Lebesgue integral, Fatou's lemma, and Lebesgue-dominated convergence theorem. Prerequisite: MA 538.

MA 654 - REAL ANALYSIS II
Semester Hours: 3

Differentiability of monotone functions, functions of bounded variation, absolute continuity, convex functions, Minkowski and Holder inequalities, Lp spaces, Riesz-Fischer representation theorem, Fubini's theorem and selected topics. Prerequisite: MA 653.

MA 656 - COMPLEX ANALYSIS I
Semester Hours: 3

Topology of the complex plane, analytic functions of one complex variable, elementary functions and their mapping properties, power series, complex integration, Cauchy's theorem and its consequences, isolated singularities, Laurent series, residue theory.

MA 658 - INTRODUCTION TO FUNCTIONAL ANALYSIS
Semester Hours: 3

Normed and inner product spaces, finite dimensional spaces, product and quotient spaces, equivalent norms, Hahn-Banach theorem, principle of uniform boundedness, openmapping theorem, Riesz representation theorem, complete orthonormal sets, Bessel's inequality, Parseval's identity, and conjugate spaces. Prerequisite: MA 538.

MA 661 - SPECIAL FUNCTIONS
Semester Hours: 3

MA 662 - ASYMPTOTIC/PERTURBATION METHOD
Semester Hours: 3

Asymptotic series, regular and singular perturbation theory, asymptotic matching, Laplace's method, stationary phase, steepest descents, WKB theory. Prerequisites: MA 502, and one of the following: MA 503, MA 504, MA 624.

MA 667 - THE CALCULUS OF VARIATIONS AND OPTIMAL CONTROL
Semester Hours: 3

Euler necessary condition for local extremum, Euler-Lagrange equation, Weierstrass necessary condition, Jacobi's necessary condition, corner conditions, problems of optimal control, Pontryagin maximum principles, transversality conditions, applications.

MA 685 - STOCHASTIC PROCESSES WITH APPLICATIONS I
Semester Hours: 3

Discrete and continuous Markov chains, Poisson processes, counting and renewal processes, and applications. Prerequisite: MA 585.

MA 686 - STOCHASTIC PROCESSES WITH APPLICATIONS II
Semester Hours: 3

Gaussian and Wiener processes, general Markov processes, special types of processes from queueing and risk theory, and selected advanced topics. Prerequisite: MA 685.

MA 690 - SPECIAL TOPICS IN MATHEMATICS
Semester Hours: 3

Offered upon demand. Advanced selected topics of interest in areas such as discrete mathematics, numerical analysis, differential equations, and stochastic processes.

MA 695 - GRADUATE SEMINAR
Semester Hour: 1

Selected topics in advanced mathematics, conducted as a research seminar.

MA 699 - MASTER'S THESIS
Semester Hours: 3-9

Required each semester a student is receiving direction on a master's thesis. A minimum of two terms is required. Maximum of nine hours credit awarded upon successful completion of the master's thesis.

MA 715 - NUMBER METHODS PARTIAL DIFFERENTIAL EQUATIONS II
Semester Hours: 3

Finite element methods for parabolic, elliptic, and hyperbolic partial differential equations; error analysis stability, and convergence. Prerequisites: MA 538 and MA 615.

MA 726 - THEORY OF PARTIAL DIFFERENTIAL EQUATIONS
Semester Hours: 3

Hilbert space theory of existence, uniqueness, and regularity for partial differential equations.

MA 740 - COMBINATORIAL ALGORITHMS
Semester Hours: 3

Linear, polynomial and exponential graph theoretic algorithms, generating combinatorial objects, and NP-completeness.

MA 756 - COMPLEX ANALYSIS II
Semester Hours: 3

Applications of residue theory, harmonic functions and their applications, Mittag-Leffler theorem, infinite products, Weierstrass product theorem, conformal mapping and Riemann mapping theorem, univalent functions, analytic continuation and Riemann surfaces, Picard's theorems, and selected topics.

MA 785 - ADVANCED PROBABILITY THEORY
Semester Hours: 3

Measure and integration, probability spaces, convergence concepts, law of large numbers, random series, characteristic functions, central limit theorem, random walks, conditioning, Markov properties, conditional expectations, and elements of martingale theory.

MA 790 - SPECIAL TOPICS
Semester Hours: 3

Offered upon demand. Advanced selected topics of interest in areas such as discrete mathematics, numerical analysis, differential equations, and stochastic processes.

MA 795 - GRADUATE SEMINAR
Semester Hour: 1

Selected topics in advanced mathematics, conducted as a research seminar.

MA 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9

Required each semester a student is receiving direction on a Ph.D. dissertation.

Applied Mathematics, PhD

The Ph.D. degree program in Applied Mathematics is designed to enable students to master a significant body of mathematics, including a specialty in Applied Mathematics; to relate this knowledge to a coherent area of science or engineering other than mathematics; and to carry on fundamental research in Applied Mathematics. Students who are interested in the program should contact the graduate program director of the department.

Each Program of Study requires at least 54 semester hours of graduate coursework, and must include a major area of concentration consisting of at least six courses in addition to the four common core courses, and a minor consisting of at least four related graduate courses in some area outside of the department. The major, minor, and other courses in the Program of Study must be selected so that the student will be prepared to conduct research in an area of Applied Mathematics.

Students must pass three examinations:

- Joint program examination
- Comprehensive qualifying examination
- Dissertation defense

The joint program examination is a written test of the student’s ability to successfully pursue a Ph.D. in Applied Mathematics. It covers a four course common core in real analysis (MA 653, MA 654) and linear and numerical linear algebra (MA 544, MA 614). The joint program examination cannot be taken more than twice.

The comprehensive qualifying examination covers the entire Program of Study and the student’s proposal for a dissertation topic, and is administered by the student’s graduate study supervisory committee on behalf of the Graduate School. The examination is part written and part oral. It cannot be taken more than twice. Upon successful completion of the comprehensive qualifying examination and dissertation proposal, the student is admitted to candidacy for the Ph.D. degree.

The dissertation defense is an oral presentation of the dissertation in the form of a seminar before the student’s graduate study supervisory committee. The dissertation is evidence that the student can independently identify a problem of contemporary significance through familiarity with the current literature in some area of Applied Mathematics, organize and execute a program of research, recognize and analyze the results, and present them in cogent, well-written exposition. It must include mathematical results suitable for publication in a nationally recognized journal.

The Ph.D. degree program in Applied Mathematics is a joint program with UAB and UA of the University of Alabama System. All requirements of the program can be completed at The University of Alabama in Huntsville.

Mathematical Sciences, MA

The Master of Arts is conferred under Plan I (thesis) or Plan II (non-thesis). Students should explore with their faculty advisor which plan is better for their particular objectives. For the M.A. degree, a Program of Study (POS) must include Education courses on advisement from the College of Education. Master's programs that include a thesis (Plan I) require at least 18 semester hours of graduate coursework in mathematics and at least 24 semester hours of total graduate coursework. Programs without a thesis (Plan II) require at least 33 semester hours of graduate coursework and at least 24 semester hours of these should be in mathematics. At least 50 percent of the coursework semester hours must be completed in courses numbered 609 or above. MA 538 or MA 539 and MA 544 should be included in every POS.

Students should plan a POS for the master's degree with the help of a faculty advisor prior to the completion of 12 semester hours of coursework. Courses taken without an approved POS may not apply toward a degree.

Master of Arts with Class A Teaching Certification

Teachers who hold the Alabama Class B Middle/Junior High or High School Certificate may pursue a program of study in mathematics that leads to a Master of Arts degree with Alabama Class A certification. The coursework for such a POS is as follows:

Code	Title	Semester Hours
MA 538	METRIC SPACES WITH APPLICATIONS (or)	3
or MA 539	MULTIDIMENSIONAL ANALYSIS	
MA 542	ALGEBRA	3
MA 544	LINEAR ALGEBRA	3
MA 585	PROBABILITY	3
MA 614	NUMBER METHODS/LINEAR ALGEBRA	3
MA 633	GEOMETRY	3
ST 687	THEORY OF STATISTICS I	3
9 semester hours of appropriate graduate education courses		9
One approved MA or ST course numbered 609 or above		3

Individuals who are interested in obtaining a Master of Arts degree with Alabama Class A certification in mathematics, but who have not completed more than 12 semester hours in teacher education (graduate or undergraduate) courses, should consider the Non-Traditional Fifth-Year Program. The mathematics (MA) and statistics (ST) courses given in the preceding paragraph would be appropriate for such a program. Students should contact the Education Department for preliminary advisement on admission and general program requirements. More details on the Non-Traditional Fifth-Year Program are given in the Education Department section.

Master's Degree Final Examination

A final comprehensive examination is required of all candidates for a master's degree. The candidate will be examined on the coursework and thesis in Plan I and on the coursework in Plan II. In the Mathematical Sciences Department this examination is oral, except that Plan II students who have passed a joint program examination for the Ph.D. degree in applied mathematics may use that examination as their master's degree final examination.

Mathematical Sciences, MS

The Master of Science degree is conferred under Plan I (thesis) or Plan II (non-thesis). Students should explore with their faculty advisor which plan is better for their particular objectives. For the M.S. degree, a Program of Study (POS) must include a minor area in the College of Engineering or the College of Science. All minors must be outside of the department and must include at least six semester hours of approved graduate coursework. Master's programs that include a thesis (Plan I) require at least 18 semester hours of graduate coursework in mathematics and at least 24 semester hours of total graduate coursework. Programs without a thesis (Plan II) require at least 33 semester hours of graduate coursework and at least 24 semester hours of these should be in mathematics. At least 50 percent of the coursework semester hours must be completed in courses numbered 609 or above. MA 538 or MA 539 and MA 544 should be included in every POS.

Students should plan a POS for the master's degree with the help of a faculty advisor prior to the completion of 12 semester hours of coursework. Courses taken without an approved POS may not apply toward a degree. Various areas of mathematics may be stressed in the POS depending on the student's needs. For example, the coursework for a non-thesis POS concentrating in probability and statistics might be:

Code	Title	Semester Hours
MA 538	METRIC SPACES WITH APPLICATIONS	3
or MA 539	MULTIDIMENSIONAL ANALYSIS	
MA 544	LINEAR ALGEBRA	3

MA 585	PROBABILITY	3
MA 653	REAL ANALYSIS I	3
MA 656	COMPLEX ANALYSIS I	3
MA 685	STOCHASTIC PROCESSES WITH APPLICATIONS I	3
ST 687	THEORY OF STATISTICS I	3
MA 686	STOCHASTIC PROCESSES WITH APPLICATIONS II	3
ST 787	THEORY OF STATISTICS II	3
Total Semester Hours		**27**

In addition, the POS should include three approved graduate courses, including at least one numbered 609 or above.

The coursework for a non-thesis POS concentrating in numerical analysis might be:

Code	Title	Semester Hours
MA 515	INTRODUCTION TO NUMERICAL ANALYSIS	3
MA 526	PARTIAL DIFFERENTIAL EQUATIONS I	3
MA 538	METRIC SPACES WITH APPLICATIONS	3
MA 544	LINEAR ALGEBRA	3
MA 614	NUMBER METHODS/LINEAR ALGEBRA	3
MA 615	NUMBER METHODS PARTIAL DIFFERENTIAL EQUATIONS	3
MA 626	PARTIAL DIFFERENTIAL EQUATIONS II	3
MA 715	NUMBER METHODS PARTIAL DIFFERENTIAL EQUATIONS II	3
Total Semester Hours		**24**

In addition, the POS should include three approved graduate courses, including at least two courses numbered 609 or above.

Other possible concentration areas include differential equations and discrete mathematics.

Master’s Degree Final Examination

A final comprehensive examination is required of all candidates for a master’s degree. The candidate will be examined on the coursework and thesis in Plan I and on the coursework in Plan II. In the Mathematical Sciences Department this examination is oral, except that Plan II students who have passed a joint program examination for the Ph.D. degree in applied mathematics may use that examination as their master’s degree final examination.

Physics and Astronomy

201C Optics Building
Telephone: 256.824.2482
Email: physics@uah.edu

Chair: Dr. James Miller (https://www.uah.edu/science/departments/physics/faculty-staff/dr-james-a-miller/)

The Physics and Astronomy department offers the following graduate degree programs:

Master of Science (p. 230)
Doctor of Philosophy (p. 229)

Admission Requirements

Refer to the Graduate School section of the Graduate Catalog for general admission and degree requirements. Additional information on Graduate Teaching and Research Assistantships is available on the department web site http://physics.uah.edu. (http://www.uah.edu/science/departments/physics/) Undergraduate preparation should include courses typically required for a Physics major, such as modern physics, quantum mechanics, and upper level classical mechanics, electrodynamics, and thermal physics.

Program Objective

The primary objective of the Physics and Astronomy department is to educate and train the next generation of physicists, perform cutting-edge and internationally-recognized research, and support the education of students in allied areas such as engineering, chemistry, atmospheric science, and the

biological sciences. Our second objective prepares Physics majors for employment in industrial research or for further graduate studies in physics or related fields, including astrophysics, optics, biophysics, engineering, or medicine.

Learning Outcomes

Students will:

- Exhibit a post-graduate level of knowledge in general physics topics
- Conduct a focused and thorough investigation of a topic and effectively communicate the results in a timely manner
- Possess the preliminary experience necessary for working in the private sector, academia, or industry

Master's Program in Physics

- Physics, MS (p. 230)

Doctoral Program in Physics

- Physics, PhD (p. 229)

PH 531 - INTRODUCTION TO PLASMA DYNAMICS
Semester Hours: 3

Single-particle motion in magnetic fields; fluid equations and fluid theory wave modes; MHD theory, stability, and wave modes; introduction to kinetic theory and hot plasma wave modes. (Same as MAE 531).

PH 541 - GEOMETRICAL OPTICS
Semester Hours: 3

Foundations and physics of geometrical optics, Fermat's principles and Huygen wavelets, refraction and reflection. The many forms of Snell's Law. Optical path lengths, geometrical wavefronts and rays. Ray tracing, ynu-chart and matrix methods. Gaussian imagery and paraxial optics, conjugate elements, cardinal points, and image-object relations. Stops and pupils, chief and marginal rays, vignetting, and the optical or Lagrange invariant. The y-ybar diagram, design of common systems: objectives, magnifiers, microscopes, collimators and detectors. Optical glasses and chromatic aberrations, wavefront and transverse aberrations, spot diagrams and ray fan plots. (Same as OSE 541 and EE 541) Fall.

PH 542 - PHYSICAL OPTICS
Semester Hours: 3

Scalar and electromagnetic waves, polarization, coherence, reflection and refraction; two beam and multiple beam interference, interferometers, Fabry-Perots, thin films, diffraction, and absorption and dispersion. (Same as OSE 542 and EE 542.) Fall, Spring.

PH 544 - OPTOELECTRONICS
Semester Hours: 3

Review of polarized light, the Jones and Mueller calculi. Propagation of light in birefringent material. Modulation of light using electro-optic effect, Kerr effect, acousto-optic effect, and Faraday effect. Elements of photodetection and detectors, signal processing, and signal-to-noise. Design and analysis of beam scanners, optical rf-spectrum analyzer, optical sensors, and optical communication systems. (Same as OPT 444 and OPE 451.) Fall even years.

PH 546 - RADIOMETRY, DETECTORS & SOURCE
Semester Hours: 3

Theory and practice of radiometry and photometry. Blackbody radiation and Lambertian sources. The propagation of radiant energy in free space and through optical systems. Detector classes, responsivity, bandwidth, and noise. Power spectral density, properties of sources, photon noise. (Same as OPT 446, OSE 546.) Spring even years.

PH 551 - QUANTUM MECHANICS I
Semester Hours: 3

Waves and particles; wave packets and the uncertainty principle; Schrodinger's equation and wave mechanics; postulates of quantum mechanics; simple systems in one, two and three dimensions; the hydrogen atom; angular momentum and spin; numerical solutions of the Schrodiner equation. Prerequisites require undergraduate quantum mechanics course(s).

PH 553 - INTRODUCTION TO PARTICLE PHYSICS
Semester Hours: 3

Survey of elementary particle physics with emphasis on the Standard Model of quarks, leptons and gauge bosons. Lorentz transformations, four-vectors and relativistic kinematics, angular momentum and spin. Lifetimes, cross-sections and Feynman rules. Quantum electro- and chromo-dynamics, Dirac equation and renormalization. Physics beyond the Standard Model. Prerequisite: PH 551 or PH 651.

PH 560 - INTRODUCTION TO SOLID STATE PHYSICS I
Semester Hours: 3

Crystal binding and crystal structure. Crystal structure determination. Phonons and lattice vibrations. Free electron gas. Electronic energy band theory. Prerequisite with concurrency: PH 551. (Same as MTS 660.) Fall, even years.

PH 561 - INTRODUCTION TO SOLID STATE PHYSICS II
Semester Hours: 3

Thermal properties of solids. Electronic properties, optical properties, electronic properties in a magnetic field, semiconductor devices, magnetism, superconductivity, defects and alloys, dislocations and crystal growth, non-crystalline solids, surfaces and interfaces. (Same as MTS 661.) Spring, odd years. Prerequisite: PH 560.

PH 570 - OPTICAL & PHOTONIC SYSTEMS DESIGN
Semester Hours: 3

Review of paraxial optics, ray tracing codes, aberration and diffraction calculations; acousto- and electro-optic modulators, spatial light modulators; fibers, fiber splicers and connectors; gratings and diffractive optical elements; laser and light emitting diodes, photodetectors and CCD arrays; correlator systems; optical communication networks; signal processing systems design. Fall, even years. Prerequisite: PH 541.

PH 571 - STELLAR ASTROPHYSICS
Semester Hours: 3

Structure and physical processes of stars from the interior to the atmosphere: energy production and transfer, atmospheric properties, and observed spectal features. Models for stellar structure. Star formation and evolution, including the effects of a companion. Prerequisites: upper level undergraduate astrophysics course, and upper level undergraduate E&M course.

PH 572 - GALAXIES & COSMOLOGY
Semester Hours: 3

Galactic structure; Oort's constants; rotation curves; galaxy types; structure formation and evolution; Hubble expansion; Friedmann equation; cosmic microwave background; radiation and matter eras; primordial nucleosynthesis; dark matter/energy issues; development of structure in the early universe; horizon & flatness problems; inflation. Prerequisite: PH 571 or advanced undergraduate Astrophysics course, suggested PH 553, PH 621. Spring, odd years.

PH 574 - INTRODUCTION TO GENERAL RELATIVITY
Semester Hours: 3

An introductory course on general relativity and gravitational physics. General relativistic phenomena as inferred from the behavior of particles and light rays for a selection of spacetimes. Major properties of such objects as black holes, wormholes, gravitational waves, and the universe as a whole. Prerequisites: Undergraduate level special relativity and classical mechanics.

PH 579 - OBSERVATIONAL ASTROPHYSICS
Semester Hours: 3

Astronomical coordinate systems and time; spherical astronomy; telescope designs; basic optics; CCDs; infrared arrays; observational calibration and noise; high resolution imaging techniques (e.g., adaptive optics); spectroscopy; and high and low energy observational techniques (e.g., X-ray telescopes, radio interferometry). Students will also conceive their own projects, write observing proposals, and convene as a Time Allocation Committee to review proposals and schedule telescope time. Students will acquire, reduce, analyze and interpret data from one of the allocated projects, and present the results in a short paper. Prerequisites: upper-level undergraduate astrophysics courses.

PH 589 - SELECTED TOPICS
Semester Hours: 3

PH 601 - CLASSICAL DYNAMICS I
Semester Hours: 3

Variational principles and Lagrangian mechanics, rigid body motion, Hamilton's equations, and theory of small oscillations. Aspects related to modern physics. Fall.

PH 607 - MATHEMATICAL METHODS I
Semester Hours: 3

Review of vector calculus and coordinate systems, introduction to tensors, matrices, infinite series, complex variables with applications to calculus of residues, partial differential equations, and Sturm-Liouville theory. Orthogonal functions, gamma functions, Bessel functions, Legendre functions, special functions, Fourier series, integral transforms and equations. Prerequisite: upper level undergraduate differential equations courses. (Same as MA 607) Fall.

PH 609 - MATHEMATICAL METHODS II
Semester Hours: 3

Continuation of PH 607. (Same as MA 609.) Spring. Prerequisite: PH 607.

PH 615 - INTRODUCTION TO RADIOLOGICAL PHYSICS
Semester Hours: 3

Prerequisite: PH 551.

PH 616 - PHYSICS OF RADIATION THERAPY
Semester Hours: 3

Operation of X-ray tubes, electron linear accelerators, cobalt-60 units, cyclotrons. Principles of accelerating waveguides, klystrons, magnetrons, electron scattering foils, flattening filters, monitor chambers, collimators. Percent-depth-dose (PDD), tissue-phantom-ratio (TPR), tissue-air-ratio (TAR), peak scatter factor (PSF). Equivalent squares, calculation of monitor units for specific dose rates, collimator scatter factor (Sc), phantom scatter factor (Sp). Principles of brachytherapy: calibration of sources, absorbed dose using AAPM TG-43 protocol. Calculation of isodose distributions: convolution/ superposition, Monte Carlo calculations. Intensity modulated radiation therapy (IMRT), stereotactic radiosurgery, tomotherapy, total-body irradiation. Prerequisite: PH 615.

PH 621 - STATISTICAL MECHANICS KINETIC THEORY I
Semester Hours: 3

Statistical methods, systems of particles, statistical thermodynamics, applications of thermodynamics, methods of statistical mechanics, applications of statistical mechanics, equilibrium between phases of chemical species. Summer.

PH 622 - STATISTICAL MECHANICS KINETIC THEORY II
Semester Hours: 3

Addresses the statistical description of collective processes in gases, plasmas, and fields based on the use of transport theory. The course provides the basis for the mathematical description of the basic kinetic and continuum models used in all fields of solar, space and astrophysics. Addresses specifically the transport of gases and Chapman-Enskog theory, magnetohydrodynamics in a collisional description, energetic particle transport in collisionless plasma, the transport of low-frequency turbulence, and if time permits, the transport of radiation. Prerequisite: PH 621.

PH 631 - ELECTROMAGNETIC THEORY I
Semester Hours: 3

Electrostatic and magnetostatic fields in vacuum and materials, Maxwell's equations, electromagnetic waves. Prerequisites: upper level undergraduate E&M course(s), PH 607. Fall.

PH 632 - FOURIER OPTICS
Semester Hours: 3

Introducing the optical system as an invariant linear system, convolution, Sommerfield's diffraction integral, Fourier Transform, angular spectrum, coherent and incoherent imaging, optical transfer function. Prerequisite PH 542 (Same as OSE 632 and EE 632.) Spring.

PH 636 - INTRODUCTION TO SPACE PLASMA PHYSICS
Semester Hours: 3

Electromagnetic fields and particles in space; solar wind and solar energetic particles; currents and plasma waves in space; shocks and particle acceleration mechanisms; solar flares and coronal mass ejections. Spring, even years. Prerequisite: PH 531.

PH 642 - OPTICAL PHYSICS
Semester Hours: 3

Fundamental physics of optics and optical phenomena. Electromagnetic fields, sources and propagation. Coherence, interference, polarization, scattering, reflection, refraction, and diffraction. Optical properties of conductors and insulators. Introduction to quantum optics, lasers, and optical device physics. Offered Spring, even years. Prerequisite: PH 551.

PH 645 - LASERS I
Semester Hours: 3

Incoherent light sources; atomic and molecular energy levels; equation or motion for probability amplitudes using first-order time dependent perturbation theory; electric dipole interaction. Einstein rate equations and the Planck radiation law; induced dipole moments and frequency dependent susceptibility. Homogeneous and inhomogeneous line broadening mechanisms; laser cavities and modes, elementary laser theory, practical lasers. Prerequisite: upper level undergraduate E&M courses. (This course may be substituted for OSE 645.) Summer.

PH 651 - QUANTUM MECHANICS I
Semester Hours: 3

Free particle motion. Principles of wave mechanics. The Schrodinger equation and one-dimensional potentials. Approximation techniques: WKB, variational method, perturbation theory. Numerical methods. Prerequisites: undergraduate quantum mechanics or modern physics, some high-level programming (e.g., C++, Fortran, Mathematica) experience. Prerequisite with concurrency: PH 607.

PH 652 - QUANTUM MECHANICS II
Semester Hours: 3

Spherically-symmetric potentials, angular momentum, spin. Identical particles. Time-dependent perturbation theory. Scattering. Atomic structure. Prerequisite: PH 651 and PH 609.

PH 654 - OPTICAL TESTING
Semester Hours: 3

Spherometry; refractive index measurements; optical bench measurements of imaging systems via T-bar nodal slide (effective focal length, f-number, axial color, field curvature and distortion, transverse ray aberrations); illumination falloff; image resolution tests (finite object); modulation transfer function; star image testing; knife edge tests; Hartmann tests; Fizeau interferometer and testing configurations; null lens testing of aspheres; wavefront measurements (point diffraction interferometer, radial shear interferometer); (Same as OSE 654.) Spring.

PH 655 - APPLIED QUANTUM MECHANICS
Semester Hours: 3

Application of quantum mechanics in solid state, electronics, materials science, and optics. Topics to include: Hydrogen atom and molecule, excitons, phonons, Bloch's theorem, periodic boundary conditions, electrons and holes, band structure of simple semiconductors, dipole transitions, optical constants, absorption and emission processes. Introduction to device physics. (Same as OSE 655) Prerequisite: PH 651 or OSE 555.

PH 661 - DATA ANALYSIS & STATISTICAL METHODS FOR ASTROPHYSICS
Semester Hours: 3

Moments of a distribution, linear and non-parametric correlation, central limit theorem, error estimation, least squares modeling, estimating model parameters, Monte Carlo techniques. Bayes' theorem and likelihood methods. Energy and temporal spectral analyses. Power density spectra: periodic and quasi-periodic systems. Prerequisite: upper level undergraduate mathematics courses. Fall, even years.

PH 670 - OPTOMECHANICAL DESIGN & MANUFACTURING
Semester Hours: 3

Practical aspects of optomechanical design, material selection, fabrication and integration of precision optical components and systems for commercial, space, and military applications. Topics include: fixture design, tolerance analysis, machining methods, thermal stabilization, integrated computer-aided design and analysis, diamond machining, finishing and plating techniques. (Same as OSE 670.) Fall, even years. Prerequisite: OSE 541.

PH 671 - OPTICAL FABRICATION & TESTING
Semester Hours: 3

Fabrication and testing techniques of optical components and systems. Component measurements: refractive index, curvature, focal lengths, cardinal points and field curvature. Wavefront aberration and transverse aberration function measurements: geometric tests, interferometric tests, null tests. Basics of grinding, figuring, polishing and optical coating. Laboratory experience in manufacturing, polishing, testing, and coating reflective or transmissive optics. Offered on demand.

PH 673 - HIGH ENERGY ASTROPHYSICS
Semester Hours: 3

Radiative Transfer: Blackbody, scattering and diffusion, bremsstrahlung, synchrotron emission, Compton scattering. Relativistic electromagnetism. Plasma effects and introduction to magnetohydrodynamics. Observational aspects of white dwarves, neutron stars and black holes. Accretion and astrophysical jets. Active galactic nuclei and gamma-ray bursts. Offered Fall of odd years.

PH 674 - GENERAL RELATIVITY & GRAVITATION I
Semester Hours: 3

Special and general relativity: vector and tensor calculus; curved manifolds; elements of differential geometry; physics in curved spacetime; the Einstein equations; simple solutions of the Einstein equations; Schwarzschild geometry and the Kerr spacetime; black holes; sources, propagation, and detection of gravitational waves; a variational approach to general relativity; special topics.

PH 679 - EDUCATION CAPSTONE COURSE
Semester Hours: 3

Capstone experience for student pursuing secondary education certification option for MS degree. Student develops 1 credit, 100 level physics course on instructor-approved topic. Development includes syllabus, textbook evaluation, representative homework assignments, midterm, final, lecture outline, and lecture notes.

PH 689 - SELECTED TOPICS
Semester Hours: 1-3

Offered upon demand. Topics include: optical surface characterization, superconductivity, aeronomy, properties of solids, laser propagation, collision theory, magnetohydrodynamics. Fall, Spring, Summer.

PH 699 - MASTER'S THESIS
Semester Hours: 3-6

Minimum of 6 credit hours required for Plan I M.S. students. Maximum of nine hours credit toward Ph.D. course requirements awarded upon successful completion of master's thesis. Fall, Spring, Summer.

PH 731 - ADVANCED PLASMA THEORY
Semester Hours: 3

Vlasov theory; electrostatic and electromagnetic waves in a hot plasma; wave damping processes; micro-instabilities; quasilinear theory; numerical simulation of plasmas; applications to space and astrophysics. Spring, odd years.

PH 732 - ELECTROMAGNETIC THEORY II
Semester Hours: 3

Continuation of PH 631. Radiation from accelerated charges; Hamiltonian formulation of electrodynamics; covariant formulation of electrodynamics. Spring Prerequisite: PH 631.

PH 733 - QUANTUM DEVICES
Semester Hours: 3

Quantum aspects of optical, electronic, and semiconductor devices approached from a phenomenological/physical point of view. Topics will include: Quantum well devices, optical modulators, optical detectors, quantum Stark effects, electro-optic devices, high speed optical devices, frequency chirping in high speed devices and system applications. (Same as OSE 755.) Fall, odd years. Prerequisite: PH 551 or PH 651 or OSE 555.

PH 742 - OPTICAL SCATTERING THEORY
Semester Hours: 3

Scattering and absorption of radiation by particles with spherical symmetry and arbitrary shapes described using Maxwell's equations, vector Helmholtz equations, the Jones and Mueller calculus, and numerical techniques. Prerequisites: PH 631, or EE 609, or ATS 561.

PH 745 - LASERS II
Semester Hours: 3

The propagation of optical beams in homogeneous and lens-like media, optical resonators, interaction between radiation and atomic systems, laser oscillations and specific laser systems, switching and mode-locking of lasers, noise in laser amplifiers and oscillators, modulation of optical radiation. Fall, even years. Prerequisite: PH 645.

PH 746 - NON-LINEAR OPTICS
Semester Hours: 3

PH 751 - COMPUTATIONAL QUANTUM MECHANICS
Semester Hours: 3

Numerical methods for solving the Schrodinger equation. Numerical approximation techniques: Rayleigh-Ritz theory. Quantum scattering from a spherically-symmetric potential. Multi-electron atoms: Hartree self-consistent field theory, Hartree-Fock theory, density functional theory. Electronic structure of diatomic molecules. Ab initio treatment of molecular structure. Additional extensive application to problems in molecular, atomic, and nuclear physics. Prerequisites: PH 652, high-level programming (e.g. C++, Fortran, Mathematica) experience. Offered on demand.

PH 752 - QUANTUM MECHANICS II
Semester Hours: 3

PH 753 - QUANTUM FIELD THEORY
Semester Hours: 3

Formalism of quantum field theory, construction and evaluation of Feynman diagrams for quantum electrodynamics and the weak interaction, first-order processes, renormalization, particle scattering and decay, nucleon structure, introduction to quantum chromodynamics, accelerator experiments, and astrophysical applications. Prerequisites: PH 609 and PH 652.

PH 789 - SELECTED TOPICS
Semester Hours: 1-3

Topics include superconductivity, advanced plasma theory, properties of solids, laser propagation, collision theory, quantum electronics, gravitational theories. Fall, Spring, Summer.

PH 792 - PHYSICS SEMINAR
Semester Hour: 1

Students attend seminars by invited speakers. Two semesters are required for all M.S. students and three semesters for Ph.D. students. Does not count toward minimum degree requirements. Fall, Spring.

PH 795 - ADV PHYSICS PROJECT LAB
Semester Hours: 3-6

Advanced laboratory research in one of the departmental research groups. Student works on an independent or group project. Completion of the course requires a written report that becomes part of the student's record. Fall, Spring, Summer.

PH 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9

Prerequisites: Students must have passed the comprehensive examination at Ph.D. level and have Ph.D. advisor's approval. No more than 9 hours may be taken prior to passing the qualifying examination. Fall, Spring, Summer.

Physics, PhD

To obtain the Ph.D. degree in physics, a student must satisfy all requirements of the Graduate School as well as those in the Department of Physics. The major steps toward a Ph.D. degree are as follows:

1. Take the necessary core courses and pass the Physics Comprehensive Examination (Comprehensive Exam) at the Ph.D. Level.

Required core courses for the Ph.D. degree are:

Code	Title	Semester Hours
PH 601	CLASSICAL DYNAMICS I	3
PH 607	MATHEMATICAL METHODS I	3
PH 609	MATHEMATICAL METHODS II	3
PH 621	STATISTICAL MECHANICS KINETIC THEORY I	3
PH 631	ELECTROMAGNETIC THEORY I	3
PH 651	QUANTUM MECHANICS I	3
PH 652	QUANTUM MECHANICS II	3
PH 732	ELECTROMAGNETIC THEORY II	3
Total Semester Hours		**24**

The Comprehensive Exam is offered every August, and covers the material in the core courses given above except PH 732, which is usually taken after the Comprehensive Exam. There are sections dealing with quantum mechanics, electromagnetic theory and relativity, and classical and statistical mechanics. A full-time course schedule leading to the Comprehensive Exam at the start of the Fall semester of the second year is listed below.

Admission to the Ph.D. program in physics is granted upon passing the Comprehensive Exam at the Ph.D. level. Students are permitted two attempts to pass the Comprehensive Exam. A student who fails on the first attempt must retake the examination the following year. Full-time students are generally expected to take the exam for the first time at the start of their second year. Further details are found on the Department’s (http://uah.edu/physics/) website.

Year 1		
Fall		**Semester Hours**
PH 607	MATHEMATICAL METHODS I	3
PH 651	QUANTUM MECHANICS I	3
PH 601	CLASSICAL DYNAMICS I	3
PH 792	PHYSICS SEMINAR	1
	Term Semester Hours:	**10**
Spring		
PH 609	MATHEMATICAL METHODS II	3
PH 652	QUANTUM MECHANICS II	3
PH 631	ELECTROMAGNETIC THEORY I	3
PH 792	PHYSICS SEMINAR	1
	Term Semester Hours:	**10**

Summer		
PH 621	STATISTICAL MECHANICS KINETIC THEORY I	3
Elective		3
	Term Semester Hours:	**6**
	Total Semester Hours:	**26**

2. Form a supervisory committee and a Program of Study.

Once the Comprehensive Exam has been passed, a student should proceed to form a supervisory committee and prepare a Program of Study. A Program of Study will consist of

- a minimum of 48 credit hours of graduate coursework. A maximum of nine semester hours of PH 699 from a completed M.S. degree with thesis may be allowed to count toward this 48 semester hour requirement.
- three semesters of PH 792 with a grade of “S”. Seminar semester hours do not count toward the 48 credit hours above.
- at least 18 semester hours of PH 799. No more than nine of these semester hours may be taken prior to passing the Qualifying Examination (see below).

Courses in addition to those enumerated above can be selected in consultation with the student’s advisory committee. Transfer of credit from other institutions requires approval of the advisory committee, the Department Chair, and the Graduate Dean.

3. Pass the Qualifying Examination.

After preliminary work on their chosen Ph.D. dissertation topic, the student must pass the Ph.D. Qualifying Examination. This examination is conducted under the auspices of the Graduate School, and tests the student’s general fitness for pursuing a research project in their chosen area and their general knowledge of physics. There are written and oral components to this exam. The written part consists of the student's responses to questions submitted by their committee; these questions can deal with the specific proposed research or the general area of research (such as optics or astrophysics, as covered, e.g., in the elective courses taken in this area). The oral part is a presentation and defense of the proposed research.

4. Complete and defend a research dissertation.

Each student must complete and successfully defend a research dissertation, which must be approved by the student’s supervisory committee, the Chair of the Physics Department, the Dean of the College of Science, and the Dean of the Graduate School. A significant portion of the dissertation should be submitted for publication in an approved journal with international circulation.

Physics, MS

There are three M.S. options in physics:

- Thesis
- Non-thesis
- Secondary Education Certification

Required core courses for each are:

Code	Title	Semester Hours
PH 601	CLASSICAL DYNAMICS I	3
PH 607	MATHEMATICAL METHODS I	3
PH 609	MATHEMATICAL METHODS II	3
PH 621	STATISTICAL MECHANICS KINETIC THEORY I	3
PH 631	ELECTROMAGNETIC THEORY I	3
PH 651	QUANTUM MECHANICS I	3
PH 652	QUANTUM MECHANICS II	3
PH 792	PHYSICS SEMINAR (two semesters) [1]	1
PH 792	PHYSICS SEMINAR	1
Total Semester Hours		**23**

1 All M.S. students are required to complete two semesters of PH 792 with a grade of “S”; these semester hours do not, however, count toward minimum degree requirements given below.

Students should complete a Program of Study with the help of their faculty advisor before the completion of 12 semester hours of graduate coursework. A Program of Study is a detailed list of courses that the student will take to satisfy the appropriate degree requirements.

M.S. with Thesis

A student must take at least 24 semester hours in graduate courses, plus at least six semester hours of PH 699, culminating in the successful defense of their thesis. Students writing a thesis do not need to take the Physics Comprehensive Examination (Comprehensive Exam).

Optics and Photonics Technology Curriculum

The OPT (PH) M.S. degree program is comprised of a minimum of 27 semester hours of graduate coursework, plus a minimum of six semester hours of PH 699. The thesis option is the only available route to the OPT degree. Students may pursue the OPT option through either the Physics Department (PH) or the Electrical & Computer Engineering Department (ECE). The OPT (PH) program of study, available on the Department website http://physics.uah.edu, meets the Department of Physics M.S. degree requirements and is suggested for students coming from a physics background. Students in this category, having a Physics Department faculty member as an advisor, will be designated as having Physics as their “home” department. Courses have been chosen such that little or no prior graduate work in physics is required. The OPT degree program does not prepare the student for taking the Comprehensive Exam or the OSE Preliminary Exam. Requirements for students seeking the OPT degree through the Electrical Engineering department, OPT (ECE), may be significantly different.

M.S. without Thesis

A student must take at least 33 semester hours of graduate coursework, and achieve an M.S. passing grade on the Comprehensive Exam. This exam is offered every August, and also serves as the preliminary examination for the Ph.D. degree program. The Comprehensive Exam covers material from the core courses listed above, and thus has sections dealing with quantum mechanics, electromagnetic theory and relativity and classical and statistical mechanics. Criteria for an M.S. or Ph.D. pass are given on the Department’s web site.

For students in the Optical Science and Engineering (OSE) Ph.D. program who desire an M.S. degree in Physics, a passing grade on the OSE Preliminary Examination is an acceptable substitute for the Comprehensive Exam.

A full-time course schedule leading to the Comprehensive Exam at the start of the Fall semester of the second year is listed below.

Year 1		
Fall		**Semester Hours**
PH 607	MATHEMATICAL METHODS I	3
PH 651	QUANTUM MECHANICS I	3
PH 601	CLASSICAL DYNAMICS I	3
PH 792	PHYSICS SEMINAR	1
	Term Semester Hours:	**10**
Spring		
PH 609	MATHEMATICAL METHODS II	3
PH 652	QUANTUM MECHANICS II	3
PH 631	ELECTROMAGNETIC THEORY I	3
PH 792	PHYSICS SEMINAR	1
	Term Semester Hours:	**10**
Summer		
PH 621	STATISTICAL MECHANICS KINETIC THEORY I	3
Elective		3
	Term Semester Hours:	**6**
	Total Semester Hours:	**26**

Nine Remaining Semester Hours

The remaining nine semester hours of graduate coursework can be taken in the Physics Department (for advanced study in optics, space physics, astrophysics, or planetary science) or from another department such as Atmospheric Science. Students need to consult with their advisor regarding the selection of topical elective courses.

M.S. with Certification

With this option, also called the *Alternative Fifth-year Program* in the College of Education section of the Graduate Catalog, students are awarded an M.S. degree in Physics as well as Class A (Master’s level) Teaching Certification by the State of Alabama. **We strongly encourage students to investigate this rewarding career option**.

This program is available to students who do not already have a Class B (baccalaureate level) Teaching Certification. Requirements are 27 graduate semester hours in Education courses and 24 graduate semester hours in Physics courses. The Education courses are specified in the College of Education section of this catalog, and include a high school internship. The Physics courses include the core courses above, plus nine additional semester hours. Three of the nine additional hours will be PH 679 the required capstone course for this M.S. option. Neither the Comprehensive Exam nor a thesis is required for this option. However, a thesis can replace the capstone course, if desired.

Space Science

National Space Science and Technology Center
Cramer Research Hall, Room 4044
Telephone: 256.961.7479
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Chair:

Gary Zank (https://www.uah.edu/science/departments/space-science/faculty-staff/gary-zank-ph-d/)

Aerojet-Rocketdyne Chair in Space Science (https://www.uah.edu/science/departments/space-science/faculty-staff/gary-zank-ph-d/)

University of Alabama Board of Trustees Trustee Professor (https://www.uah.edu/science/departments/space-science/faculty-staff/gary-zank-ph-d/)

Director, Center for Space Plasma and Aeronomic Research (CSPAR) (https://www.uah.edu/science/departments/space-science/faculty-staff/gary-zank-ph-d/)

Distinguished Professor and Chair, Department of Space Science (https://www.uah.edu/science/departments/space-science/faculty-staff/gary-zank-ph-d/)

The University of Alabama in Huntsville (https://www.uah.edu/science/departments/space-science/faculty-staff/gary-zank-ph-d/)

The Space Science department offers the following graduate degree programs**:**

Master of Space Science (p. 236)
Doctorate of Space Science (p. 238)

Program Objective

The Space Science department will provide opportunities through our graduate program for students to be introduced to and engage in cutting edge research in solar physics, heliospheric science, cosmic-ray physics, and high-energy astrophysics with faculty from the Department of Space Science and with our research partners: The University of Alabama in Huntsville's (UAH's) Center for Space Plasma and Aeronomic Research (CSPAR) and Marshall Space Flight Center (MSFC). Additionally, the department will provide a unique unified Space Science graduate program under the umbrella of a single university department.

Learning Outcomes

Students will demonstrate:

- Inculcated problem solving skills through introductory research in the field of space science for future use in science, engineering, teaching, and technology professions
- Ability to write a scholarly document
- Ability to prepare and deliver an effective oral scientific presentation

Master's Degree in Space Science

- Space Science, MS (p. 236)

Doctoral Degree in Space Science

- Space Science, PhD (p. 238)

SPA 522 - INTRODUCTION TO PLASMA PHYSICS
Semester Hours: 3

Provides students with an introduction to the basic physical processes associated with plasmas, which permeate all space environments. Both particle and fluid approaches are introduced, and a variety of elementary drift and wave phenomena are derived. Applications of the theory to various plasma instabilities are explored, along with specific examples of where these may occur in space science. While the goal of this course is to prepare students for more advanced topics in space physics, many of the fundamentals covered are equally relevant for students interested in plasma confinement and its associated engineering challenges.

SPA 526 - SPACE WEATHER
Semester Hours: 3

Physics of solar active regions, physics of solar flares and coronal mass ejections (CMEs), the propagation of CMEs, the acceleration and propagation of solar energetic particles, CME interaction with earth's magnetosphere.

SPA 532 - SPACE ORIENTATION EDUCATORS
Semester Hours: 3

A weeklong course at the U.S. Space and Rocket Center in Huntsville, Alabama for pre-service and in-service teachers. The inquiry based workshops are taught around the theme of space exploration include activities to be done across the curriculum. All activities are correlated to National Math, Science, Technology, Social Studies, and Reading Standards. Activities based on curriculum developed by NASA, CAP, NSATA, and the USSRC. Topics include moon, mars, rocketry, propulsion, hydroponics, math, biology, history and literature.

SPA 582 - SCIENCE CAREER PREP
Semester Hour: 1

This course will review many of the soft skills necessary to function as a successful scientist, whether in an academic career, in a federal laboratory, a for-profit research career in a company, or even a commercial career. Your career begins with graduate school, and learning the skills for a successful graduate career will carry over to your professional career. The goal of the course is impart wisdom from successful graduate students and career scientists, providing both a basis for a successful graduate career and your subsequent career. The course will help students reduce the learning things "the hard way" approach by providing guidance for your career path. Each week will focus on a different skill that a career scientist requires.

SPA 610 - ADVANCED MATH METHODS FOR SPACE SCIENCE
Semester Hours: 3

This course will focus on analytical methods for a series of advanced topics with an emphasis on practical applications to space science, such as Vector and Fourier Analysis, ODEs/PDEs in space science, and Green's functions, Spherical Harmonics, Spectral Analysis, Wavelet Transforms, Fractals and Complexity, and Inverse Problems.

SPA 622 - CLASSICAL & QUANTUM STATISTICS
Semester Hours: 3

Statistical methods, systems of particles, statistical thermodynamics, kinetic theory, methods of statistical mechanics, equilibrium between phases of chemical species. Quantum statistics of identical particles. Spin and statistics. Bose-Einstein and Fermi-Dirac distributions.

SPA 623 - TRANSPORT PROCESSES IN SPACE
Semester Hours: 3

Course presents a systematic treatment of classical and anomalous transport theory for gases, plasmas, energetic particles, and low frequency turbulence. The Chapman-Enskog approach is used to derive transport coefficients for neutral gases and collisional plasmas. The relationship between multi-fluid and MHD models is presented. Weak solutions and shock waves are discussed. The transport of energetic particles that experience scattering by magnetic field fluctuations is presented, together with basic models of the turbulence responsible for scattering turbulence transport in expanding flows such as the solar wind. Prerequisite: SPA 622 and SPA 522.

SPA 624 - SPACE PHYSICS I
Semester Hours: 3

A broad introduction to particle, MHD, and kinetic phenomena in space. This course is intended for all students interested in space, astro-, and plasma physics. Course covers fusion processes inside the Sun, solar neutrinos, solar atmosphere, coronal magnetic fields, physical mechanisms of magnetic field line reconnection and magnetic dynamo, the interaction between the solar wind with planets and the interstellar medium, corotating and merged interaction regions, collisional and collisionless shock waves in space. Includes an introduction to charged particle acceleration in the heliosphere. Examines differences between planetary magnetospheres, solar-terrestrial relationships, solar activity, climate, and culture. Prerequisite: SPA 522, SPA 631 (w/concurrency).

SPA 625 - SPACE PHYSICS II
Semester Hours: 3

The course develops a deeper understanding and knowledge of plasma instabilities, kinetic dispersion relations, microinstabilities, electrostatic and electromagnetic instabilities; advanced magnetohydrodynamics including MHD turbulence, reconnection; wave-particle interactions, including basic quasi-linear theory; weak and strong wave turbulence; nonlinear waves; collisionless shock waves. Prerequisite: SPA 624.

SPA 627 - HIGH ENERGY RADIATION DETECTION AND MEASUREMENT
Semester Hours: 3

This course will provide students with basic understanding of radiation detection for space-based missions. This course will cover the basic nuclear processes in radioactive sources and the interaction of radiation with matter. The statistical treatment of experimental data will be reviewed. General characteristics common to all types of detectors will be given. We will then cover specific classes of detectors focusing on ionization, scintillation and semiconductor detectors. Light collection and detection techniques will follow. The student will then be introduced to basic signal processing and timing techniques important to a successful instrument design. This course will be taught from a physicist point of view emphasizing the physical processes and interactions that make detection of radiation possible. This course is suitable for those students interested in detector development or astrophysical data analysis using state-of-the-art technology.

SPA 628 - SOLAR PHYSICS
Semester Hours: 3

The workings of the Sun, from its interior to the outer reaches of the corona and solar wind with emphasis on the fundamental physical processes from both observational and theoretical point of views, including energy release in core of the Sun and its transport to the solar atmosphere, dynamo theory and the generation of the magnetic field of the Sun, solar wind model and and interplanetary magnetic field, kinetic process and particle acceleration in solar flares, plasma emission and radiation transfer, electron beams and solar radio bursts, magnetic reconnection and solar flares.

SPA 629 - ASTROPHYSICAL FLUID DYNAMICS
Semester Hours: 3

Covers astrophysical phenomena occurring outside the boundaries of the solar system. Subjects include stellar structure and rotation, waves and instabilities in astrophysical plasmas, the physics of spherical and disk accretion, supernova blast waves, and charged particle transport and acceleration in cosmic plasmas. Introduction to the principles of stellar formation, helioseismology, stellar dynamo, coronal heating, and astrophysical turbulence. Prerequisite: SPA 522.

SPA 630 - WAVES IN FLUIDS
Semester Hours: 3

Comprehensive introduction to the science of wave motions in fluids. Waves and first-order (hyperbolic) equations, wave hierarchies; gas dynamics and fluid equations; acoustics, nonlinear plane waves, simple waves, shock waves and structure, shock reflection, similarity solutions, supersonic flows in gas dynamics; the wave equation, including plane, spherical and cylindrical waves, geometrical optics, including far-field approximation, caustics, nonhomogeneous media, anisotropy; water waves, including shallow water theory; group velocity, dispersion; nonlinear waves, including Korteweg-de Vries, sine-Gordon, and nonlinear Schroedinger equations, solitons. Prerequisite: SPA 610.

SPA 631 - WAVES AND FIELDS
Semester Hours: 3

This course will cover the following topics: 1) Review of static solutions of the Maxwell equations. Boundary-value applications. Green function solutions. 2) Covariant electrodynamics: Basic application of special relativity to charged particles and fields. Lienard-Wiechert potentials. Solutions to the wave equation. 3) Space Science applications: Thermal Spectra and Particle Distributions. Cyclotron and synchrotron radiation. Bremsstrahlung and collisions. Compton Scattering. Prerequisite: SPA 610.

SPA 632 - IONOSPHERIC AND MAGNETOSPHERIC
Semester Hours: 3

This course will give insights to the Earth's ionosphere and magnetosphere. Seminars cover basic concepts and fundamental plasma physics relevant to the ionosphere and magnetosphere, electrodynamics, electric circuit systems, geomatic storms, and substorms, auroras, etc. Training projects involve the use of satellite data and ground-based observations. Prerequisite: SPA 522.

SPA 634 - INTRODUCTION TO SPACE SCIENCE
Semester Hours: 3

In this course we survey a broad range of research areas that span a multitude of space environments. In each case we investigate the physical conditions of the environment, and look at some of the key current and past science questions and the techniques used to address them. We begin by studying basics of plasma physics and then apply the knowledge to the Sun, from its inner workings to its unusually hot atmosphere. This sets the stage for our subsequent survey of the solar wind and its interaction with planets that leads to the formation of magnetospheres. We also explore the techniques used to understand various space environments, from the design of detectors through the methods used to understand the collected data, to theoretical models and the computational techniques used to solve them.

SPA 636 - ADVANCED SPACE WEATHER
Semester Hours: 3

Advanced topics in Space Weather with emphasis on practical effects and impacts on human technology and society: interaction of solar disturbances with Earth's magnetosphere, Solar Energetic Particles, and their effects; Forecasting and Nowcasting of Space Weather; Space Weather at Mars and other planets. Prerequisite: SPA 522.

SPA 662 - COMPUTATIONAL PHYSICS
Semester Hours: 3

Numerical methods to solve common physics problems using C or Fortran. Numerical integration and differentiation, root finding, data fitting, introductory stochastic methods, linear and non-linear differential equations. Fourier analysis. Elliptic parabolic hyperbolic partial differential equations via finite differences, integro-differential equations. Applications to classical dynamics, electromagnetism, statistical and quantum physics.

SPA 663 - COMPUTATIONAL FLUID DYNAMICS AND MAGNETOHYDRODYNAMICS
Semester Hours: 3

Numerical simulations of various problems in space physics, astrophysics, engineering, and plasma dynamics. Finite-volume and finite-difference, shock-capturing and shock-fitting methods for hyperbolic equations, including gas dynamics, MHD, and shallow water equations. The hierarchy of numerical methods is introduced in a systematic way, starting from standard linear schemes and arriving at modern discontinuity-capturing non-linear methods. Exact and approximate Riemann solvers, characteristic analysis of underlying equations. Different implementations of boundary conditions are introduced in relation with the mathematical properties of quasilinear hyperbolic systems. Prerequisites: SPA 624, SPA 662.

SPA 685 - ANALYSIS SPACECRAFT DATA
Semester Hours: 3

This course is to prepare students for observational research using spacecraft data, especially in-situ measurements of particles and fields. Students will first learn to access spacecraft databases and use softwares of their choice. Students will be introduced to common data analysis methods such as distribution function, model fitting, spectral analysis, etc. Examples of real spacecraft data will be shown to illustrate structures in the heliosphere, such as the HCS, ICME and interplanetary shocks. Finally, students will gain practical experience by working on research projects.

SPA 689 - SELECTED TOPICS
Semester Hours: 3

Selected Topics in Space Science not covered in other courses.

SPA 699 - MASTER'S THESIS
Semester Hours: 1-6

SPA 741 - PHYSICS OF COSMIC RAYS
Semester Hours: 3

Covers two principal areas of cosmic ray physics: 1) cosmic ray origin and acceleration, and 2) cosmic ray transport and detection. Includes galactic cosmic rays, anomalous cosmic rays, and solar energetic particles. Transport theory, acceleration mechanisms and observational signatures. Prerequisite: SPA 623.

SPA 742 - GAMMA-RAY BURSTS AND JETS
Semester Hours: 3

Astrophysical jet sources: kinetic and magnetically-dominated relativistic outflows. Blandford-McKee solution. Photospheres. Relativistic shock physics. Emission in relativistic plasmas. Gamma-ray bursts; observations, theory. Prerequisite: SPA 622, SPA 624.

SPA 771 - COMPETITIVE GRANT WRITING WORKSHOP
Semester Hour: 1

This course is designed for senior level graduate students who are about to graduate and start their professional career. It will introduce students to the real and complete process of competing for grant support. It is comprised of a series of lectures (workshops), case studies, and ends with a formal proposal from each participant and a mock review process.

SPA 789 - SELECTED TOPICS
Semester Hours: 3

Selected Topics in Space Science not covered in other courses.

SPA 796 - JOURNAL CLUB
Semester Hour: 1

This course requires graduate students to read, interpret and present literature critically to fellow students, researchers, and faculty. Students stay abreast of current knowledge in the field, develop presentation skills and promote department unity. Faculty instructor will lead, assign, and provide students feedback on their presentations.

SPA 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Students must have passed the Comprehensive Examination at PhD level and have PhD advisor's approval. No more than 9 hours may be taken prior to passing the Qualifying Examination.

Space Science, MS

Information below is intended for prospective students who are considering a Master's degree in Space Science from UAH.

All questions about enrolling in our M.S. program should be directed to Dr. Jakobus le Roux (jakobus.leroux@uah.edu), Chair of the SPA Graduate Committee.

Requirements for M.S. Degree - Thesis Option

1. Complete the core coursework (15 credit hours), see Core Courses below.
2. Complete an additional nine credit hours of elective courses. These are chosen from the Elective Courses list.
3. Complete SPA 582 and SPA 796 once.
4. Complete six hours of Master's thesis (SPA 699).
5. Write and defend a Master's thesis.

Code	Title	Semester Hours
Core Courses		
SPA 522	INTRODUCTION TO PLASMA PHYSICS	3
SPA 610	ADVANCED MATH METHODS FOR SPACE SCIENCE	3
SPA 622	CLASSICAL & QUANTUM STATISTICS	3
SPA 624	SPACE PHYSICS I	3
SPA 631	WAVES AND FIELDS	3
Required Courses		
SPA 582	SCIENCE CAREER PREP	1
SPA 796	JOURNAL CLUB	1
Elective Courses		
Choose 3 courses from the following:		
SPA 526	SPACE WEATHER	
SPA 623	TRANSPORT PROCESSES IN SPACE	
SPA 625	SPACE PHYSICS II	
SPA 627	HIGH ENERGY RADIATION DETECTION AND MEASUREMENT	
SPA 628	SOLAR PHYSICS	
SPA 629	ASTROPHYSICAL FLUID DYNAMICS	
SPA 630	WAVES IN FLUIDS	
SPA 662	COMPUTATIONAL PHYSICS	
SPA 663	COMPUTATIONAL FLUID DYNAMICS AND MAGNETOHYDRODYNAMICS	
SPA 689	SELECTED TOPICS	
SPA 741	PHYSICS OF COSMIC RAYS	
SPA 742	GAMMA-RAY BURSTS AND JETS	
SPA 771	COMPETITIVE GRANT WRITING WORKSHOP	
SPA 789	SELECTED TOPICS	
Total Semester Hours		**26**

Year 1		
Fall		**Semester Hours**
SPA 522	INTRODUCTION TO PLASMA PHYSICS	3
SPA 582	SCIENCE CAREER PREP	1
SPA 610	ADVANCED MATH METHODS FOR SPACE SCIENCE	3

SPA 622	CLASSICAL QUANTUM STATISTICS	3
	Term Semester Hours:	**10**
Spring		
SPA 526	SPACE WEATHER	3
SPA 624	SPACE PHYSICS I	3
SPA 631	WAVES AND FIELDS	3
SPA 796	JOURNAL CLUB	1
	Term Semester Hours:	**10**
Summer		
SPA 699	MASTER'S THESIS	3
	Term Semester Hours:	**3**
Year 2		
Fall		
SPA 627	HIGH ENERGY RADIATION DETECTION AND MEASUREMENT	3
SPA 662	COMPUTATIONAL PHYSICS	3
SPA 699	MASTER'S THESIS	3
	Term Semester Hours:	**9**
	Total Semester Hours:	**32**

Requirements for M.S. Degree - Non Thesis Option

1. Complete the core coursework (15 credit hours), see Core Courses below.
2. Complete an additional 15 credit hours of elective courses. These are chosen from the Elective Courses list.
3. Complete SPA 582 and SPA 796 once.
4. Pass a Comprehensive Examination ("Comps"). The Comps are offered annually during the summer semester and consist of three sections: (a) Electromagnetic Theory, (b) Classical and Quantum Statistics, and (c) Plasma Physics. A passing grade of 40 percent or above in all three sections is required for a M.S. pass.

Code	Title	Semester Hours
Core Courses		
SPA 522	INTRODUCTION TO PLASMA PHYSICS	3
SPA 610	ADVANCED MATH METHODS FOR SPACE SCIENCE	3
SPA 622	CLASSICAL & QUANTUM STATISTICS	3
SPA 624	SPACE PHYSICS I	3
SPA 631	WAVES AND FIELDS	3
Required Courses		
SPA 582	SCIENCE CAREER PREP	1
SPA 796	JOURNAL CLUB	1
Elective Courses		
Choose 5 courses from the following:		
SPA 526	SPACE WEATHER	
SPA 623	TRANSPORT PROCESSES IN SPACE	
SPA 625	SPACE PHYSICS II	
SPA 627	HIGH ENERGY RADIATION DETECTION AND MEASUREMENT	
SPA 628	SOLAR PHYSICS	
SPA 629	ASTROPHYSICAL FLUID DYNAMICS	
SPA 630	WAVES IN FLUIDS	
SPA 662	COMPUTATIONAL PHYSICS	
SPA 663	COMPUTATIONAL FLUID DYNAMICS AND MAGNETOHYDRODYNAMICS	
SPA 689	SELECTED TOPICS	
SPA 741	PHYSICS OF COSMIC RAYS	
SPA 742	GAMMA-RAY BURSTS AND JETS	

SPA 771	COMPETITIVE GRANT WRITING WORKSHOP	
SPA 789	SELECTED TOPICS	
Total Semester Hours		**32**

Year 1		
Fall		**Semester Hours**
SPA 522	INTRODUCTION TO PLASMA PHYSICS	3
SPA 582	SCIENCE CAREER PREP	1
SPA 610	ADVANCED MATH METHODS FOR SPACE SCIENCE	3
SPA 622	CLASSICAL QUANTUM STATISTICS	3
	Term Semester Hours:	**10**
Spring		
SPA 526	SPACE WEATHER	3
SPA 624	SPACE PHYSICS I	3
SPA 631	WAVES AND FIELDS	3
	Term Semester Hours:	**9**
Year 2		
Fall		
SPA 625	SPACE PHYSICS II	3
SPA 627	HIGH ENERGY RADIATION DETECTION AND MEASUREMENT	3
SPA 662	COMPUTATIONAL PHYSICS	3
SPA 796	JOURNAL CLUB	1
	Term Semester Hours:	**10**
Spring		
SPA 628	SOLAR PHYSICS	3
	Term Semester Hours:	**3**
	Total Semester Hours:	**32**

Space Science, PhD

Information below is intended for prospective students who are considering a Ph.D. degree in Space Science from UAH.

All questions about enrolling in our Ph.D. program should be directed to Dr. Jakobus le Roux (jakobus.leroux@uah.edu), Chair of the SPA Graduate Committee.

Requirements for a Ph.D. degree

1. Complete the core coursework (18 credit hours), see Core Courses below.
2. Complete an additional 30 credit hours of elective courses. These are chosen from the Elective Courses list.
3. Complete SPA 796 three times with each time counting towards your degree.
4. Complete SPA 582 once.
5. Pass a Comprehensive Examination ("Comps"). The Comps are offered annually during the summer semester and consist of three sections: (a) Electromagnetic Theory, (b) Classical and Quantum Statistics, and (c) Plasma Physics. A passing grade of 60 percent or above in all three sections is required for a Ph.D. pass.
6. Pass a Ph.D. qualifier exam. This step involves writing a dissertation proposal and forming a Ph.D. committee, that would normally consist of the student's faculty advisor and at least four other members from the UAH graduate faculty. We encourage students to invite at least one committee member external to the department.
7. Complete 18 credit hours of dissertation units (SPA 799).
8. Write and defend a Ph.D. dissertation.
9. Students must have a first authored peer reviewed paper published or accepted in a major international journal before their graduation date. Examples of acceptable journals include The Astrophysical Journal, Journal of Geophysical Research, Physics of Plasmas, Geophysical Research Letters, and Physical Review.

Code	Title	Semester Hours
Core Courses		
SPA 522	INTRODUCTION TO PLASMA PHYSICS	3
SPA 610	ADVANCED MATH METHODS FOR SPACE SCIENCE	3
SPA 622	CLASSICAL & QUANTUM STATISTICS	3
SPA 623	TRANSPORT PROCESSES IN SPACE	3
SPA 624	SPACE PHYSICS I	3
SPA 631	WAVES AND FIELDS	3
Required Courses		
SPA 582	SCIENCE CAREER PREP	1
SPA 796	JOURNAL CLUB [1]	1
Elective Courses		
SPA 526	SPACE WEATHER	3
SPA 625	SPACE PHYSICS II	3
SPA 627	HIGH ENERGY RADIATION DETECTION AND MEASUREMENT	3
SPA 628	SOLAR PHYSICS	3
SPA 629	ASTROPHYSICAL FLUID DYNAMICS	3
SPA 630	WAVES IN FLUIDS	3
SPA 662	COMPUTATIONAL PHYSICS	3
SPA 663	COMPUTATIONAL FLUID DYNAMICS AND MAGNETOHYDRODYNAMICS	3
SPA 689	SELECTED TOPICS	3
SPA 741	PHYSICS OF COSMIC RAYS	3
SPA 742	GAMMA-RAY BURSTS AND JETS	3
SPA 771	COMPETITIVE GRANT WRITING WORKSHOP	1
SPA 789	SELECTED TOPICS	3

1 Required to take class three times, with each time counting towards your degree.

Year 1		
Fall		**Semester Hours**
SPA 522	INTRODUCTION TO PLASMA PHYSICS	3
SPA 582	SCIENCE CAREER PREP	1
SPA 610	ADVANCED MATH METHODS FOR SPACE SCIENCE	3
SPA 622	CLASSICAL QUANTUM STATISTICS	3
	Term Semester Hours:	**10**
Spring		
SPA 526	SPACE WEATHER	3
SPA 624	SPACE PHYSICS I	3
SPA 631	WAVES AND FIELDS	3
SPA 796	JOURNAL CLUB [1]	1
	Term Semester Hours:	**10**
Year 2		
Fall		
SPA 625	SPACE PHYSICS II	3
SPA 627	HIGH ENERGY RADIATION DETECTION AND MEASUREMENT	3
SPA 662	COMPUTATIONAL PHYSICS	3
SPA 796	JOURNAL CLUB [1]	1
	Term Semester Hours:	**10**
Spring		
SPA 623	TRANSPORT PROCESSES IN SPACE	3
SPA 628	SOLAR PHYSICS	3

SPA 629	ASTROPHYSICAL FLUID DYNAMICS	3
SPA 796	JOURNAL CLUB [1]	1
	Term Semester Hours:	**10**
Year 3		
Fall		
SPA 630	WAVES IN FLUIDS	3
SPA 741	PHYSICS OF COSMIC RAYS	3
or SPA 742	or GAMMA-RAY BURSTS AND JETS	
SPA 799	DOCTORAL DISSERTATION	3
	Term Semester Hours:	**9**
Spring		
SPA 663	COMPUTATIONAL FLUID DYNAMICS AND MAGNETOHYDRODYNAMICS	3
SPA 771	COMPETITIVE GRANT WRITING WORKSHOP	1
SPA 799	DOCTORAL DISSERTATION	6
	Term Semester Hours:	**10**
Year 4		
Fall		
SPA 799	DOCTORAL DISSERTATION	9
	Term Semester Hours:	**9**
Spring		
SPA 799	DOCTORAL DISSERTATION	3-9
	Term Semester Hours:	**3-9**
	Total Semester Hours:	**71-77**

[1] Required to take class three times, with each time counting towards your degree.

Course Descriptions

Accounting (ACC)

ACC 513 - CORPORATE AND PARTNERSHIP TAXATION
Semester Hours: 3

Tax accounting for partnerships, corporations, Subchapter S corporations, estates, and trusts. Tax administration and research are emphasized.

ACC 515 - ADVANCED FINANCIAL ACCOUNTING
Semester Hours: 3

The course will cover topics of financial accounting issues regarding consolidated financial statements, business combinations, and intercorporate investments. Master of Accountancy students only.

ACC 516 - ADVANCED COST ACCOUNTING
Semester Hours: 3

This course explores advanced development and use of cost management data for external reporting and especially internal planning and control. Topics include accounting ethics, the balanced scorecard, cost allocation, inventory management, capital budgeting, management control systems, and performance measurement. Master of Accountancy students only.

ACC 517 - ACCOUNTING FOR STATE & LOCAL GOVERNMENTS AND NON-PROFITS
Semester Hours: 3

The course considers accounting at state and local governments and not-for-profit organizations. Special accounting principles, budgeting, accounting for varioius funds and account groups are emphasized.

ACC 520 - STATE AND LOCAL TAXATION
Semester Hours: 3

Principles of state income tax, sales, and other excise taxes and property tax. Taxation of interstate commerce will be examined along with US constitutional restrictions on the ability of states to tax interstate commerce.

ACC 533 - FORENSIC ACCOUNTING
Semester Hours: 3

Study of the nature and types of fraud. The course covers the tools and techniques used to prevent, investigate, and detect fraud.

ACC 540 - BASIC GOVERNMENT CONTRACT ACCOUNTING
Semester Hours: 3

Basic coverage and principles of government contract accounting with an emphasis on the Federal Acquisition Regulation (FAR).

ACC 541 - ADVANCED GOVERNMENT CONTRACT ACCOUNTING
Semester Hours: 3

Advanced issues in government contract cost accounting with an emphasis on the Federal Acquisition Regulation (FAR) and Cost Accounting Standards (CAS) cost allocation guidelines. Prerequisite: ACC 540.

ACC 570 - SEMINAR/CONTEMPORARY ACCOUNTING ISSUES
Semester Hours: 3

Explores current topics in professional accounting. Master of Accountancy students only.

ACC 580 - PROFESSIONAL CERTIFICATION
Semester Hours: 3

Review of the four areas of the Accounting Standards and Procedures: Regulation, Business Environment and Concepts, Financial Accounting and Reporting, Auditing, and Attestation. Knowledge of the concepts in each of the areas is required for professional accounting certification and practice. Master of Accountancy students only.

ACC 590 - SPECIAL PROJECTS
Semester Hours: 3

Independent study in the field of accounting which is of interest to a student.

ACC 595 - INTERNSHIP IN ACCOUNTING
Semester Hours: 1-3

Internship with a business or government agency that has particular relevance to the educational goals of the program. Students must keep a log and submit a report on their internship.

ACC 600 - FOUNDATIONS OF ACCOUNTING FOR MANAGERS AND ENGINEERS
Semester Hours: 3

A graduate level introduction to the accounting framework and how it is used in evaluating economic conditions and success in decision making organizations. The course considers financial statements, accounting reports, and accounting terminology that constitutes the language of business. The course also introduces the use of accounting information for decision-making, coordinating, motivating, and evaluating.

ACC 602 - MANAGERIAL ACCOUNTING
Semester Hours: 3

Examines the managerial uses of accounting. The focus is on the students gaining a comprehensive understanding of accounting concepts in decision-making, planning, and control. Prerequisite: ACC 600.

ACC 603 - FINANCIAL ACCOUNTING PROBLEMS & ANALYSIS
Semester Hours: 3

A capstone course covering specialized topics in financial accounting, their impacts on financial statements and basic financial statement analysis tools for decision making. Topics include inventory, pensions, derivative financial instruments, accounting changes and errors, and foreign currency. Master of Accountancy students only or permission of instructor. Must be completed with a grade of B or better.

ACC 607 - ACCOUNTING ANALYTICS
Semester Hours: 3

Applications of business analytics to support accounting, auditing, and management decision-making. Emphasis on descriptive, visual, and predictive analysis. Master of Accountancy students only.

ACC 613 - TAX RESEARCH
Semester Hours: 3

This course focuses on the use and understanding of primary and secondary federal tax research materials as they apply to solving complex tax issues confronting tax practitioners. This course's ultimate goal is to help the students solve a tax problem by determining the relevant tax law, finding the relevant law, reconciling any conflicting law and communicating those conclusions. Additionally this course explores the procedural aspect of tax accounting necessary to practice before the Internal Revenue Service. Prerequisite: ACC 513 (with concurrency). Masters of Accountancy students only.

ACC 614 - COST MANAGEMENT
Semester Hours: 3

A study of various approaches to identifying and proactively managing the costs of providing services and products. Special attention is given to the development of cost data useful to managers for decision-making, current issues in cost management, and ethical considerations.

ACC 642 - ADVANCED AUDITING TOPICS
Semester Hours: 3

Coverage of additional expectations and practices in the field of auditing. Broad areas of coverage will include the role of internal auditors, auditing information technology, and system and organization controls (SOC) reports. Prerequisite: MAcc students only.

ACC 650 - SELECTED RESEARCH TOPICS
Semester Hours: 3

ACC 699 - MASTER'S THESIS
Semester Hours: 1-3

Required each semester a student is working on and receiving direction on a masters thesis. A minimum of 2 semesters is required, but no more than six hours of credit is allowed.

Astronomy (AST)

AST 571 - STELLAR ATMOSP/INTERIORS
Semester Hours: 3

AST 572 - GALACTIC STRUC/COSMOLOGY
Semester Hours: 3

AST 573 - HIGH-ENERGY ASTROPHYSICS
Semester Hours: 3

Atmospheric and Earth Science (AES)

AES 501 - SURVEY ATMOSPHERIC SCIENCE
Semester Hours: 3

General survey of the field of atmospheric science includes thermodynamics, atmospheric dynamics, cloud physics, and atmospheric radiation. Quantitative examination of atmospheric properties including atmospheric composition, structure and dynamics.

AES 502 - SCIENTIFIC & SOCIETAL ASPECTS OF NATURAL DISASTERS
Semester Hours: 3

Examination of the physical causes of major natural geophysical hazards and their impact on the natural and built environment, society and the economy. Evaluation of the ability to forecast events, and develop sound mitigation and recovery measures. Specific case studies are considered.

AES 507 - ENVIRONMENTAL THREATS, PUBLIC POLICY, & DECISION MAKING
Semester Hours: 3

Researchers, policymakers and environmental campaigners have identified 25 potential future threats to the global environment. This course examines the nature and consequences of these threats and their potential impacts for the survival of the human race.

AES 508 - PYTHON FOR ID ESS APPLICATIONS
Semester Hours: 3

Introduction to GIS model building, Python programming, and automation of scripts for ArcGIS. Techniques in Model Builder, Python, and the methods for automation will be taught using data from numerous available data sources across the internet with heavy emphasis on the Earth Sciences.

AES 509 - SCIENTIFIC PROGRAMMING FOR EARTH & ATMOSPHERIC SCIENTISTS
Semester Hours: 3

Survey of data types and languages commonly used in the meteorological community along with practical application to meteorology. Course is designed to prepare students for graduate work and research in atmospheric science.

AES 510 - OPERATIONAL WEATHER FORECASTING
Semester Hours: 3

Operational Meteorology covers subjective and objective methods of atmospheric prognosis, including techniques for forecasting operationally-important weather elements. Course explores interpretation, use and systematic errors of computer-generated products, human factors within forecasting, and application of meteorological theory in an operational setting. Course instruction is accomplished through analysis of various weather events from beginning to completion.

AES 514 - GEOSPATIAL APPLICATIONS
Semester Hours: 3

An introductory look at the ways in which GIS can be put to use in different fields of study, drawing examples from Demography, Sociology, Archaeology, History and Ecology. Focus on cartography and map creation principles and public geospatial data acquisition.

AES 515 - ADVANCED TOPICS IN GIS
Semester Hours: 3

Advanced special topics: visualization of GIS and remote sensing data, landscape characterization (pattern vs. process), multitemporal analysis, aggregation of data types, developing an integrated GIS environment for performing complex space-time modeling analyses, and land-atmosphere ineractions. Same as AES 415.

AES 520 - INTRODUCTION TO ATMOSPHERIC CHEMISTRY & AIR POLLUTION
Semester Hours: 3

An introduction designed to provide students with the basics of atmospheric chemistry and air pollution concepts. Topics include air pollutants, air-pollution meteorology, atmospheric gases and aerosols, and atmospheric processes.

AES 541 - ATMOSPHERIC THERMODYNAMICS & CLOUD PHYSICS
Semester Hours: 3

Thermodynamic & cloud physical processes in the atmosphere. Atmospheric statics & stability. Role of aerosols in nucleation of cloud and ice particles. Physical processes that produce the growth of hydrometeors in cold and warm clouds. Applicable measurement techniques.

AES 551 - ATMOSPHERIC FLUID DYNAMICS I
Semester Hours: 3

Fluid dynamics in the atmosphere. Coriolis acceleration, scale analysis, and appropriate approximations of the complete governing equations. Numerical analysis and interpretation of weather phenomena.

AES 554 - FORECASTING MESOSCALE PROCESSES
Semester Hours: 3

Detection and forecasting of atmospheric mesoscale phenomena including the structure and evolution of clouds, precipitation (including floods), thunderstorms, and severe weather. Includes basics of instruments used to detect mesoscale phenomena, most notably satellite and radar. Prerequisites: AES 551.

AES 561 - ATMOSPHERIC RADIATION I
Semester Hours: 3

Fundamentals of terrestrial atmospheric radiation. Topics include: basic concepts, radiative transfer equation, gaseous absorption, scattering by molecules and particles, band models, and transmittance along an inhomogeneous path.

AES 571 - INTRODUCTION TO RADAR METEOROLOGY
Semester Hours: 3

Introduction to principles of radar meteorology, including radar operations, hardware, interpretation, and analysis. Topics covered include doppler, dual-polarization and dual-wavelength radar theory, methods, and applications. Prerequisite: AES 541.

AES 572 - SATELLITE METEOROLOGY
Semester Hours: 3

The goal for this course is to provide students in undergraduate and graduate level Earth and Atmospheric Science a background in satellite meteorology. During all components of the course there will be a heavy emphasis on practical meteorological satellite interpretation with respect to land surface and especially atmospheric features. Prerequisites: AES 508 or AES 509.

AES 590 - SPECIAL TOPICS IN AES
Semester Hours: 1-3

Selected topics of interest not included under other courses.

AES 603 - CLIMATE DYNAMICS
Semester Hours: 3

Origin and evolution of the climate system including underlying causes for past climates such as occurred during the ice ages. Statistical processing of various time series to extract climactic signals in the data. Determination of global-scale forcing mechanisms, which impact climate. Prerequisites: AES 541 and AES 551.

AES 606 - DATA ANALYSIS ATMOSPHERIC SCIENTISTS
Semester Hours: 3

A theoretical and practical introduction to various data analysis methods commonly used in atmospheric science. Topics include forecasting techniques to generate models to fit data, model assessment using parametric tests, probability theory, and Monte Carlo methods to solve a variety of problems. Prerequisite: AES 509.

AES 610 - LAND USE APPLICATIONS & SUSTAINABILITY
Semester Hours: 3

Study of land use and sustainability issues using satellite image processing and GIS. International examples of urbanization, agriculture, transportation, water management, and natural resources exploitation. Discussions of current literature and quantitative analyses of satellite and situ data. Prerequisite: AES 515 or consent of instructor.

AES 612 - ADVANCED GIS FOR EARTH AND ATMOSPHERE PROBLEMS
Semester Hours: 3

Advanced GIS and remote sensing/image processing. Discussion, guided readings, and group labs to interact with student peers and instructor to develop geospatial solutions to problems relevant to their thesis research including appropriate research design, data collection, and analysis. Prerequisites: AES 515 and AES 610.

AES 620 - ATMOSPHERIC CHEMISTRY & AEROSOLS
Semester Hours: 3

Primary processes, thermodynamics, photochemistry, kinetics, models, and measurements applied to troposphere and stratosphere; natural and anthropogenic; chlorine, nitrogen, hydrogen, and oxygen catalytic cycles; ground- and satellite-based observations of trace species. Prerequisite: AES 520.

AES 622 - AIR POLLUTION MODELING
Semester Hours: 3

Air pollution Lagrangian and Eulerian modeling concepts and methods from micro to synoptic scales; plume, large eddy simulations and urban-regional models in research and regulatory applications; transport, dispersion, chemistry, clouds, aerosols, and wet/dry deposition. Prerequisites: AES 520 and AES 551.

AES 624 - AEROSOIS AND CLOUDS
Semester Hours: 3

Principles of atmospheric aerosois and clouds, including chemistry, physics, dynamics and their roles on climate and air quality. Prerequisites: AES520.

AES 625 - AIR POLLUTION APPLICATIONS & DECISION MAKING
Semester Hours: 3

Course will review principles of air pollution, measurement methods, regulation, national and international standards and how research is used to make decisions regarding air quality. The course will use ground-based, satellite, and numerical modeling information through a case study approach. Prerequisite: AES 501.

AES 630 - PHYSICAL CLIMATOLOGY
Semester Hours: 3

This course examines the physical aspects of the global climate system, including the global energy balance, surface energy balance, hydrologic cycle, climate classification, and ocean circulation, natural and anthropogenic climate change and other selected topics such as climate sensitivity. Prerequisite: AES 501 or AES 541.

AES 632 - ENERGY, CLIMATE, ENVIRONMENT
Semester Hours: 3

This course focuses on energy and its impact on the environment including climate change and air pollution. Specific energy forms, such as fossil fuels, nuclear energy, and solar energy, are discussed.

AES 635 - GENERAL CIRCULATION
Semester Hours: 3

Detailed examination of the observed dynamic, thermodynamic and chemical structure of the atmosphere, including mid-latitude baroclinic systems, tropical systems, global-scale energy, mass and momentum budgets, and the fundamental climatology of the atmosphere. Prerequisites: AES 541 and AES 551.

AES 642 - PRECIPITATION PHYSICS FOR RADAR
Semester Hours: 3

Cloud microphysics theory, models, in-situ and radar observations of hydrometers will be utilized together to explore advanced concepts in precipitation physics and their connection to radar meteorology, including coalescence, break-up, freezing, size sorting, aggregation, rimming, and melting. Prerequisites: AES 541 and AES 571.

AES 651 - ATMOSPHERIC FLUID DYNAMICS II
Semester Hours: 3

Wave motions in the atmosphere with emphasis of Rossby, Kelvin and gravity waves. Systematic scaling of primitive equations to develop quasi-geostrophic and Elkman-layer theory. Shallow water theory, stratified flows, and barotropic and baroclinic instability. Prerequisite: AES 551.

AES 652 - ADVANCED SYNOPTIC METEOROLOGY
Semester Hours: 3

Analysis, interpretation, and forecasting synoptic-scale, and mesoscale phenomena, including air masses, frontal systems, cyclones, anticyclones, and waves toward understanding process dynamics. Emphasize the use of observational, satellite and numerical model data, including radars and profilers. Prerequisites: AES 541 and AES 551.

AES 655 - BOUNDARY LAYER METEOROLOGY
Semester Hours: 3

Survey of atmospheric boundary layer (ABL) properties. Review of turbulence, convective and stable boundary layers, surface forcing, boundary layer discontinuities, and singular phenomena within the ABL. Atmospheric field measurements are used to enhance understanding of ABL process. Prerequisites: AES 541 and AES 551.

AES 656 - TROPICAL METEOROLOGY
Semester Hours: 3

Overview concepts of the dynamics and climatology of the tropics and of significant tropical precipitation systems. Topics also include Kelvin waves, equatorial flows, convective scale dynamics, island meteorology, tropical cyclones, ENSO, radiative-convective equilibrium, and gregarious cloud systems. Prerequisites: AES 541 and AES 551.

AES 657 - NOWCASTING THEORY METHODS
Semester Hours: 3

Theory, methods and applications of 0-6 hour weather and ecological prediction, which is a forecast time period when numerical prediction models have low skill. Topics include predictability, data assimilation, statistical methods, and algorithms using Earth and atmospheric science observations.

AES 670 - SATELLITE REMOTE SENSING I
Semester Hours: 3

Using a hands on approach, this course covers a broad range of topics concerning digital image processing applied to the remote sensing of atmospheric, cloud and surface properties using various satellite data sets. Prerequisite: AES 509.

AES 671 - GROUND BASED REMOTE SENSING
Semester Hours: 3

Principles and measurement capabilities of active and passive ground-based remote sensing systems: radar, wind profiler, lidar, sodar, and passive radiometer systems. Integration of remote sensing measurements to retrieve properties of atmospheric phenomena. Hands-on usage and field measurements. Prerequisite: AES 541.

AES 672 - DUAL POLARIZATION RADAR METEOROLOGY
Semester Hours: 3

Theory, analysis, and interpretation of dual polarization radar for meteorological applications. Course covers dual polarization radar system hardware; the basic theory underlying polarimetric radar data and methodology; analysis, interpretation and application of polarimetric radar variables; and dual meteorological and convective weather applications; specifically, precipitation measurement and hydrometeor identification. Example applications include rain rate estimation, drop size determination, hail identification, tornado detection, snow vs rain delineation, and cloud electrification studies. Prerequisite: AES 571.

AES 673 - LIGHTNING
Semester Hours: 3

An introduction to lightning. Topics include qualitative and quantitative description of lightning discharges; electrification of thunderstorms; temporal and spatial variation of lightning on multiple scales; various types of lightning; basic lightning models; current methods of measuring lightning. Prerequisite: AES 509.

AES 675 - ATMOSPHERIC DATA ASSIMILATION
Semester Hours: 3

Data assimilation methods and concepts including objective analysis and initialization as relevant to numerical weather prediction. Emphasis on a variation of methods, successive correction, optimal interpolation, adjoin and gradient concepts, singular vectors, Kalman filters, and nudging. Prerequisites: AES 541 and AES 551.

AES 676 - REMOTE SENSING OF ENVIRONMENT
Semester Hours: 3

This course pursues both basic and advanced concepts in radiative transfer processes and retrieval algorithms of land surface biophysical variables from remote sensing observations, with an emphasis on the hands-on experience of data preprocessing and information extraction by using ENVI. Prerequisite: AES 514.

AES 680 - NUMERICAL MODELING APPLICATIONS ESS
Semester Hours: 3

This course will provide the physical basis for numerical model applications in the earth-atmosphere system including spatial and temporal scales. Prerequisites: AES 501 and AES 509.

AES 681 - NUMERICAL ATMOSPHERIC MODELING
Semester Hours: 3

Introduction to numerical methods applied to simulation of the atmosphere. Basic numerical solution techniques, along with filtering, radiative parameterizations, thermodynamics, turbulent parameterization, initialization, and coordinate transformation. Prerequisite: AES 551.

AES 690 - SPECIAL TOPICS IN ESS
Semester Hours: 3

Selected topics of interest not included under other courses.

AES 698 - MASTERS CAPSTONE
Semester Hours: 3

An extended research project resulting in a substantive paper that involves the original collection, analysis and/or interpretation of scientific data and/or results. Conducted under the guidance of an advisor. Required for MS ESS non-thesis option.

AES 699 - MASTER'S THESIS
Semester Hours: 1-6

A minimum of six thesis credit hours is required for MS degree.

AES 740 - CLOUD PROCESSES
Semester Hours: 3

Theory and observations of the bulk microphysics and kinematic structures of clouds. Topics include: interactions among dynamical, microphysical and thermodynamic processes within cloud systems, the dynamics of organized convective systems, and remote sensing of clouds and precipitation features. Prerequisites: AES 541 and AES 551.

AES 761 - ATMOSPHERIC RADIATION II
Semester Hours: 3

Advanced topics in atmospheric radiative transfer. Specific topics include Maxwell equations, Mie theory, polarization and radiative transfer in a scattering atmosphere. Prerequisite: AES 561.

AES 770 - SATELLITE REMOTE SENSING II
Semester Hours: 3

Using various satellite data sets and radiative transfer models, this course will train students to calculate and study cloud, aerosol, ocean and land surface properties to assess the radiative energy budget of the earth-atmosphere system. Prerequisite: AES 670.

AES 780 - SEMINAR
Semester Hour: 1

Speakers are invited to report on research relevant to the field of Atmospheric and Earth System Science. Students are expected to attend at least twelve seminars and to write short descriptions of the presentations.

AES 781 - STUDENT SEMINAR
Semester Hour: 1

Guest speakers reports on research relevant to the fields of Atmospheric and Earth System Science. Students are expected to attend weekly seminars, submit a paper based on at least ten talks, and make a 15 minute conference-type presentation on a research topic in atmospheric science selected in agreement with their advisor.

AES 782 - PROFESSIONAL DEVELOPMENT
Semester Hour: 1

Topics concerning professional ethics, writing scientific journal articles, proposals and resumes, preparing budgets, networking, time management, conference presentations, research administration, funding agencies, stress, and burnout will be discussed.

AES 790 - SELECTED TOPICS IN ATMOSPHERIC SCIENCE
Semester Hours: 1-4

Selected topics of interest not included under other courses.

AES 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on a doctoral dissertation.

Biotechnology Science & Engineering (BSE)

BSE 601 - CURRENT TOPICS IN BIOTECHNOLOG
Semester Hours: 3

Survey of current Biotechnology literature. Students will be required to critically evaluate the assigned literature, develop detailed written summaries and present their critical evaluations to the class and the instructor.

BSE 620 - INT BIOINFORMATICS:FUND/METHOD
Semester Hours: 3

Students will learn how computational and mathematical techniques are being used to understand DNA and protein sequences, how the information from the genome is being used to understand phenomena at a macro-level. Pre/Corequisites: Graduate student admitted to the Ph.D. program in Biotechnology Science and Engineering. Graduate students in other programs may seek permission from the Director of the Biotechnology Science and Engineering Program to take this class.

BSE 621 - INT BIOINFORMATICS:COMP LAB AP
Semester Hour: 1

Students will use a variety of computational tools and software for data mining, sequence alignment, phylogenetic analysis, clustering, quantitative metabolic pathways analysis and other topics covered in BSE 620. Pre/Corequisites: Graduate student admitted to the Ph.D. program in Biotechnology Science and Engineering. Graduate students in other programs may seek permission from the Director of the Biotechnology Science and Engineering Program to take this class.

BSE 702 - LAB ROTATIONS IN BIOTECHNOLOGY
Semester Hours: 3

Acquire a broad background in biotechnology science and engineering through two 6-week rotations in an active research program under the director of faculty mentors. Students will pursue an independent research project and a detailed written report will be required at the end of each of the two 6-week rotations. Prerequisite: BSE 601.

BSE 703 - BIOTECHNOLOGY RESEARCH
Semester Hours: 6

Advanced research in a specific targeted topic under the direct supervision of a faculty member in collaboration with scientists and researchers at a biotechnology company or business or a research laboratory that has specific relevance to the biotechnology science and engineering program. Completion of this course will require a written report and an oral presentation tot he faculty and students in the biotechnology program.

BSE 780 - BIOTECHNOLOGY SCI/ENG SEMINAR
Semester Hour: 1

Seminar for Biotechnology Science and Engineering. Current topics in Biotechnology and Bioengineering are discussed by visiting speakers from acadmic industries and industry.

BSE 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9

Required each semester student is enrolled and receiving direction on a doctoral dissertation.

Biological Sciences (BYS)

BYS 501 - INTRODUCTION TO BIOLOGY GRADUATE STUDIES
Semester Hour: 1

This course exposes new graduate students to the resources, skills, and approaches to be successful in independent research and graduate studies in the biological sciences. In addition, students will receive introductory training in developing research questions; study design, data analysis, searching and critically reviewing the scientific literature, oral and written scientific communication, proposal and grant writing, teaching and mentoring, ethical conduct of research and behavior, time management, and career planning.

BYS 505 - PSYCHOPHARMACOLOGY
Semester Hours: 3

Introduction to drug classification and action with emphasis on physiological and psychological interactions. Same as PY 505.

BYS 517 - PRINCIPLES OF PLANT PHYSIOLOGY
Semester Hours: 4

The objectives in the development of the plant physiology course are to provide students with opportunities to: (1) study the biological functions of plants from the whole organism to the cellular level; (2) to gain an understanding of the complexity of plant genetics, stress response pathways (hormones) and nutritional requirements of plants; (3) to explore the symbiotic relationship of plants and the mycorrhizae and (4) to appreciate how dependent human beings are on plants from those in our forests and environment, to those in agricultural production and beyond. Students will develop an invidiualized research proposal and will also participate in class experimentation of tissue culture techniques, effects of plant grown regulators, phototropic response(s) on growth and development as well as other primary topics throughout the semester.

BYS 519 - GENE STRUCTURE & FUNCTION
Semester Hours: 3

Advanced studies of macromolecular structure and biological function of proteins and nucleic acids involved in the passage of genetic information and cellular response. Structural significance of viruses and molecular evolution included.

BYS 523 - PRINCIPLES OF VIROLOGY/A&M
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Principles of viral infectivity, multiplication, and chemical constitution; laboratory techniques for their isolation, cultivation, identification, and enumeration.

BYS 524 - MYCOLOGY/A&M
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Lines of phycomycetes using representative species; various series of actinomycetes; representative pathogenic (crop and vegetative pathogens) and nonpathogenic heterobasidiomycetideae organisms; order and families of homobasidiomycetidae. Ontogenetics, cellular, and structural study applied to all divisions, classes, series, orders, and families.

BYS 526 - MICROBIAL ECOLOGY
Semester Hours: 4

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Relationship of soil and aquatic microorganisms and their importance in ammonification, nitrification, and other biological processes.

BYS 531 - BIOLOGICAL DATA SKILLS
Semester Hours: 3

This course covers a range of computational skills needed specifically for biologists who do not have any training in compuer science. The course focuses on command line tools, basic programming in Python, and various aspects of data handling including, data curation, organization, storage, querying, and archiving. The course will include a project that ties together skills that are useful for individual students.

BYS 535 - ADVANCED MICROBIOLOGY
Semester Hours: 3

Aspects of microbial behavior, development, morphogenesis or physiology.

BYS 537 - PSYCHOBIOLOGY STRESS & ILLNESS
Semester Hours: 3

Overview of physiological stress responses and their influence on health, behavior, and illness. Same as PY 536.

BYS 542 - NUTRITIONAL PHYSIOLOGY
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Advanced laboratory dealing with modern techniques of molecular biology and biochemistry.

BYS 543 - MOLECULAR BIOLOGY OF THE CELL
Semester Hours: 3

Advanced study of cell structure and function of macromolecules (lipids, proteins, carbohydrates and nucleotides). In depth literature readings on subcellular organelles, metabolic pathways, cell cycle, cancer, and cell differentiation.

BYS 547 - BIOCHEMISTRY I
Semester Hours: 3

Structural chemistry and function of biomolecules, mechanisms of biochemical reactions, and enzyme kinetics. Same as: CH 561.

BYS 548 - BIOCHEMISTRY II
Semester Hours: 3

Energy transduction, metabolism, biosynthesis of macromolecular precursors, storage, transmission, and expression of genetic information. Same as CH 562. Prerequisites: BYS 547 or CH 561.

BYS 556 - ADVANCED MOLECULAR TECHNIQUES
Semester Hours: 3

Laboratory techniques in molecular biology including current methodology in genomics, proteomics, and RNA analysis. Prerequisite: BYS 519 with concurrency.

BYS 560 - ENVIRONMENTAL BIOLOGY/A&M
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Principles of interaction between living systems and their resources. Current problems in management of natural resources including new approaches in management of pest populations.

BYS 561 - HERPETOLOGY
Semester Hours: 4

Classification, diversity, anatomy function, ecology, behavior, and evolution of amphibians and reptiles. Laboratory and field trips devoted to anatomy and identification, with an emphasis on Alabama and southeastern U.S. species.

BYS 562 - COMMUNITY ECOLOGY
Semester Hours: 4

Detailed consideration of ecological principles and concepts, as well as biotic and abiotic factors relevant to development of communities and ecosystems. Field trips required.

BYS 563 - POPULATION ECOLOGY
Semester Hours: 4

Distribution, population dynamics, and behavior of populations in relation to environmental factors. Field trips required.

BYS 564 - LIMNOLOGY
Semester Hours: 3

Fresh-water environments and organisms exemplified by lakes, ponds, and streams in North Alabama.

BYS 566 - ORNITHOLOGY
Semester Hours: 4

An examination of birds, including classification, diversity, anatomy, function, ecology, behavior, and evolution. Laboratory and field trips devoted to anatomy and identification, with an emphasis on Alabama and southeastern U.S. species.

BYS 567 - ANIMAL BEHAVIOR
Semester Hours: 3

This course examines the role of animal behavior in survival and reproduction. It emphasizes the genetic, morphological, and physiological basis of behavior. Particular emphasis is placed on the mechanisms underlying behavior and their evolutionary significance.

BYS 601 - BIOINFORMATICS I
Semester Hours: 3

Practical use in bioinformatics and X-ray crystallography.

BYS 602 - BIOINFORMATICS II
Semester Hours: 3

Practical use in bioinformatics and applied genomics.

BYS 610 - BIOLOGY GRADUATE INTERNSHIP
Semester Hours: 1-5

This course enables a student to get UAH credits for a paid or unpaid internship in a field related to biology. Arrangements must be made between the internship supervisor and the UAH instructor.

BYS 619 - MICROBIAL GENETICS
Semester Hours: 3

Transmission, expression, and evolution of genes in microorganisms. Studies of chromosomes, plasmids, transposons, bacteriophages, and other genetic elements.

BYS 630 - IMMUNOLOGY
Semester Hours: 4

Innate, humoral, and cell-mediated immunity. Immune deficiencies and hypersensitivities. Autoimmunity, transplantation, and tumor immunology.

BYS 631 - MEDICAL PHARMACOLOGY/A&M
Semester Hours: 3

Course offered jointly by Alabama A&M University and UAH but which is taught on the A&M campus. Drug-receptor interaction, kinetics of drug absorption, distribution and elimination, and discussion of drugs affecting different systems. Pharmacogenetics, toxicity, mutagenesis, teratogenesis, carcinogenesis, and drug interactions. Mechanism of action of drugs, in relation to their use as therapeutic agents in medicine.

BYS 690 - SEMINAR
Semester Hour: 1

Student reports on current journal articles, research, or assigned readings. Graduate students should attend whether enrolled for credit or not. May be taken up to three times for credit.

BYS 691 - SPECIAL TOPICS
Semester Hours: 1-4

Directed readings and/or written reports on topics of individual student interest carried out under the supervision of an instructor. Prerequisite: permission of instructor required before registration.

BYS 692 - RESEARCH
Semester Hours: 2-4

Individual investigations of biological problems under supervision of a graduate faculty member. Permission of instructor required before registration.

BYS 699 - MASTER'S THESIS
Semester Hours: 1-6

Required each semester student is working on and receiving direction on master's thesis. Minimum of six hours required for M.S. thesis students.

Business Legal Studies (BLS)

BLS 500 - LAW, ETHICS & BUSINESS
Semester Hours: 3

An analytical review of corporate ethics addressed from a legal and business standpoint. Focus on codes of ethics, integration of integrity into corporate cultures, top management commitment to ethics, civic involvement, employer-employee relations, consumer protection, and international business.

BLS 506 - GOVERNMENT CONTRACT LAW
Semester Hours: 3

Application of the legal principles governing government contracts as developed from common law, statutes, regulations, and court decisions. Includes requests for proposals, negotiation, inspection, acceptance, delivery, warranties, modification of contracts, equitable adjustment, and disputes. Prerequisite: MGT 501 or ACC 540.

BLS 510 - BUSINESS NEGOTIATIONS
Semester Hours: 3

This course is designed to familiarize students with the theories, basic skills, and ethics involved in negotiation. Through a combination of readings, lectures, videotapes, role-play exercises, and discussion, students will develop an understanding of the dynamics of negotiation and the approaches available to a wide variety of business leaders engaged in the negotiation process. The course will include sessions in which students will have the opportunity to gain experience through role playing of simulations taken from actual cases.

BLS 511 - BUSINESS LAW FOR ACCOUNTANTS
Semester Hours: 3

In-depth study of legal principles and problems encountered in practice by professional accountants. This course covers legal topics from a Uniform Commercial Code perspective.

BLS 590 - SPECIAL TOPICS BUSINESS LAW
Semester Hours: 3

Specialized instruction of an area of interest to students in business.

BLS 625 - LEGAL ASPECTS OF ENGINEERS
Semester Hours: 3

Legal problems and principles relevant to the practice of professional engineers. The legal system, contracts, torts, business organizations, employment law, intellectual property law, and environmental law.

Chemical Engineering (CHE)

CHE 540 - PHYSICAL PROP OF FLUIDS
Semester Hours: 3

Theoretical, experimental, and correlation methods for determining and predicting the thermodynamic and transport properties of various fluids. Critical properties, equations of state, vapor pressure and latent heat, heat capacity. Viscosity, thermal conductivity, diffusion coefficient, phase equilibrium, heat and free energy for formation.

CHE 541 - CHEMICAL KINETICS & REACTOR DE
Semester Hours: 3

Fundamental principles of chemical kinetics and chemical reactor engineering along with the design of both thermal and catalytic reactors.

CHE 549 - INTRO ENVIRONMENTAL ENGR
Semester Hours: 3

Engineering aspects of air, water, and thermal pollution. Hydrologic cycle, water sources and uses;industrial and other sources of primary and secondary pollutants. Transport process in environmental problems and in their control.

CHE 552 - EXPER TECH IN FLUID MECH
Semester Hours: 3

CHE 559 - SELECTED TOPICS/CHE
Semester Hours: 1-6

Discussion of biocompatible polymers and their application in drug delivery systems. Polymers of natural and synthetic origin will be studied, special emphasis will be placed upon the synthesis of biocompatible polymers. The formation of polymeric micelles, hydrogels, and liposomes will be studied. The process of extravasation as an uptake mechanism for polymeric delivery systems will be discussed. Reading material will be based on the latest publications in the field.

CHE 560 - INTRO TO BIOPROCESS ENGR
Semester Hours: 3

Application of engineering principles to the analysis of and the development and design of processes using biological catalysts including enzymes, plant and animal cells, and genetically engineered cells. Other topics include fermentation and biological mass transport processes.

CHE 561 - BIOSEPARATIONS RECOMBI TECH/PR
Semester Hours: 3

General characteristics of separation processes used in the biotechnology industry, including removal of insolubles, isolation and purification of thermally sensitive products for final use by the customer. Application of unit operation principles for biological separations, recombinant DNA techniques, protein engineering. Prerequisite: CHE 560.

CHE 594 - APPLIED MATERIALS PROCESSING
Semester Hours: 3

Synthesis and processing methods of materials for engineering applications. Selection and use of materials performance factors for design of structural and functional components. Use of computational methods in solving open-ended design problems that depend on an understanding of the nature and properties of materials will be emphasized. All classes of materials are covered.

CHE 595 - POLYMER ENGINEERING
Semester Hours: 3

Engineering principles of polymers and their role in manufacturing processes. Aspects of polymer phenomena and their relationship to processing of structural and functional components.

CHE 641 - ADV THERMODYNAMICS
Semester Hours: 3

Application of classical thermodynamics. Treatment of problems involving nonideal gases and liquids, phase equilibrium, and chemical equilibrium.

CHE 642 - PHYSICOCHEMICAL HYDRODYNAMICS
Semester Hours: 3

Treatment of electrokinetic phenomena, axial dispersion, convective diffusion in liquids, Brownian motion, flows driven by surface tensions, capillary motion.

CHE 644 - INTRO ELECTROCHEM SYSTEM
Semester Hours: 3

Thermodynamics, transport, and kinetics of electrodes and cells. Systems analysis of batteries, fuel cells, porous electrodes, electroplating, electrowinning, and corrosion processes. Convective diffusion at high Schmidt numbers.

CHE 646 - THERMODYNAMICS OF MATRLS
Semester Hours: 3

Fundamental thermodynamic review, phase equilibrium, chemical reaction equilibrium, free energy, binary and ternary phase transformations, solution models and selected topics.

CHE 648 - TRANSPORT PHENOMENA I
Semester Hours: 3

Introduction to transport phenomena, fluid and continuum mechanics. Exact solutions of the Navier-Stokes equation. Introduction to boundary-layer. Multiphase flows. Capillary flows.

CHE 649 - TRANSPORT PHENOMENA II
Semester Hours: 3

Introduction to transport phenomena with emphasis on energy and mass transport. Equations of energy change. Free and forced convection. Equations of mass change. Ficks Law. The Stephan-Maxwell equations. Mass transport in multiphase systems. Prerequisite: CHE 648.

CHE 650 - PRINC LIQUID/SOLID INTER
Semester Hours: 3

Applies basic principles in thermodynamics and kinetics to characterize surfaces and surface phenomena. Reviews fundamental properties of gas-liquid, liquid-liquid, solid-liquid, and solid-gas interfaces and phenomena occurring at these interfaces.

CHE 652 - INTRO TO AIR POLLU CONTROL
Semester Hours: 3

Technology of air pollution dealing with air pollutants, effects, sources, combustion processes, and abatement and control technology. Engineering contributions to both the problems and their solutions. Nature of air pollution problem and fundamental technological approaches to its solution.

CHE 657 - ADVANCED PROCESS CONTROL
Semester Hours: 3

Application of modern control theory to chemical processes; multivariable control; estimation and adaptive control, optimal control.

CHE 658 - CATALYSIS/REACTOR DESIGN
Semester Hours: 3

Treatment of homogeneous and heterogeneous reaction kinetics, transport in fluid-solid reactions, catalyst deactivation and their effects on the analysis and design of chemical reactors. Prerequisite: CHE 541.

CHE 659 - SELECTED TOPICS/CHE
Semester Hours: 1-6

CHE 696 - GRAD INTERNSHIP CHE ENGR
Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization, or government agency that has particular interest and relevance to the graduate student. Permission of CHE faculty member required.

CHE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of nine hours of credit is awarded upon successful completion of master's thesis. The 1 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 1 hour option once in their career.

CHE 724 - INSTR METH/BIO-MTLS CHARACTERI
Semester Hours: 3

CHE 725 - INSTR METH/BIO-MTLS CHARACTERI
Semester Hours: 4

CHE 747 - ADV TOP/BIOENGINEERING
Semester Hours: 3

Engineering aspects of microbial processes and the processing of biological materials. Integrating knowledge of governing biological properties and principles with chemical engineering methodology. Emphasis on current literature in the areas of purification and separation technology, bioprocess development, and biomaterials.

CHE 749 - MASS TRANSPORT
Semester Hours: 3

Mass transfer in solid and fluid systems under steady and transient conditions. Integration of momentum, heat and mass transfer equations with application to reactive, rheological and multicomponent systems.

CHE 757 - OPT TECH/FLUID MECHANICS
Semester Hours: 3

Laser courses, molecular interactions with light and diatomic spectroscopy needed fluorescence, Brillouin scattering, four wave mixing, CARS and other applications in optical fluid diagnostics.

CHE 759 - ADV SELECTED TOPICS IN CHE
Semester Hours: 1-3

CHE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation.

Chemistry (CH)

CH 500 - TOPICS IN CHEMISTRY
Semester Hours: 1-3

Advanced laboratory research in one of the departmental research groups. The student works on an independent or group research project. Completion of the course requires an appropriate written and oral report. Prerequisites: Approval of instructor.

CH 521 - CHEMICAL INSTRUMENTATION
Semester Hours: 3

Use of basic instrumentation in NMR, mass spectrometric, chromatographic, and spectrophotometric analysis.

CH 522 - CHEMICAL INSTRUMENTATION LABORATORY
Semester Hour: 1

Complements the lecture material for CH 521. Introduction to modern analytical instrumentation including IR, UV and atomic absorption spectrophotometers, nuclear magnetic resonance, electroanalytical equipment, and gas and liquid chromatographs. Prerequisite with concurrency: CH 521.

CH 549 - SPECTROSCOPY & MOLECULAR STRUCTURE
Semester Hours: 3

Intermediate level treatment of principles of spectroscopy and their application to determination of molecular structure.

CH 553 - INTRO QUANTUM MECHANICS I
Semester Hours: 3

Waves and particles; Bohr's model; de Broglie waves, wave-packets, uncertainty principle; quantum mechanics postulates; Schroedinger equation; systems in 1, 2 & 3 dimensions; hydrogen atom. Same as PH 551, OSE 555, and MTS 651.

CH 554 - INTRO QUANTUM MECHANICS II
Semester Hours: 3

Angular momentum and spin; atomic structure and spectrum; time-independent perturbation theory, variational methods; time-dependent perturbation theory and interactions of light with matter; scattering theory; electronic structure of solids; relativistic quantum mechanics. Same as: PH 552, MTS 652. Prerequisite: PH 551 or CH 553.

CH 561 - BIOCHEMISTRY I
Semester Hours: 3

Structural chemistry and function of biomolecules, mechanisms of biochemical reactions, enzyme kinetics, and energy transfer. Same as: BYS 547.

CH 562 - BIOCHEMISTRY II
Semester Hours: 3

Metabolism, biosynthesis of macromolecular precursors, storage, transmission, and expression of genetic information, and molecular physiology. Same as BYS 548. Prerequisites: CH 561 or BYS 547.

CH 600 - ADVANCED INORGANIC CHEMISTRY
Semester Hours: 3

Survey with emphasis on structure and reactivity of inorganic compounds.

CH 602 - CHEMISTRY OF COORDINATION COMPOUNDS
Semester Hours: 3

Modern bonding theory and stereochemistry of coordination compounds.

CH 621 - METHODS OF CHEMICAL ANALYSIS
Semester Hours: 3

Literature, seminar course. Theory and methodology of various techniques of chemical analysis.

CH 631 - SYNTHETIC ORGANIC CHEMISTRY
Semester Hours: 3

Survey of certain reactions that enjoy widespread application to the synthesis of organic compounds.

CH 632 - PHYSICAL ORGANIC CHEMISTRY
Semester Hours: 3

Reactive intermediates, structure-activity relationships, reaction mechanisms and techniques used to determine them.

CH 633 - ORGANIC STRUCTURE DETERMINATION
Semester Hours: 3

Structure determination of organic molecules using spectroscopic methods, especially NMR, IR, and MS. Emphasis on the theory and interpretation of many NMR methods useful in chemistry research.

CH 634 - MOLECULAR MODELING
Semester Hours: 4

Molecular modeling methods, such as molecular mechanics, molecular docking, molecular orbital theory, and density functional theory, will be used to investigate conformational properties of organic compounds, molecular interactions between biological macromolecules and organic ligands, electronic structure of organic and inorganic compounds, frontier molecular orbitals, pericyclic reactions, and reactive intermediates. Extensive computational laboratory work included.

CH 635 - CHEMICAL TOXICOLOGY
Semester Hours: 3

An introduction to the principles of chemical toxicology, including the effects of drugs, environmental pollutants, natural toxins and venoms, and other potentially hazardous chemicals at the physiological, cellular, and molecular level.

CH 640 - ADVANCED CHEMICAL THERMODYNAMICS
Semester Hours: 3

First, second, and third laws of thermodynamics. Thermodynamic functions. Applications to thermal properties of gases, liquids, solids, and solutions. Chemical reactions, phase transitions, and electrochemistry.

CH 641 - STATISTICAL THERMODYNAMICS
Semester Hours: 3

Principles leading to the development of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. Thermodynamic properties calculated from partition functions.

CH 642 - ADVANCED CHEMICAL DYNAMICS
Semester Hours: 3

Non-equilibrium thermodynamics, macroscopic and microscopic theories of diffusion, chemical reaction rate laws and mechanisms, transition state theory, gas phase molecular dynamics, electrical conduction in electrolyte solutions, electrode kinetics. Prerequisite: CH 640.

CH 643 - QUANTUM CHEMISTRY
Semester Hours: 3

Application of quantum theory to the chemical bond.

CH 644 - CHEMICAL ELECTRODYNAMICS
Semester Hours: 3

Maxwell's equations applied to electrodynamic problems in chemistry. Theory of dielectrics, dipole moments, Beer's law, Landolt's rule, light scattering, magnetic properties, quantum theory of radiation.

CH 645 - POLYMER PHYSICAL CHEMISTRY
Semester Hours: 3

Introduction to structure, properties and processing of polymers. Physical behavior of polymers, structure-property relationships, polymer characterization, thermodynamics of polymer solutions and melts, mechanical evaluation of polymers. Same as MTS 747.

CH 646 - THERMODYNAMICS OF MATERIALS
Semester Hours: 3

Fundamental thermodynamic review, phase equilibrium, chemical reaction equilibrium, free energy, binary and ternary phase transformations, solution models and selected topics. Same as CHE 646 and MTS 646.

CH 647 - ADVANCED BIOPHYSICAL CHEMISTRY I
Semester Hours: 3

Topics include: computer data analysis and simulation, first and second laws of thermodynamics, free energy and equilibrium, calorimetry, protein stability, binding and interactions, solution thermodynamics, electrolytes.

CH 648 - ADVANCED BIOPHYSICAL CHEMISTRY II
Semester Hours: 3

Advanced biophysical chemistry, including biochemical reaction kinetics, enzyme catalysis, quantum mechanics, statistical thermodynamics, spectroscopy, including UV-VIS, fluorescence, circular dichroism, NMR, and Structure determinations. An emphasis is placed on the current research literature.

CH 649 - POLYMER SYNTHESIS & CHARACTERIZATION
Semester Hours: 3

Same as MTS 649.

CH 650 - PRINCIPLES OF THE LIQUID/SOLID INTERFACE
Semester Hours: 3

Applies principles in thermodynamics & kinetics to characterize surfaces & surface phenomena. Fundamental properties of gas-liquid, liquid-liquid, solid-liquid and solid-gas interfaces and phenomena at these interfaces. Same as MTS 650 and CHE 650.

CH 699 - MASTER'S THESIS
Semester Hours: 3-6

Required each semester a student is enrolled and receiving direction on a masters thesis. Minimum of two terms is required. (A maximum of six hours may be applied towards the degree).

CH 700 - CURRENT TOPICS IN CHEMISTRY
Semester Hours: 1-3

Advanced laboratory research in one of the departmental research groups. The student works on an independent or group research project. Completion of the course requires a written and an oral report. Prerequisite: approval of instructor.

CH 705 - SELECTED TOPICS IN INORGANIC CHEMISTRY
Semester Hours: 3

Prerequisites: CH 600 and approval of instructor.

CH 721 - SELECTED TOPICS IN ANALYTICAL CHEMISTRY
Semester Hours: 3

Prerequisites: CH 621 and approval of instructor.

CH 735 - SELECTED TOPICS IN ORGANIC CHEMISTRY
Semester Hours: 3

Prerequisites: CH 632 and approval of instructor.

CH 745 - SELECTED TOPICS IN PHYSICAL CHEMISTRY
Semester Hours: 3

CH 746 - SOLID STATE CHEMISTRY
Semester Hours: 3

Chemical properties of solids. Includes phase equilibria, chemical bonding in ionic and covalent crystals, thermodynamics of atomic defects, ionic conductivity in solids, corrosion, & introduction to surfaces and adsorption.

CH 765 - SELECTED TOPICS IN BIOCHEMISTRY
Semester Hours: 3

Prerequisites: approval of instructor.

CH 780 - CHEMISTRY SEMINAR
Semester Hour: 1

Required during each semester of residence.

CH 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9

Civil Engineering (CE)

CE 511 - INTRO GEOGRAPHICAL INFO SYS
Semester Hours: 3

Introduces vector, raster and tabular concepts, emphasizing the vector approach. Topics include: spatial relationships, map features, attributes, relational database, layers of data, data ingesting, digitizing from maps, projections, output, applications, and availability of public data sets.

CE 520 - URBAN TRANSPORTATION PLANNING
Semester Hours: 3

Planning of highway systems and terminals as part of a complete planning approach; public transportation system planning; transportation planning studies, projection analysis, plan formulation, and programming.

CE 541 - OPEN CHANNEL HYDRAULICS
Semester Hours: 3

Design and analysis of erodible and non-erodible channels. Uniform flow, channel roughness, gradually and spatially varied flow, rapidly varied flow, hydraulic jumps, gradually varied unsteady flow, flood routing, flow measurements, channel models, channel and culvert design.

CE 549 - INTRO ENVIRONMENTAL ENGR
Semester Hours: 3

Engineering aspects of air, water, and thermal pollution. Hydrologic cycle, water sources and uses; industrial and other sources of primary and secondary pollutants. Transport process in environmental problems and in their control.

CE 550 - ENVIRONMENTAL CONTROL
Semester Hours: 3

Engineering design and synthesis of environmental control systems. Control of multiphase systems with application to air and water pollution control.

CE 552 - INDUSTRIAL WASTE TREATMENT
Semester Hours: 3

Advanced topics in the area of hazardous waste management and water quality control. Emphasis on industrial waste, including hazardous waste management. Topics include: generation, storage, collection, transfer, disposal, recycling, economic, environmental, and regulatory considerations.

CE 554 - SOLID & HAZARDOUS WASTE MGMT
Semester Hours: 3

Waste characterization, minimization, collection, treatment, transport, and disposal. Landfill design and incineration options. Leachate characteristics and potential groundwater contamination. Prerequisite: CE 549.

CE 555 - WATER QUALITY LABORATORY
Semester Hours: 3

Properties of natural water sources and laboratory methods associated with water and wastewater treatment systems. Students design and demonstrate a water treatment system to bring a water sample into compliance with drinking water standards.

CE 556 - WATER QUALITY CONTROL PROC
Semester Hours: 3

Principles of public water supply design. Source selection, collection, purification, and distribution for municipal use. Collection of waste waters, their treatment, and disposal. Prerequisite: CE 549.

CE 557 - HYDROLOGY
Semester Hours: 3

Occurrence and movement of water over the earth's surface for engineering planning and design. Relationship of precipitation to streamflow with frequency analysis, flood routing, and unit hydrograph theory.

CE 558 - ENVIRONMENTAL ENGR DSGN
Semester Hours: 3

Engineering design and project management of environmental quality/restoration systems. Students will complete a design project focusing on one of the following systems: sanitary landfill, municipal incinerator, or groundwater/site remediation. Lectures will address skills for technical presentations and proposal writing, as well as process design and decision making.

CE 559 - SEL TOPICS CIVIL ENGINEERING
Semester Hours: 1-6

CE 561 - VIBRATIONS ELASTIC SYS
Semester Hours: 3

Formulation of the equations of motion of discrete and continuous systems, analytical and numerical methods of solution, eigenvalue problems, and dynamic response.

CE 571 - ADVANCED SOIL MECHANICS
Semester Hours: 3

Continuum mechanics applied to soil behavior. Theoretical approaches to consolidation, shear strength, slope stability and soil stabilization.

CE 572 - SOIL DYNAMICS
Semester Hours: 3

Behavior of soils under dynamic, earthquake and blast loading. Analysis of foundation vibration and isolation.

CE 573 - EARTH STRUCTURES ENGINEERING
Semester Hours: 3

Principles of earth structure design. Theories of earth pressures and the design of retaining wall systems including gravity, cantilever, mechanically stabilized earth, flexible sheet pile, and anchored wall systems. Methods of stability analyses for retaining walls, earth slopes, and embankment design.

CE 574 - APP MECHANICS OF SOLIDS
Semester Hours: 3

Stresses and strains at a point, theories of failures, stress concentration factors, thick-walled cylinders, torsion of noncircular members, curved beams, unsymmetrical bending, and shear center.

CE 577 - EXP TECH SOLID MECHANICS
Semester Hours: 3

Experimental methods to determine stress, strain, displacement, velocity, and acceleration in various media. Theory and laboratory applications of electrical resistance strain gages, brittle coatings, and photoelasticity. Application of transducers and experimental analysis of engineering systems.

CE 578 - MATRIX METH STRUCT MECH
Semester Hours: 3

Matrix application to formulation and solution of linear problems in structural mechanics. Stresses, vibrations, and stability of engineering structures.

CE 581 - STRUCTURAL ANALYSIS II
Semester Hours: 3

Reactions, shears, moments and deformations in complex structural systems. Statically indeterminate systems, advanced geometric and energy methods.

CE 583 - REINFORCED CONCRETE DESIGN
Semester Hours: 3

Theory and practice of reinforced concrete design. Theory and design of high strength concrete mixtures. Design of reinforced concrete beams, slabs and columns using the ultimate strength design code of the American Concrete Institute.

CE 584 - STEEL DESIGN
Semester Hours: 3

Principles of the design of steel structures using ASD methods. Analysis and design of structural elements including beams, columns, and connection details.

CE 585 - FOUNDATION ENGINEERING
Semester Hours: 3

Design of foundations with emphasis on reinforced concrete, footings, caissons, piles, retaining walls, and mat foundations. Effect of bearing pressure on foundations. Prerequisite: CE 583.

CE 586 - ADV CEMENTITIOUS & COMPOSITE
Semester Hours: 3

Concrete structures, rheology, mechanical properties, environmental durability, dimensional stability, advanced concrete technologies (such as high strength, fiber reinforced, and fracture mechanics), advanced fiber polymer composites, and repair/rehabilitation of concrete structures.

CE 587 - BRIDGE DESIGN
Semester Hours: 3

Structural design of bridge components based on governing design codes, loadings, and structural analysis. Topics may include the introduction to Load and Resistance Factor Design (LRFD) design philosophy, loads and analysis, reinforced concrete girders and deck slabs, steel girders, etc.

CE 603 - ADVANCED CONCRETE DESIGN
Semester Hours: 3

Design of concrete columns; bond, anchorage and reinforcing details; design of two-way slabs; design and analysis of multistory building frames; introduction to prestressed concrete; design of prestressed cross-sections for moment.

CE 611 - GIS IN CIVIL ENGINEERING
Semester Hours: 3

Advanced topics in geographical information systems (GIS) with civil engineering applications. Emphasis will be placed on spatial/temporal data analyses using digitized maps and database information in an area of CE specialization. Research project will be required.

CE 622 - ADVANCED TRAFFIC ENGRG DESIGN
Semester Hours: 3

In depth analysis of traffic engineering concepts related to intersection analysis (signalized and un-signalized) as well as arterial systems.

CE 646 - EROSION & SEDIMENTATION
Semester Hours: 3

River morphology and river response, incipient erosion and its prediction, bed form and roughness, degradation, aggradation, and local scour in alluvial rivers. Design of stable channels, computation of bed load.

CE 650 - ENVIRONMENTAL IMPACT ANAL
Semester Hours: 3

National environmental policy act and its implementation. Environmental impact process. Writing an environmental impact statement.

CE 651 - ENVIRONMENTAL REGULATIONS
Semester Hours: 3

Basic understanding of environmental law with an appreciation for the practical implementation of regulations for environmental engineers. Includes an overview of the major American environmental laws for protection of water and air resources, as well as permitting requirements and health/safety responsibilities. Prerequisite: CE 549.

CE 652 - INTRO TO AIR POLLUTION CONTROL
Semester Hours: 3

Technology of air pollution dealing with air pollutants, effects, sources, combustion processes, and abatement and control technology. Engineering contributions to both the problems and their solutions. Nature of air pollution problem and fundamental technological approaches to its solution.

CE 653 - GROUNDWATER ENGINEERING
Semester Hours: 3

Application of engineering principles to the movement of groundwater. Influence of physical and geological environment on groundwater hydraulics. Water well hydraulics and aquifer evaluation. Emphasis on practical groundwater engineering problems. Prerequisites: MA 526 or MAE 693.

CE 654 - ENVIRONMENTAL TRANSPORT
Semester Hours: 3

Fundamental principles of mass transport, chemical partitioning/transformations in environmental systems. Practical transport examples for surface water, ground water, and atmospheric systems will be presented and mathematical modeling will be utilized for solutions.

CE 655 - HAZARDOUS WASTE MGMT
Semester Hours: 3

Topics include definition of hazardous waste, regulatory considerations, risk assessments, and categories of waste. Current and emerging treatment and disposal technologies will be explored.

CE 656 - ADV. WASTEWATER ENGINEERING
Semester Hours: 3

Advanced topics in wastewater engineering. Theory and modeling of biological wastewater treatment processes. Focus on theory/modeling of biological processes and current research on advanced wastewater treatment processes. Prerequisites: CE 556.

CE 657 - ADVANCED HYDROLOGY
Semester Hours: 3

Hydrologic cycle, including interrelationships between classical and statistical methods of hydrology. Evaluation of governing equations, linearizations, analytical approximations and numerical solution techniques for various boundary conditions. Stochastic hydrologic modeling in both temporal and spatial domains. Prerequisites: ISE 690, MAE 586, MAE 693, and CE 557.

CE 658 - SUSTAINABLE DESIGN
Semester Hours: 3

The built environment has a substantial impact on energy and material resources as well as being a critical determinant of health and productivity. This course covers topics such as site planning and construction variables, energy and water alternatives, and current rating systems. Case studies and field trips of historic and contemporary projects exemplifying various sustainability features will be included.

CE 659 - SEL TOPICS CIVIL ENGINEERING
Semester Hours: 1-6

CE 660 - STRUCTURAL DYNAMICS
Semester Hours: 3

Application of the theory of vibrations to discrete and continuous models of structures. Numerical methods of analysis for both spatial and temporal variables. Model synthesis and step-by-step time integration methods. Finite element applications: substructuring techniques.

CE 662 - GEOTECHNICAL ENGINEERING
Semester Hours: 3

Shallow foundation's immediate and consolidated settlement, advanced deep foundations under lateral and axial loads, design of single and pile groups, soil-pile interaction, introduction to seismology, earthquake characteristics, dynamic soil properties and response, soil profile response spectra, soil liquefaction. Prerequisite: CE 585.

CE 666 - EARTHQUAKE ENGR & STRUCT DYNAM
Semester Hours: 3

This allows structural engineers to consolidate their knowledge on the effect of earthquake ground motions on civil engineering structures. The course will cover the analysis and the theories of structures made of various materials that are located in active seismic zones. Finally, the course will allow structural engineers to acquire new basic knowledge in earthquake engineering that will allow them to communicate better with scientists and engineers of other disciplines in earthquake engineering (e.g. seismologist, geotechnical engineers, etc.).

CE 671 - CONTINUUM MECHANICS
Semester Hours: 3

Kinematics and kinetics, various coordinate systems, constitutive equations for continuous media; governing partial differential equations from first and second laws of thermodynamics; applications to solids, liquids, and gases.

CE 672 - THEORY OF ELASTICITY
Semester Hours: 3

Formulation of boundary-value problems of classical elasticity. Application to plane problems, prismatic members, and axisymmetric problems. Introduction to three-dimensional problems.

CE 673 - PLASTICITY
Semester Hours: 3

Fundamentals of mechanical behavior of metals and nonmetals for stress states greater than the yield stress state. Deformation and flow theories. Stress-strain relations and yield criteria. Solution of boundary value problems with plastic bodies. Limit analysis of structures.

CE 674 - FINITE ELEMENT ANALYS I
Semester Hours: 3

Finite element theory, variational methods, weighted residuals. Applications to linear partial differential equations in continuous media. Solution of boundary value and initial value problems.

CE 675 - ROCK MECHANICS
Semester Hours: 4

Principles of continuum mechanics applied to the design of structures in rock; tunnels, underground structures and foundations. Joint behavior; stresses; analysis of rock slopes; instrumentation.

CE 676 - VISCOELASTICITY
Semester Hours: 3

Mechanical behavior of materials having time-dependent and temperature-dependent material properties. Creep and relaxation phenomena. Elastic-viscoelastic analogies. Formulation of stress-strain laws. Solution of boundary value problems for viscoelastic bodies.

CE 677 - OPTICAL TECH IN SOLID MECH
Semester Hours: 3

Overview of conventional methods for experimental stress analysis. Introduction to applied optics with emphasis on non-destructive, laser-based testing methods, fiber optic recording systems, photoelectronic-numerical data acquisition, and computer aided analysis.

CE 678 - MECHANICS OF COMPOSITE MATRLS
Semester Hours: 3

Introduction to composite materials, micro- and macro-mechanical behavior of laminae; bending, buckling and vibration of laminated plates.

CE 679 - HYPERVELOCITY IMPACT PHENOMENA
Semester Hours: 3

Fundamental principles of penetration mechanics. Analytical and numerical approaches to perforation and penetration problems. Shock jump conditions, hugoniots, and equations of state; low, high, and hypervelocity impacts of finite and thin targets.

CE 681 - ADVANCED STRUCTURAL ANALYSIS
Semester Hours: 3

Explores modern methods of structural analysis, matrix formulation of flexibility and stiffness methods, and analysis of structures with material and geometric nonlinearities. Also introduces energy methods for indeterminate structures. Prerequisite: CE 581.

CE 683 - GRADUATE SEMINAR
Semester Hour: 1

Professional activities designed to promote the skills required to organize and deliver oral technical presentations and to broaden the individual's awareness of technical issues. Required for all students pursuing a graduate degree. Students will be graded "S" (Satisfactory) or "U" (Unsatisfactory) based upon their performance and attendance. Students who do not receive an "S" grade must register for the course until an "S" is obtained.

CE 696 - GRAD INTERNSHIP CE ENGR
Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization or government agency that has particular interest and relevance to the graduate student. Permission of CEE faculty member required.

CE 697 - MASTER'S PLAN II PROJECT
Semester Hours: 3

Application-oriented student project designed to show competence in an area of civil engineering.

CE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of nine hours of credit is awarded upon successful completion of master's thesis. The 1 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 1 hour option once in their career.

CE 722 - SLIDING MODE CONTROL
Semester Hours: 3

CE 756 - HAZARDOUS WASTE REMEDIAT
Semester Hours: 3

Engineering design skills applied to the solution of real world hazardous waste remediation problems. Remedy screening and selection; treatment train development for a Superfund facility.

CE 762 - WAVE MOTION CONT ELASTIC BODIE
Semester Hours: 3

Elements of stress wave propagation in bounded elastic media. Propagation of elastic waves in infinite and semi-infinite bodies, cylinders, rods and beams.

CE 765 - RAND VIBRAT ELASTIC SYSTEM
Semester Hours: 3

Dynamic analysis of elastic systems including the response of complex structures to random excitations. Typical excitations include random wind, thermal, earthquake, aerodynamic, and ocean wave phenomena. Probabilistic mechanics methods. Concepts of reliability. Stationary and ergodic processes.

CE 772 - THEORY STRUCT STABILITY
Semester Hours: 3

Energy criterion for stability of elastic structure under conservative loading. Stability concept for general continuous systems. Rigorous and approximate methods of analysis. Buckling of structural elements under impulsive and nonconservative loading. Postbuckling behavior.

CE 773 - THEORY OF SHELLS
Semester Hours: 3

Analysis of thin plates and shells, including higher approximations theories and transverse-shear deformations; illustration of theories by selected problems.

CE 774 - FINITE ELEMENT ANAL II
Semester Hours: 3

Advanced topics in finite element analysis: application to nonlinear partial differential equations in continuum mechanics: theoretical studies of convergence and stability of solutions.

CE 778 - FRACTURE MECHANICS
Semester Hours: 3

CE 779 - ADV PENETRATION MECHANIC
Semester Hours: 3

Advanced analytical modeling of penetration and perforation phenomena, hydrocode development and applications, and similitude analysis.

CE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

PhD Research.

Communication Arts (CM)

CM 505 - ADVANCED MEDIA WRITING
Semester Hours: 3

This course offers an overview of various media writing genres, including Broadcast, Advertising and Public Relations. Students complete a mix of timed assignments with each context to acquire a more complete survey of media writing and prepare for a career within the mass media.

CM 508 - CLASSICAL RHETORICAL THEORY
Semester Hours: 3

This course surveys the early development of rhetorical theory in the Western world, from its sophistic origins in the 5th century BCE, through the Greek philosophers and educators, to the Romans and early Christians.

CM 509 - CONTEMPORARY RHETORICAL THEORY
Semester Hours: 3

This course surveys contemporary rhetorical thought, including modern and postmodern theories. The course requires rigorous academic analysis and critique as students explore historical and current rhetorical concepts.

CM 514 - CREATIVE NONFICTION WRITING
Semester Hours: 3

This course introduces students to the genre of creative non-fiction. Undergraduate students (CM 414) will write five essays and revise toward a final writing portfolio. Graduate students (CM 514) will write five essays and a collage assignment, revising toward a final portfolio.

CM 518 - LEGAL ARGUMENT
Semester Hours: 3

This course examines argumentation in legal communities, that is, the way lawyers and judges provide reasoned support for the positions they defend concerning what the law requires in a given case. It considers common forms of legal argument, sources and forms of evidence, and legal values that underlie legal argument. It provides students with a critical perspective from which to judge legal arguments and a basic set of tools for developing legal arguments. This course will not provide any in-depth consideration of the content of civil, criminal or constitutional law, but will use examples from various areas of law to illustrate how legal arguments are developed.

CM 520 - PUBLIC RELATIONS WRITING
Semester Hours: 3

This course provides students with professionalization in their writing and editorial skills in public relations. By emphasizing different audiences and various media, students will find and hone their public relations voice. Students will gain experience with instant responses, making ethical and legal decisions, and practicing a wide range of PR writing and design including the development of media kits, pitches, backgrounders, press releases, memos, newsletters, radio announcements, and brochures. Students will gain firsthand experience writing on a digital platform for a non-profit organization and building a digital audience.

CM 530 - MASS MEDIA IN AMERICA
Semester Hours: 3

This course is designed to examine the role and influence of different forms of media in various societies. The course focuses on evolutions in mass media in the larger world as a context for what has happened in America. The use, and sometimes abuse, of media has evolved continually as technology has advanced. By focusing on the structures and theories of mass communication, this course helps students make critical judgments about how media influences society and how society influences media.

CM 533 - DARK SIDE INTERPERSONAL COMM
Semester Hours: 3

Research from the dark side of communication has typically been studied from a single standpoint confined to a specific context. This course offers a more complete view of human communication by exploring a variety of topics related to the "darker" side of interactions situated in the contexts of Interpersonal Communication, Organizational Communication, Computer Mediated Communication, Health Communication, and Blended Communication. By merging theory and practical application, the different contexts provide students with an enhanced understanding of how dark side behaviors are experienced and communicated.

CM 535 - SOCIAL MEDIA
Semester Hours: 3

This course focuses on uses and effects of social media in interpersonal, organizational, mass mediated, health, and political settings. It investigates questions such as: Who uses social media? Can we develop meaningful relationships through social media? How do people use social media to find information, get social support, and evoke political change? Is privacy dead? This course focuses on the history of social media and current computer-mediated communication theories.

CM 540 - PUBLIC RELATIONS CAMPAIGNS
Semester Hours: 3

This course provides professionalization and team work experience for students in the public relations track. Students practice the research, planning, implementation, and evaluation of strategic communication plans for various public relations contexts.

CM 542 - USABILITY STUDIES
Semester Hours: 3

Introduces students to the theory and practices of usability, which involves designing useful, easy-to-use websites, software, and products. The course involves group projects conducting real-world usability testing.

CM 544 - ADVERTISING
Semester Hours: 3

This course defines advertising and considers how it works, how it is developed, and some controversies surrounding its use.

CM 551 - ORGANIZATIONAL TRAIN & DEVELOP
Semester Hours: 3

Provides students with the opportunity to learn to design, and execute, professional organizational training programs. Students learn to design needs assessments, write training proposals and contracts, as well as design budgets, training scripts, presentations and post-evaluations for companies.

CM 552 - USER-CENTERED DESIGN
Semester Hours: 3

Introduces students to user-centered design principles that inform the practice of user experience design. Students will use visual thinking as they complete contextual inquiries and mapping exercises.

CM 553 - COMMUNICATING WITH USERS
Semester Hours: 3

This course teaches students how to effectively research user needs and produce technical communication documents to meet those needs.

CM 554 - NEW MEDIA WRITING & RHETORIC
Semester Hours: 3

This course teaches students to consider and implement rhetorical principles across a variety of media and includes an examination of communication strategies used widely in academic and industry settings. The course focuses on new media through an exploration of digital technologies and the way digital culture and new media have dramatically impacted reading, writing and research practices.

CM 591 - THE RHETORIC OF PUBLIC MEMORY
Semester Hours: 3

Historical markers, monuments, memorials, and museums all contain public memory. The focus on this class is to rhetorically examine these curated southern sites for how they interpret the past for current audiences with future implications.

CM 600 - INTERNSHIP
Semester Hours: 3

The student works in a professional capacity for at least 10 hours a week under a general supervision of a faculty member and direct supervision of a management-level practitioner in some field of professional communication (user experience, advertising, public relations, professional writing, and journalism).

CM 610 - COMMUNICATION PEDAGOGY
Semester Hours: 3

This course is designed to prepare students for teaching in the field of communication. Toward this end, students will explore a mix of theories, methods, and strategies related to communication pedagogy. Students will also have the opportunity to develop their teaching competency by engaging in various teaching assignments.

CM 631 - ADVANCED COMMUNICATION THEORY
Semester Hours: 3

This course surveys major theories that inform the scholarly study of human communication. Through readings, discussions, and research, students learn how communication theories are developed, analyzed, evaluated, and applied. More specifically, the course goals are: 1) to enhance students' ability to critically analyze current theories of human communication, and 2) to provide students with the opportunity to actively participate in research that tests major communication theories. Original works are read.

CM 633 - INTERPERSONAL COMMUNICATION
Semester Hours: 3

The art of communicating "one to one" is the focus of this course. This course surveys major theories that inform the scholarly study of interpersonal communication. Through readings, discussions, and research, we will learn how interpersonal communication theories are developed, analyzed, evaluated, and applied. More specifically, the course goals are: 1) to enhance students' ability to critically analyze current theories of interpersonal communication, 2) to provide students with the opportunity to actively participate in research that tests major interpersonal communication theories.

CM 640 - SPECIAL TOPICS
Semester Hours: 3

CM 655 - COMMUNICATION AND CULTURE
Semester Hours: 3

This course explores the complex and dynamic relationship between communication and culture. It uses a contextual approach to examine significant similarities and distinctions between and among cultures from both macro and micro cultural perspectives, giving particular attention to how verbal and nonverbal communication moderates our cultural practices.

CM 662 - INFORMATION ARCHITECTURE
Semester Hours: 3

This class reviews research in technical communication, information science, cognitive science, semiotics, and computer science that helps students understand how communities represent, organize, retrieve, and ultimately use information.

CM 670 - ADVANCED COMMUNICATION METHODS
Semester Hours: 3

This course is concerned with the methods and philosophy of scientific communication research. Having taken a basic course that covers elements of research design is highly recommended.

CM 675 - RHETORICAL CRITICISM
Semester Hours: 3

This course examines how rhetorical scholars analyze persuasive discourse, providing hands-on opportunities for students to engage in such analyses. It examines significant variables in rhetorical processes, a number of methods employed to understand adaptations to rhetorical needs, and considers pragmatic, ethical, social and ideological dimensions of persuasive discourse.

CM 699 - MASTERS THESIS
Semester Hours: 3-6

Required each semester during which a student is working and receiving direction on a masters thesis. No more than 6 hours credit may be applied toward the degree.

Computer Engineering (CPE)

CPE 512 - INTRO PARALLEL PROGRAMMING
Semester Hours: 3

Introduction to processing in parallel and distributed computing environments. General concepts of parallel machine models, processes, mutual exclusion, process synchronization, message passing, and programming languages for parallel computing and scheduling. Design and analysis of parallel algorithms. Parallel programming environments: Pthreads for shared memory multiprocessor systems and PVM/MPI for distributed networked computers.

CPE 523 - HARDWARE/SOFTWARE CO-DESIGN
Semester Hours: 3

Study and design of Systems On a Chip (SOC). Emphasis on Field Programmable realizations of SOC systems. Prerequisite: CPE 522 or CPE 526.

CPE 526 - VLSI HARDWARE DESC LANG/MODL/S
Semester Hours: 3

Modern VLSI design techniques and tools, such as silicon compilers, (V)HDL modeling languages, placement and routing tools, synthesis tools, and simulators. Students will design, simulate, and layout using both programmable logic families and ASIC libraries.

CPE 527 - VLSI DESIGN I
Semester Hours: 3

Introduction to VLSI design using CAD tools, CMOS logic, switch level modeling, circuit characterization, logic design in CMOS, systems design methods, test subsystem design, design examples, and student design project. Design project to be fabricated and tested in CPE 528. Students enrolling in CPE 527 must enroll concurrently in CPE 527L.

CPE 527L - LABORATORY
Semester Hours: 0

Students enrolling in CPE 527L must enroll concurrently in CPE 527.

CPE 528 - VLSI DESIGN II
Semester Hours: 3

Advanced experience with CAD tools for VLSI design, IC testing. Design project from CPE 527 will be fabricated and tested. Implementation and verification of test programs, IC testing and troubleshooting, legal, economic, and ethical design issues. Oral presentations and written reports are required. Students enrolling in CPE 528 must enroll concurrently in CPE 528L.

CPE 528L - LABORATORY
Semester Hours: 0

Students enrolling in CPE 528L must enroll concurrently in CPE 528.

CPE 531 - INTRO COMPUTER ARCHITECTURE
Semester Hours: 3

Existing computer structures. Computer organization with emphasis on busing systems, storage systems, and instruction sets. Special purpose architecture, performance models and measures, VLSI influence on architecture.

CPE 534 - OPERATING SYSTEMS
Semester Hours: 3

Study of the fundamentals of operating systems. Emphasis on processes, file management, interprocess communication, input-output, virtual memory, networking and security.

CPE 536 - INTERNALS OF MODERN OPER SYS
Semester Hours: 3

In depth study of the design of modern operating systems such as Unix, NT, and Linux. Emphasis on the internals and implementation details of interrupt processing, real-time clocks, device independent I/O, process management, memory management, and file management.

CPE 538 - REAL TIME & EMBEDED SYSTEMS
Semester Hours: 3

Study of design methodologies for reliable real time systems.

CPE 549 - INTRO TO CYBERSECURITY ENGINRG
Semester Hours: 3

Introduction to cryptography and computer security through hardware and physical security to a knowledge of audit methods, security management, and public law. The course will introduce security engineering skills such as business process analysis, software security, IAE evaluation, and IAE testing.

CPE 555 - SECURE SOFTWARE DEV
Semester Hours: 3

Overview of methodologies for development of high-assurance software. Major topics include analysis of security and safety risks, software certification criteria, the software development lifecycle, risk mitigation, design and coding best practices, verification techniques, and auditing of software for insecure and unsafe coding constructs.

CPE 557 - SOFTWARE REVERSE ENGR
Semester Hours: 3

This course provides fundamental knowledge of software reverse engineering. The course provides the ability (a) to understand software of unknown origin or software for which source code is unavailable, (b) to determine how something works, (c) to discover data used by software, and (d) to aid in the analysis of software. The course introduces tools for reverse engineering, including disassemblers, debuggers, monitors, virtual machines and modern tools for software analysis.

CPE 559 - SYSTEMS SECURITY
Semester Hours: 3

This course (1) introduces cyber physical, industrial control, embedded and Supervisory Control and Data Acquisition (SCADA) control systems, (2) examines common vulnerabilities and threats associated with these systems, and (3) examines techniques to defend these systems from cyber-attacks.

CPE 561 - TRANSLATION SYSTEMS
Semester Hours: 3

Grammars, parsers, and lexical analyzers; implementation of translators via top-down and bottom up techniques; grammar analysis to identify ambiguities. Practical applications of translators including conversion of file formats and compilation of traditional computer languages.

CPE 590 - SPECIAL TOPICS IN COMP ENGR
Semester Hours: 1-3

CPE 590L - SELECTED TOPICS LABORATORY
Semester Hours: 0

CPE 601 - SURVEY INFORMATION ASSURANCE
Semester Hour: 1

CPE 610 - SELECTED TOPICS IN COMPUTER EN
Semester Hours: 1-6

CPE 612 - PARALLEL ALGORITHMS
Semester Hours: 3

Introduction to metrics describing the performance and scalability of parallel algorithms. Performance analysis of parallel algorithms for performing sorting, matrix multiplication, solving linear equations, and FFT.

CPE 613 - GEN PURPOSE GPU COMPUTING
Semester Hours: 3

The focus of this course is to introduce emerging techniques and programming paradigms that can be used to accelerate the processing speed of scientific and other high performance applications using Graphics Processing Units, GPUs. GPUs represent low-cost highly parallel video processing hardware that can be programmed for general purpose applications using UDA/OpenCL software architecture. The course will survey the current state of research and industrial activity and will give student's hands-on experience implementing design applications on real-world GPU facilities for a wide range of scientific applications. Prerequisite: CPE 512.

CPE 619 - MODELING & ANAL COMPU/COMMUN S
Semester Hours: 3

Modeling of single and multiprocessor systems, single and multi-stage interconnection networks, Computer Networks. Analysis using Stochastic processes, Markov and Queuing techniques. Modeling using Petri Nets and Finite State models. Prerequisite: EE 500 or MA 585.

CPE 621 - ADVANCED EMBEDDED SYSTEMS
Semester Hours: 3

Deeply embedded low-power wireless sensors. Low-power microcontroller architectures, sensor platform architecture, wireless intelligent sensors, low power wireless communication standards, battery powered systems, resource constrained operating systems, data aggregation/sensor synergy, and collaborative signal processing.

CPE 625 - CMOS ANALOG CIRCUIT DESIGN
Semester Hours: 3

Analog circuit design in CMOS technology. CMOS processing technology. MOS transistor modeling. Basic current mirrors and single-stage amplifiers. Noise analysis and modeling. Basic OPAMP design and compensation. Advanced current mirrors and OPAMPS. Bandgap references. Oscillators. CMOS technology characterization for radio-frequency (RF) design.

CPE 626 - ADVANCED VLSI DESIGN
Semester Hours: 3

Advanced VLSI Design. Case study of the VLSI design of a modern RISC processor using a Hardware Description Language. Prerequisite: CPE 526.

CPE 628 - TESTING OF HARDWARE SYSTEMS
Semester Hours: 3

Introduction to testing of digital electronic circuits and systems. Topics include: fault modeling, testing problems, testing schemes, test generation for combinational and sequential circuits, the complexity of testing, design for testability, built-in self-testing and boundary scan.

CPE 631 - ADV COMP SYSTEMS ARCHITECTURE
Semester Hours: 3

Study of architectural features of modern processors, including cache memories and memory systems, pipeline designs, branch prediction techniques. Design of superscalar, multithreaded VLIW processors, code optimization for such systems will be studied. Quantitative evaluation of architectural features are emphasized throughout the course. Prerequisite: CPE 512 and CPE 531.

CPE 633 - FAULT-TOLERANT COMPUTING SYS
Semester Hours: 3

Analysis and design of very high reliability and availability systems. Fault types, reliability techniques, and maintenance techniques. Case studies of high-availability long-life, life-critical systems. Both hardware and software techniques for achieving fault-tolerance will be studied.

CPE 635 - SYSTOLIC ARRAY PROCESSING
Semester Hours: 3

Systolic structure of fast algorithms and switchable array realizations.

CPE 643 - OPTICAL COMMUNICATIONS
Semester Hours: 3

CPE 645 - COMPUTER NETWORK SECURITY
Semester Hours: 3

Principles and concepts of computer network security. Introduction to cryptography, confidentiality, authentication, digital signatures, E-mail security, IP security, web security, intruders, malicious software, firewall, and other network security-related issues.

CPE 646 - MOBILE & WIRELESS NETWORKS
Semester Hours: 3

High-level issues in mobile and wireless networks. The main topics are mobile IP, mobile Ad hoc NETworks (MANETS) wireless sensor networks, wireless LAN, Bluetooth, cellular networks, satellite systems and security issues in mobiles and wireless networks.

CPE 647 - UBIQUITOUS COMPUTING
Semester Hours: 3

The course is based on the new "anytime, anywhere" computing paradigm, also known as ubiquitous computing. This course is project oriented, and explores issues of mobile, wireless, and distributed computing in Internet environment, advanced human-computer interfaces, and power efficient computing.

CPE 648 - ADVANCED COMPUTER NETWORKS
Semester Hours: 3

Advanced principles and concepts of general-purpose computer networks, with a special emphasis to internetworking and Internet. Transport and higher level protocols emphasis. Programming issues. High-speed networking, congestion control, data compression, security and distributed processing will be covered.

CPE 649 - ADV CYBERSECURITY ENGINEERING
Semester Hours: 3

Introduction to topics ranging from how to attack computer systems and networks to how to protect and recover from attacks on computer systems and networks. Basic process utilized by computer attackers in order to develop a complete understanding and appreciation of the threat to information assurance. Process of detecting, preventing, and recovering from information assurance attacks. Intrusion Detection and Prevention Systems, Auditing, Security Vulnerability Assessments, and the Incident Response process. Prerequisite: CPE 549.

CPE 649L - ADV CYBERSECURITY ENG LAB
Semester Hours: 0

Students enrolling CPE 649 must enroll concurrently in CPE 649L.

CPE 656 - SOFTWARE ENGRG STUDIO I
Semester Hours: 3

This is the first course in a two course studio series required for the MSSE degree in the College of Engineering. Students will work in small design teams on medium sized software projects. Activities include developing requirements, designing and constructing system prototypes, developing and implementing test and verification plans, and presenting the project for evaluation. The practice of software design and evaluation will be conducted in an iterative cycle using best software engineering practices, so that design and execution can be refined over the lifecycle of the project. Prerequisite: CS 650.

CPE 657 - SOFTWARE STUDIO
Semester Hours: 3

Graduate software studio is a capstone course in the MSSE program which requires students to present mastery of software development through completion of an extensive software project which follows a defined process. Students work in collaborative teams which will require extensive collaboration outside of class through meetings, teleconferencing, and documentation. Prerequisites: CS 650 plus 9 graduate credits or approval of instructor.

CPE 658 - SOFTWARE ENGRG STUDIO II
Semester Hours: 3

This is the second course in a two course studio series required for the MSSE degree in the College of Engineering. Students will work in small design teams on medium sized software projects. Activities include developing requirements, designing and constructing system prototypes, developing and implementing test and verification plans, and presenting the project for evaluation. The practice of software design and evaluation will be conducted in an iterative cycle using best software engineering practices, so that design and execution can be refined over the lifecycle of the project. Prerequisite: CPE 656.

CPE 690 - SELECTED TOPICS COMPUTER ENGRG
Semester Hours: 1-6

CPE 692 - CYBERSECURITY CAPSTONE
Semester Hours: 3

A capstone course emphasizing the integration of various principles, theories, and techniques for developing, implementing and using cybersecurity strategies and applications in organizations. Includes readings, lectures, tours, situation analysis, cases, and the completion of a major practical project. Normally taken in the last semester of a student's program. Minimum grade B required. Prerequisites: CS 585, CPE 549, IS 660, IS 663.

CPE 695 - PROJECTS IN COMPUTER ENGRG
Semester Hours: 3

CPE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours credit is awarded upon successful completion of master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

CPE 710 - SEL TOPICS IN PARALLEL PROC
Semester Hours: 3

CPE 715 - SELECTED TOPICS IN COMPUTAT TH
Semester Hours: 3

CPE 720 - SELECTED TOPICS IN VLSI DESIGN
Semester Hours: 3

Prerequisite: CPE 626.

CPE 726 - ALGORITHMS FOR VLSI DESIGN TOO
Semester Hours: 3

Tools for VLSI Design. This course is concerned with the algorithms found in VLSI design tools.

CPE 730 - SELECTED TOPICS IN COMPUTER SY
Semester Hours: 3

Prerequisite: CPE 631.

CPE 731 - DISTRIBUTED SHARED MEMORY SYS
Semester Hours: 3

Study issues related to performance, granularity of sharing, multithreading, cache coherence, memory consistency models, pull vs push caching, false sharing, thread migration. Case studies systems, including DASH, FLASH ThreadMarks, SHRIMP, Calypso, Alewife to understand these issues.

CPE 735 - SELECTED TOPICS IN OPERATING S
Semester Hours: 3

CPE 740 - SPEC TOPICS COMPUTER NETWORKS
Semester Hours: 3

Prerequisite: CPE 648.

CPE 742 - PARALLEL PROCESS DESIGN
Semester Hours: 3

CPE 748 - MOBILE & WIRELESS NETWORKS
Semester Hours: 3

High-level issues in mobile and wireless networks. The main topics are mobile IP, Mobile Ad hoc NETworks (MANETs), wireless sensor networks, wireless LAN, Bluetooth, cellular networks, satellite systems, and security issues in mobiles and wireless networks. Prerequisite: CPE 648 or CS 670.

CPE 760 - SEL TOPICS COMPILER/TRANSLAT S
Semester Hours: 3

CPE 790 - SEL TOPICS COMPUTER ENGRG
Semester Hours: 1-6

CPE 795 - RESEARCH IN COMPUTER ENGRG
Semester Hours: 1-6

CPE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

Computer Science (CS)

CS 513 - INTENSIVE COMP ARCH & OS
Semester Hours: 4

Combinational circuits and sequential circuits. Computer hardware organization including CPU, instruction representation Assembly language. Floating point. Register transfer. Pipelining, memory systems including cache. Digital arithmetic, I/O units. Scheduling, file management, processes, threads, virtual machines, hypervisors. Prerequisites: MA 172 or equivalent and (CS 521 or CS 221 or CPE 212 or equivalent).

CS 517 - INTENSIVE COMPUTING THEORY
Semester Hours: 4

Intensive introduction to computing theory selected core topics from the undergraduate Computer Science curriculum, including Boolean algebra, digital logic, proof methods, recursion and recurrences, graphs and trees, iterative and recursive algorithms, sorting and searching algorithms, and divide- and-conquer algorithms. Prerequisites: MA 172 or equivalent and (CS 521 or CS 221 or CE 211 or equivalent).

CS 521 - INTENSIVE INTRODUCTION TO PROGRAMMING AND SOFTWARE ENGINEERING
Semester Hours: 4

A comprehensive, intensive introduction to programming, data structures, software engineering, and problem solving fundamentals. Primary language used in this course is C++, with an intro to other widely used languages, such as Java and Python. No credit for students who have taken data structures. No credit for CS gradaute students. Prerequisite: MA 172.

CS 524 - PRINCIPLES PROGRAMMING LANG
Semester Hours: 3

Comparison of principles and paradigms of modern programming languages. How different programming languages implement lexical, syntax, and semantic analysis, including the design of compilers. Formal grammars, BNF notation, parse trees, abstract data types. No credit for student who have taken CS 424. Prerequisite: CS 317 or CS 517.

CS 526 - PROG TRANS & COMPILER CONSTR
Semester Hours: 3

Language representation; grammar classification; lexical analysis technique and tools; parsing technique and tools; compile-time and run-time symbol table design; code generation and optimization; error diagnostics. Compiler writing tools. Prerequisite: CS 317 or CS 517; (CS 424 or CS 524 and CS 403 recommended).

CS 530 - SURVEY ARTIFICIAL INTELLIGENCE
Semester Hours: 3

Survey of Artificial Intelligence (AI). AI crosses many disciplines, to make computational systems behave intelligently. This course provides a broad intro of AI sub-domains, including search, knowledge representation, reasoning, & machine learning. No credit for students who have taken CS 430. Prerequisite: CS 317 or CS 517; (CS 424 or CS 524 recommended).

CS 543 - INTRO TO MULTIMEDIA SYSTEMS
Semester Hours: 3

Multimedia authoring, color models for image and video, introduction to image and video compression, digital audio, multimedia networks, multimedia synchronization, multimedia retrieval. Students may not receive credit for both CS 443 and CS 543. Prerequisite: CS 317 or CS 517; (CS 490 recommended).

CS 545 - INTRO COMPUTER GRAPHICS
Semester Hours: 3

Introduces underlying theory and mechanics of interactive computer graphics. Basic modeling, rasterization, 2D/3D transformations, and viewing. 3D graphics rudiments. Some hardware and historical perspectives. Many programs. No credit for students who have taken CS 445 Prerequisites: (CS 221 or CS 517) and MA 244.

CS 546 - ADVANCED COMPUTER GRAPHICS
Semester Hours: 3

High resolution 3D graphics, including advanced topics in viewing, vertex processing, fragment processing, local and global illumination and shading, 3D modeling (including curve and surface representation), texture mapping, and some coverage of solid modeling and color theory. Game production pipeline. Hierarchical issues, visibility, and 3D processing algorithms may also be covered. A significant number of programming projects are involved, with some different program requirements and additional theoretical expectations for CS 546 students. (Same as CS 456; no credit for both). Prerequisite: CS 445 or CS 545.

CS 547 - GAME ENGINES & LEVEL DEV
Semester Hours: 3

(Same as CS 447) This course provides the opportunity for students to produce fully functional games from beginning to end with team members. Along the way, students work on homework/projects involving design document creation, prototyping and gameplay/implementation. Also, game software as artistic content has led to collaborations between engineers and artists. In this course, students focus on not only game engineering development but also art asset generation and management. Considers a 3D game design and development using game engines focusing on the fundamental components for developing cross-platform games. The course focus includes design, development, and distribution of computer games. Emphasis also is on user interface and menus, scripting for game programming, game physics, terrain generation, asset management, animation management, special effects, and cross platform game development. Students may not receive credit for both CS 447 and CS 547. Prerequisites: CS 330 and (CS 445 or CS 545).

CS 548 - HUMAN-COMPUTER INTERACTION
Semester Hours: 3

Introduces underlying theory and mechanics of interactive computer graphics. Basic modeling, rasterization, 2D/3D transformations, and viewing. 3D graphics rudiments. Some hardware and historical perspectives. Many programs. Introduction to human-computer interaction and principles of graphical user interface design. Includes examination of interactive environments including windowing systems development tools, multimedia, and visual programming interfaces. Prerequisite: CS 445 or CS 545.

CS 553 - CLIENT/SERVER ARCHITECTURES
Semester Hours: 3

Client/server distributed computing. Web based applications. Students will practice concepts in programs involving leading edge technologies such as AJAX, RESTful and WS-* web services, Enterprise Java Beans, .NET. No credit for students who have taken CS 453 Prerequisite: (CS 307 or CS 321) (CS 370 recommended).

CS 554 - INTRO TO CLOUD COMPUTING
Semester Hours: 3

Different cloud computing paradigms: IaaS, SaaS, PaaS. Open Source cloud software (for ex., OpenStack, CloudStack). RESTful interfaces, AWS interface. Cloud security. Students may not receive credit for both CS 454 and CS 554. Though not required as a prereq, students are recommended to have taken CS 390 or CS 590. Prerequisites: (CS 307 or CS 321 or CPE 353) and (CS 370, or CPS 348, or IS 460 or IS 560).

CS 565 - NETWORK SECURITY
Semester Hours: 3

Fundamentals of network security and cryptography. Examines security at different network layers. Wireless security. Firewalls. Intrusion detection and penetration analysis. Students may not receive credit for both CS 465 and CS 565. Prerequisites: CS 221 or CPE 212.

CS 566 - OFFENSIVE SECURITY
Semester Hours: 3

Theoretical and practical network and web app Penetration Testing with hands on labs for the firve ethical hack phases including reconnaissance, scanning & vulnerability assessment, gaining access and exploitation, maintaining access, covering tracks. Other red-team offensive security approaches.

CS 571 - MOBILE COMPUTING SFTWR ARC&DEV
Semester Hours: 3

Considers application design for the mobile space, focusing on the fundamental requirements for mobile applications that target mobile devices. The course focus includes development, testing, distribution of mobile applications in a cross-platform environment. Emphasis also is on multimedia and entertainment computing and games. This course will also cover various issues in mobile computing from the readings from research literature such as software engineering practices, analysis of social media and general mobile analytics. Prerequisites: CS 221 or CPE 212.

CS 580 - MOBILE DIGITAL FORENSICS
Semester Hours: 3

This course examines digital forensics of mobile devices such as smart phones and tablets in a law enforcement context. Mobile device characteristics that make forensics examinations difficult are discussed. Various forensics tools are critically examined with an eye toward improved tool development. Prerequisites: CS 413 or CS 513 or CPE 323.

CS 581 - MODELING & SIMULATION I
Semester Hours: 3

Discrete event simulation from a computer science perspective. Mathematics of probability distributions applied to simulation. Design, implementation, and application of discrete event simulation software. Application to computer and network system design. Prerequisites: CS 221 and either MA 385 or MA 585 OR ISE 390 or ISE 690.

CS 582 - MODELING & SIMULATION II
Semester Hours: 3

Advanced modeling methods, including Monte Carlo simulation, agent-based modeling, and mathematical modeling, from a Computer Science perspective. Emphasis on implementation, execution, and validation of working computer models using different modeling methods. Prerequisites: CS 481 or CS 581.

CS 585 - INTRO CYBERSECURITY ENGR
Semester Hours: 3

Introduction to cryptography, computer security, security management, auditing, process analysis, software security, evaluation, and testing. Focuses on tools, processes, and methods needed to design, implement, and test systems and to adapt existing systems to survive in a hostile environment. . No credit for students who have taken CS 485 or CPE 449 Prerequisites: CS 370 or CPE 348.

CS 588 - INTRO TO BIG DATA COMPUTING
Semester Hours: 3

Provides big data concepts and characteristics; big data architectural concepts; big data ecosystem. Includes MapReduce framework and programming and coverage of big data applications. No credit for students who have taken CS 488 Prerequisites: CS 317 or CS 517.

CS 590 - PROGRAMMING ENVIRON W/UNIX
Semester Hours: 3

Strategies for design and development of systems and programs in the UNIX environment. Emphasis: automated tool and system development using UNIX tools. Advanced shell concepts including control flow and interrupt handling. Process and inter-process communication. Prerequisites: CS 221; (CS 390 recommended).

CS 595 - INDEPENDENT STUDY
Semester Hours: 3

Individual directed study under the supervision of an instructor. Must have approval of the instructor.

CS 596 - SPECIAL TOPICS
Semester Hours: 3

Individual directed study under the supervision of an instructor. Must have approval of the instructor.

CS 600 - INTERNSHIP IN COMPUTER SCIENCE
Semester Hour: 1

Work experience in Computer Science or a related field in a business or government agency; conducted under the direction of the agency supervisor and approved by a member of the CS faculty. A substantial report must be produced and approved by the supervisor and the faculty member.

CS 603 - FORMAL LANG/AUTOMAT THRY
Semester Hours: 3

Formal definition of programming languages. Formal grammars: regular, context-free, context sensitive, and phrase-structure. Automata: finite-state, pushdown, linear-bounded automata, Turing Machines. Relationship between formal languages and automata.

CS 613 - COMPUTER ARCHITECTURES
Semester Hours: 3

Organization, operation, and analysis of advanced computer architectures. Topics include advanced pipelining approaches, multi-processor architectures, instruction set architectures, memory hierarchy design, hardware and software-based performance optimization, and system performance measurement. Prerequisite: CS 513.

CS 617 - DES & ANALY OF ALGORITHM
Semester Hours: 3

Strategies of algorithm synthesis and analysis. Classical algorithm categories such as: divide-and-conqurer, greedy method, dynamic programming, search and traversal. Computational complexity; theoretical results from lower- and upper-bound studies, NP-hard, and NP-complete problems. Prerequisite: CS 517.

CS 630 - ARTIFICIAL INTELLIGENCE I
Semester Hours: 3

Comparing and evaluating different approaches to the architecture and development of intelligent systems. Computationally efficient solutions for intelligent systems. Prerequisite: CS 530.

CS 637 - DEEP LEARNING
Semester Hours: 3

Deep learning, a branch of machine learning focuses on modern neural networks. Deep learning extracts layered data representations to maximize task performance. Requires advanced algorithm and programming knowledge and a strong mathematical background in calculus, linear algebra, and probability & statistics. Several programming projects. Prerequisites: (CS 317 or CS 517) and MA 244 and (MA 385 or ISE 390).

CS 640 - MACHINE LEARNING
Semester Hours: 3

Discriminant analysis, maximum likelihood decisions, deterministic and nondeterministic approaches for trainable classifiers, preprocessing and feature extraction, clustering, syntatic pattern recognition. Pattern recognition in image analysis. Prerequisites: (CS 317 or CS 517) and MA 244 and (MA 385 or ISE 390).

CS 641 - DATA MINING
Semester Hours: 3

Data preprocessing, distance measures, classification with decision trees, Bayesian classifiers, neural networks, support vector machines, frequent item set analysis, association rule generation, clustering methods. Prerequisites: (CS 317 or CS 517) and MA 244 and (MA 385 or ISE 390).

CS 642 - COMP PROC/DIGITAL IMAGES
Semester Hours: 3

Introduction to image processing systems; sensing, sampling and quantization; image transforms; image enhancement and restoration; image segmentation, and description; image correlation; image sequence analysis; practical applications of image processing. Prerequisites: (CS 317 or CS 517) and MA 244, MA 385.

CS 646 - COMPUTER GEOMETRY MODELING
Semester Hours: 3

Numerical and computer representation of curves and surfaces. Solid geometry modeling. Geometric data management. Curve and surface design, including cubic-B-splines, especially Bezier curves/surfaces. Interpolation methods. Graph-based and Boolean models. Applications to robotics, graphics, CAD. Prerequisite: CS 545.

CS 650 - SOFT'W ENGINEERING PROC
Semester Hours: 3

The process of developing complex software products. Includes software life cycles, phases of development and disciplines such as CM, QA, V&V, and T&E. Issues of professionalism and the ethical use of computers. Background in algorithms and programming languages assumed. Prerequisite: CS 317 or CS 517 or CS 521.

CS 652 - OBJECT-ORIENTED DESIGN
Semester Hours: 3

A survey of formal and informal techniques and methodologies for software analysis, requirements, architecture and design. Emphasis is on effective development processes. Comparison of different approaches, considering their advantages and disadvantages. Prerequisite: CS 650.

CS 656 - SOFTWARE TESTING
Semester Hours: 3

Advanced software testing techniques, including white box, black box, integration testing, and system testing. Other topics may include test data adequacy, test data selection, and output oracle, including functional, structural, and fault-based testing methods. Prerequisite: CS 650.

CS 658 - SOFTWARE PROC & PROD IMPROVEMT
Semester Hours: 3

Software quality assurance as an umbrella activity. Use of process, project, quality and product metrics to gain insight into the software development activity. Use of metrics to drive incremental process improvement techniques. Examination of CASE tools and how they affect the software process. Prerequisite: CS 490 or CS 513.

CS 670 - WIRELESS SENSOR NETWORKS
Semester Hours: 3

Detailed analysis of the organization and operation of wireless sensor networks. Node and network architecture, link-layer protocols, naming and addressing, topology control, routing protocols, data-centric and content-centric networking, transport layer and quality of service. Prerequisites: CS 370 or CPE 348, minimum grade of C-.

CS 681 - MALWARE ANALYSIS
Semester Hours: 3

The goal of this course is to introduce the students to malware analysis. Malware analysis involves both static and dynamic analysis as well as obfuscation techniques. This course assumes basic knowledge of reverse engineering/static analysis. After completing the course a student should be able to statically analyze a malware even if advanced obfuscation techniques are used. Further, the student should be able to setup a sandboxed environment for dynamic analysis and it to dynamically analyze the malware and draw conclusions about the purpose, nature and exploit used by the malware. Prerequisite: CPE 457 or CPE 557 (minimum grade of C-).

CS 685 - APPLIED CRYPTOGRAPHY
Semester Hours: 3

Principles and concepts of applied cryptography. Classical cipher's, advanced encryption standard, public-key cryptography and RSA, key exchange and Diffie-Hellman, hashing, authentication, digital signatures, and other cryptography-related issues. Prerequisites: CS 370 or CPE 348.

CS 687 - DATABASE SYSTEMS
Semester Hours: 3

Basic concepts of database systems. Use of semantic models in database design. Data models with an major focus on the relational and object-oriented models. Relational query languages and normal forms. Database management system design issues. Security and integrity issues. Prerequisite: CS 617.

CS 690 - ADVANCED OPERATING SYSTEMS
Semester Hours: 3

Issues related to shared memory multiprocessors, multicore computers, clusters, grids and clouds. Concurrency and distributed process coordination. Introduction to network communication issues and systems such as client-server, peer-to-peer, and transaction based. Prerequisite: CS 513.

CS 692 - CYBERSECURITY CAPSTONE
Semester Hours: 3

A capstone course emphasizing the integration of various principles, theories, and techniques for developing, implementing and using cybersecurity strategies and applications in organizations. Includes readings, lectures, situation analysis, cases, and the completion of a major practical project. Normally taken in the last semester of a student's program. Minimum grade B required. Prerequisites: (IS 501 or CS 585 or CPE 549) and IS 550.

CS 695 - INDEPENDENT STUDY
Semester Hours: 3

Individual directed study under the supervision of an instructor. Must have instructor approval.

CS 696 - SELECTED TOPICS IN CS
Semester Hours: 3

Course offered by an instructor in a specialized area of computer science. Must have instructor approval.

CS 699 - MASTER'S THESIS
Semester Hours: 6

Must have instructor approval. Required each semester a student is working and receiving direction on a master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

CS 717 - ADV ALGORITHM DES/ANALYSIS
Semester Hours: 3

Parallel algorithms, combinatorial algorithms, approximation algorithms for NP-complete problems, computational complexity. Distribution of algorithms across complex architectures. Prerequisite: CS 617.

CS 790 - OPERATING SYSTEMS SEMINAR
Semester Hours: 3

Advanced research topics in operating system theory and practice. Students will read and discuss classic and current papers in the literature. Each student will present reports in class and prepare a substantial research paper. Prerequisite: CS 690.

CS 795 - INDEPENDENT STUDY
Semester Hours: 3

Individual directed study under the supervision of an instructor. Must have instructor approval.

CS 796 - ADVANCED SELECTED TOPICS
Semester Hours: 3

Course offered by an instructor in a specialized area of computer science. Must have instructor approval.

CS 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation. Maximum of 18 hours credit toward degree.

Economics (ECN)

ECN 511 - ECONOMICS OF INFORMATION TECHNOLOGY
Semester Hours: 3

This course explores the economic theory underlying consumer and firm behavior and strategy in the information technology industry with an emphasis on developing formal tools of analysis and applying them to real-world examples. Core topics include cost structures, non-competitive markets, network effects, pricing strategies, and strategic decision problems, including collective action problems such as cybersecurity.

ECN 545 - APPLIED GAME THEORY
Semester Hours: 3

An introduction to game theory and its applications. Students will explore the use of games to understand strategic interactions and apply them to business and other real-world contexts. Prerequisites: ECN 600.

ECN 554 - INTERNATIONAL ECONOMICS
Semester Hours: 3

Behavior of foreign-exchange rates under different monetary standards, methods of financing international trade, historical development of international financial institutions, current and proposed methods for fostering international trade, and problems of international liquidity.

ECN 561 - ECONOMIC DEVELOPMENT
Semester Hours: 3

Understand economic development in the developing world. Examine economic transformation & social change towards addressing poverty, inequality, and social justice. Highlight domestic and international institutional, structural, and political sources of economic dynamism/lack thereof in the Global South.

ECN 575 - LABOR ECONOMICS
Semester Hours: 3

Economic analysis of labor markets; labor demand and labor supply at the market and individual level. Topics include individual decisions to supply labor, compensating wage differentials, human capital investment, discrimination in labor markets, pay and productivity, and the role of labor unions.

ECN 580 - INTRODUCTION TO ECONOMETRICS
Semester Hours: 3

An introduction to the quantitative measurement and analysis of actual economic and business phenomena.

ECN 590 - SPECIAL PROJECTS
Semester Hours: 3

Faculty guided independent study in an area of interest to the student and faculty member.

ECN 600 - FOUNDATIONS OF ECONOMICS
Semester Hours: 3

This course covers the economic foundations in which businesses operate. Coverage includes output and pricing decisions of firms in various market structures; consumer and producer choice at the micro level; and macroeconomic issues, such as unemployment and inflation and government policy.

ECN 626 - MANAGERIAL ECONOMICS AND TECHNOLOGY
Semester Hours: 3

The principles of microeconomics are used to formulate and analyze problems and these principles are applied to business decisions. The course includes an introduction to regression analysis and forecasting. Basic international economic concepts and the importance of technology are explicitly introduced. Prerequisites: ECN 600 and MSC 600.

Education (ED)

ED 500 - SPECIAL TOPICS IN EDUCATION
Semester Hours: 1-3

Independent study, special projects, and special in-service programs.

ED 501 - INTRODUCTION TO EDUCATION PRACTICUM
Semester Hours: 0

Initial practicum experience designed to provide the opportunity to explore the role of the classroom teacher in today's diverse school settings. Required for graduate students receiving their initial certification.

ED 510 - FOUNDATIONS OF LITERACY
Semester Hours: 3

This course includes a study of methods, materials, and strategies for reading instruction. Components of the course will include but not be limited to the five pillars of reading instruction identified by the National Reading Panel (2000): phonemic awareness, phonics, fluency, vocabulary, and comprehension. Emphasis is placed on the various stages of and approaches to literacy development, knowledge of which is required for the Alabama Reading Specialist licensure.

ED 513 - LITERATURE FOR CHILDREN AND ADOLESCENTS
Semester Hours: 3

Course content will include the study of various genres of children's and adolescent literature and their relationship to beginning reading, enhancement of reading comprehension, and intervention instruction in the various content areas. (Same as EH 613) Must be admitted to the Teacher Education Program.

ED 520 - COMPUTER BASED INSTRUCTIONAL TECHNOLOGY
Semester Hours: 3

Introduces prospective teachers to current state of the art in educational technology. Extensive hands-on experiences with microcomputers and other emerging technology. Emphasis on effectively integrating technology into instructional setting for both special and regular students.

ED 521 - SECONDARY ELA INSTRUCTION WRITING TO READ
Semester Hours: 2-3

Candidates explore the ways they can use specific writing-to-learn activities to enhance their students' capacity to understand a variety of complex texts. Candidates will learn techniques for engaging students in the questioning, inference-making, syntactical pattern recognition, and meaning-making of both fiction and nonfiction works.

ED 522 - MIDDLE AND SECONDARY SCHOOL MATHEMATICS METHODS
Semester Hours: 2-3

This course is part one in a series of two courses that are designed for teacher candidates who are pursuing teaching certification who are pursuing teaching certification in middle and/or secondary mathematics. This methods course provides background for middle school and secondary teaching from the perspective of theory, research, and practice.

ED 523 - TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS I
Semester Hours: 2-3

This course will focus on how secondary students learn science. Candidates will learn how to develop and design developmentally appropriate lessons in which their students are able to make observations, examine relationships, notice patterns, and make inferences, while confronting naive misconceptions. Candidates will discuss the nature of science (NOS).

ED 524 - TEACHING SOCIAL STUDIES IN MIDDLE AND SECONDARY SCHOOLS I
Semester Hours: 2-3

This course teaches research-based techniques and strategies employed by social science teachers at the secondary levels. As well as learning theoretical foundations and the goal of social science instruction (citizenship skills), students will learn pedagogic skills, instructional strategies, and modes of reasoning unique to the social studies classroom.

ED 530 - APPLIED MULTICULTURALISM
Semester Hours: 3

Through an examination of constructs such as race, ethnicity, social class, gender, sexual orientation, and religious affiliation, students will develop an understanding of the connections between identity, difference, power, and privilege and the role(s) school (could/should) play in perpetuating or ending discriminatory practices. Furthermore and more importantly, students will develop an understanding of the ways research in both the humanities and social sciences can be used to interpret, analyze, and critique multiculturalism. Students will leave the course with research-based pedagogical practices designed to help all students learn to the best of their abilities.

ED 531 - SECONDARY ELA INSTRUCTION READING TO WRITE
Semester Hours: 2-3

In this course, candidates will explore the ways they can use specific reading activities to enhance their students' ability to express themselves in multiple registers and forms of discourse. Candidates will learn techniques for engaging students in the process of developing and expressing their ideas while demonstrating and improved command of the grammatical, syntactical, and discursive elements of language.

ED 532 - SPACE ORIENTATION FOR TEACHERS
Semester Hours: 3

A weeklong course at the U.S. Space and Rocket Center in Huntsville, Alabama for pre-service and in-service teachers. The inquiry based workshops are taught around the theme of space exploration include activities to be done across the curriculum. All activities are correlated to National Math, Science, Technology, Social Studies, and Reading Standards. Activities based on curriculum developed by NASA, CAP, NSATA, and the USSRC. Topics include moon, mars, rocketry, propulsion, hydroponics, math, biology, history and literature.

ED 533 - TEACHING SCIENCE IN MIDDLE AND SECONDARY SCHOOLS II
Semester Hours: 2-3

Students will discuss the status of science education in our nation's schools, and the need for implementing research-based strategies in the classroom using the 5E learning cycle as framework.

ED 534 - TEACHING SOCIAL STUDIES IN MIDDLE AND SECONDARY SCHOOLS II
Semester Hours: 2-3

This methods course is designed to study effective techniques and strategies employed by social science teachers at the middle and secondary levels. As well as learning theoretical foundations in social studies education, students will learn pedagogic skills, instructional strategies, and modes of reasoning unique to the social studies classroom.

ED 535 - INTRODUCTION TO APPLIED EDUCATIONAL RESEARCH
Semester Hours: 3

Introduction to the nature of research and its relationship to educational thought and practice. Primary focus will be on planning and executing research activities (i.e. action research, thesis development) in the diverse classroom and analyzing the collected data to improve instruction, educational performance, and adding to the body of knowledge in educational practices.

ED 539 - TEACHING REASONING AND PROOF IN SECONDARY MATHEMATICS
Semester Hours: 2-3

This methods course provides background for middle school and secondary teaching from the perspective of theory, research, and practice. It is designed to provide an introduction to and practice in ways in which to encourage students in mathematical reasoning and proof.

ED 540 - COGNITIVE DEVELOPMENT THEORIES OF LEARNING
Semester Hours: 3

The course is designed to inform students about recent developments in Cognitive Psychology and their implications for teaching and learning. Students will leave the course with a variety of "cognitive understandings" for use in differentiated classrooms.

ED 545 - CURRICULUM AND INSTRUCTION IN SECONDARY SCHOOLS
Semester Hours: 3

This course is designed to address various contemporary teaching and learning strategies, as well as related issues, assessments strategies, and applicable theories related to secondary teaching and learning.

ED 560 - CURRICULUM AND EMERGING INSTRUCTIONAL TECHNOLOGY
Semester Hours: 3

Designed to build competency in computer technologies appropriate to instructional use. Concepts of authoring and scripting will be used to unify course materials. (Same as CS 560.).

ED 565 - INTRODUCTION TO DIFFERENTIATED INSTRUCTION
Semester Hours: 3

The course provides an introduction to the philosophy and practice of differentiation. Students will examine the elements, content, process, product, affect and environment by which instruction can be differentiated to address the complex challenges of meeting the diverse learning needs of all students.

ED 570 - DIFFERENTIATED INSTRUCTION FOR SPECIAL POPULATIONS
Semester Hours: 3

The course provides practical strategies to maximize learning for all students, particularly those with disabilities, gifted/talented, and English language learners (ELL).

ED 575 - READING IN THE PRIMARY GRADES
Semester Hours: 3

An introduction to the basic principles of literary instruction in culturally and linguistically diverse primary grade classrooms, including theoretical bases for instruction, methods of instruction and organization, developmentally appropriate strategies and materials, and assessment of children's literacy. Class activities include mini-lessons, discussions, group activities, and presentations. An intensive school-based practicum in grades preK-2 is required.

ED 580 - PROJECT BASED LEARNING
Semester Hours: 3

Develop a robust understanding of Project Based Learning (PBL) through critiquing, evaluating, and synthesizing PBL's core theoretical concepts.

ED 593 - EDUCATING EXCEPTIONAL CHILDREN AND YOUTHS
Semester Hours: 3

Introduction to the field of exceptional children and youth, including observations. This course, or equivalent, is a prerequisite to certification. Intensive field experience required.

ED 600 - SPECIAL PROBLEMS IN EDUCATION
Semester Hours: 1-3

Independent study, special projects, and in-service programs.

ED 604 - CONTRIBUTIONS IN PSYCHOLOGY TO EDUCATION
Semester Hours: 3

Principles, theory, and practice of psychology for teaching and administrative service in educational institutions. Factors that determine learning and conditions of effective teaching. Administrator and supervisor as organizer of the milieu wherein teaching, learning, and growth occur. Intensive field required.

ED 605 - REACHING RESEARCH AND INSTRUCTION
Semester Hours: 3

Elements of effective reading instruction for beginning readers as supported by current research and practice. Topics include balance, language-rich/print-rich environment, language development, phonemic awareness, print awareness, phonics, writing, spelling, and comprehension. Intensive field experience required.

ED 607 - EDUCATIONAL LEADER AS THE EVALUATOR
Semester Hours: 3

Procedures and techniques of evaluation and research approaches. Emphasis on teachers as evaluators; based on action research in the classroom. Intensive field experience required.

ED 608 - EXPANDING READING ABILITY IN THE CONTENT AREA
Semester Hours: 3

Strategies to enhance reading comprehension when using materials in all subject areas. Teacher directed, integrated instruction; extensive use of authentic printed materials; discussion at literal and higher levels of understanding, motivation, vocabulary, and writing. Intensive field experience required.

ED 609 - CLASSROOM AND BEHAVIOR MANAGEMENT
Semester Hours: 3

A focus on the variety of instructional management options to meet classroom and individual student needs to ensure success in school is integrated throughout all course activities. A range of management practices, including strategies for diverse and special populations is offered. Theoretical and reflective practices are incorporated during classroom meetings. Students will observe, research, and discuss current classroom approaches. After reflections, effectiveness of observed practices will be assessed. Student will discuss and develop alternative activities that promote successful management techniques. Intensive field experience required. Admission to the Teacher Education program or permission of chair is required for this class.

ED 610 - TEACHING FINE ARTS IN THE ELEMENTARY SCHOOL
Semester Hours: 2-3

This course covers multiple aspects of fine arts education including the use of content, functions, and achievements of the performing arts (dance, music, theatre) and visual arts as primary media for communication, inquiry, and engagement among elementary students.

ED 612 - DIAGNOSIS AND ASSESSMENT OF READING
Semester Hours: 3

Focuses on ways to address the needs of students who do not read at grade level. Intervention strategies such as on-going assessment and evaluation, explicit instruction in phonemic awareness and phonics, extensive practice, comprehension strategies, and writing, along with careful examination of standardized state assessment measures. Intensive field experience required.

ED 615 - READING IN THE INTERMEDIATE GRADES
Semester Hours: 3

This course provides an in-depth study in and application of the process of reading and reading instruction, theoretical approaches, instructional strategies, classroom organization, and the formal/informal assessment of reading in intermediate grades. This course is required of all elementary education majors and secondary education candidates who are pursuing a middle school endorsement. Intensive field experience required.
Prerequisites: Admission to the Teacher Education Program.

ED 620 - USING TECHNOLOGY FOR SPECIAL POPULATIONS
Semester Hours: 3

Prepares teachers to plan curriculum integration by using computer technology and software in various curriculum areas for both regular and special students. Students will develop competency in instructional design and production skill techniques and implement instructional events using long-distance technologies.

ED 635 - USING ASSESSMENT TO GUIDE DIFFERENTIATED INSTRUCTION
Semester Hours: 3

The focus of this course would be to use a variety of norm-referenced, criterion-referenced and other assessment data to inform instruction for a diverse classroom within the RTi model. Students would learn to use formative and summative assessments to determine the type of strategies needed to teach content.

ED 650 - DIFFERENTIATING ELEMENTARY MATHEMATICS AND SCIENCE INSTRUCTION
Semester Hours: 3

This course will focus on guiding the learner to apply the concepts of differentiated instruction within mathematics and science contexts. Participants will learn how to implement effective strategies for managing flexible groups, acquire ideas for providing students with a variety of options to successfully target mathematics and science standards and understand how to plan strategically in order to reach the needs of diverse learners within the classroom through inquiry-based learning.

ED 665 - DIFFERENTIATING ELEMENTARY LITERACY (READING AND WRITING INSTRUCTION)
Semester Hours: 3

This course will focus on guiding the learner to apply the concepts of differentiated instruction to elementary literacy concepts. Advanced teacher candidates will develop and implement differentiated instructional plans that utilize individual and flexible grouping strategies and resources to support the growth of strategic, independent readers and writers.

ED 671 - TEACHING ELEMENTARY LANGUAGE ARTS
Semester Hours: 3

Introduction to current practices in language arts instruction with emphasis on the development of an integrated curriculum using children's literature as a foundation. Includes appropriate techniques for teaching of grammar, spelling, and handwriting. Intensive field experience required. Prerequisites: Admission to the Teacher Education Program.

ED 672 - TEACHING ELEMENTARY SOCIAL STUDIES
Semester Hours: 3

Teaching social studies in grades K-6. Helping beginning teachers acquire background skills in organizing and teaching units of work. Intensive field experience required. Prerequisites: Admission to the Teacher Education Program.

ED 673 - TEACHING NATURAL AND HEALTH SCIENCE
Semester Hours: 3

Integrates concepts from reflective practice with elementary science teaching. Opportunity to refine teaching skills in the planning, implementation, and evaluation of science lessons and units of instruction. Intensive field experience required. Prerequisites: Admission to the Teacher Education Program.

ED 674 - TEACHING ELEMENTARY MATHEMATICS
Semester Hours: 3

Overview of the mathematics concepts and skills taught in grades K-6 with an emphasis on the principles, methods, and materials used in the teaching and evaluation of elementary school mathematics. Focuses on the attitudes and behaviors of students and teachers in the actual planning and implementation of mathematics instruction for an elementary school classroom. Intensive field experience required. Prerequisite: Admission to the Teacher Education Program.

ED 690 - MASTER'S ACTION RESEARCH PROJECT
Semester Hours: 3

The capstone course will serve as a mechanism to support the research, methodology, development, and experimental stages of the required action research. The student's work will be approved and supervised by a selected faculty advisor with direct connections to the research area. A symposium in which students present their research report will be culminating activity.

ED 691 - PORTFOLIO SEMINAR & SYMPOSIUM
Semester Hour: 1

The seminar will provide a forum in which the student's culminating portfolio is refined and submitted for faculty review. The seminar will also serve as a mechanism to support the final writing stages of the required action research project or case study report. The student's work will be approved and supervised by the faculty advisor(s). A symposium in which students present their research will be the culminating activity.

ED 692 - ADVANCED P-12 INTERNSHIP
Semester Hours: 3

This internship is for students in advanced programs. The internship is completed throughout the program with a culminating portfolio of all internship assignments.

ED 693 - ELEMENTARY INTERNSHIP
Semester Hours: 3-6

Observation, participation and teaching in elementary school (full time, 15 week semesters). Students will also attend campus-based seminars designed to meet specific needs of the interns.

ED 696 - P-12 INTERNSHIP
Semester Hours: 3-6

ED 698 - HIGH SCHOOL INTERNSHIP
Semester Hours: 3-6

Observation, participation, and teaching in middle/high school (full-time, 15 week semester). Students will also attend campus based seminars designed to meet specific needs of interns.

Education Collaborative (EDC)

EDC 511 - INSTRUCTIONAL STRATEGIES IN INCLUSIVE CLASSROOMS
Semester Hours: 3

This course provides foundational, in-depth pedagogical strategies for assisting learners in constructing their own understanding of information. This course focuses on multiple instructional options that all learners need in order to be successful. It takes a broad approach to the multiple teaching models that are necessary for working with diverse populations. Prerequisite w/concurrency: ED 501.

EDC 551 - FOUNDATIONS OF VISUAL IMPAIRMENTS
Semester Hours: 3

Introduction to academic language found within the profession of special education of students with visual impairments. Examines standards, organizations, programs, and services for students with visual impairments. Studies the basic anatomy, diseases, and disorders of the visual system and explores how to conduct a Functional Vision Assessment.

EDC 560 - INTERMEDIATE ORIENTATION AND MOBILITY SKILLS
Semester Hours: 3

Development of orientation and mobility skills for individuals who are blind and visually impaired. Topics include human guide, indoor travel, and residential travel.

EDC 561 - ADVANCED ORIENTATION AND MOBILITY SKILLS
Semester Hours: 3

Development of advanced orientation and mobility skills for individuals who are blind or visually impaired. Topics include business travel, rural travel, and specialized travel.

EDC 610 - BEHAVIORAL ASSESSMENT
Semester Hours: 3

This course will provide an introduction to the strategies, methods, and ethics associated with behavioral assessment. The defining characteristics, strengths, and weaknesses of indirect assessments, descriptive assessments, and functional analysis will be reviewed. Students will learn to differentiate between and implement each type of assessment method. Assessment data collection, analysis, and interpretation will be discussed in the context of identifying appropriate behavioral interventions and goals. Prerequisites: EDC 612, EDC 613 adn EDC 614.

EDC 611 - ETHICS AND PROFESSIONALISM IN APPLIED BEHAVIOR ANALYSIS
Semester Hours: 3

This course will familiarize the student with ethical and professional responsibilities for Board Certified Behavior Analysts. Ethical decision-making processes will be emphasized with respect to the ethical guidelines set forth by the BACB (C), and the relationship between ethics, policy, and law will be explored.

EDC 612 - FUNDAMENTALS OF APPLIED BEHAVIOR ANALYSIS I
Semester Hours: 3

This course will introduce students to the goals, philosophical assumptions, and dimensions of applied behavior analysis. Students will also be introduced to the basic concepts and principles of behavior analysis including, but not limited to, respondent and operant conditioning, reinforcement and punishment contingencies, schedules of reinforcement, extinction, motivating operations, and automatically and socially mediated consequences. The concepts and principles will be discussed with respect to how they are relevant to socially significant behavior.

EDC 613 - FUNDAMENTALS OF APPLIED BEHAVIOR ANALYSIS II
Semester Hours: 3

Students will describe and explain behavior from the perspective of radical behaviorism and distinguish among behaviorism, the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. Students will be able to define and provide examples of more complex concepts and principles such as stimulus control, discrimination, generalization, verbal operants, and derived stimulus relations. Prerequisites: EDC 612.

EDC 614 - RESEARCH METHODS OF APPLIED BEHAVIOR ANALYSIS
Semester Hours: 3

The purpose of this course is to introduce students to the fundamentals of behavior analytic research methods. The course will examine the strategies and tactics used in single-subject research to implement socially important behavior change. Prerequisite: EDC 612.

EDC 615 - INTERVENTIONS IN APPLIED BEHAVIOR ANALYSIS
Semester Hours: 3

This course will prepare students to identify and implement effective, data-based behavior-change procedures and interventions in applied settings. Elements of behavior change and procedures to accomplish behavior increases, decreases, generalization, and maintenance will be examined. Emphasis will be placed on reinforcement, schedules of reinforcement, extinction, and alternate treatment procedures. This course will also examine strategies, teaching self-management, group-oriented contingencies, shaping techniques, behavior chains, motivational systems, punishment, and other topics. Students will learn how to select and implement function-based interventions for the reduction of problem behaviors and skills-based prevention strategies. Prerequisites: EDC 612, EDC 613 and EDC 614.

EDC 616 - SUPERVISION AND MANAGEMENT IN APPLIED BEHAVIOR ANALYSIS
Semester Hours: 3

This course will prepare students to conduct supervision using the principles of behavior analysis. Students will develop performance expectations based on the context, select individualized, assessment-based goals to develop supervisee skills, develop function-based strategies to improve supervisee performance, and design staff training procedures based on behavior analytic research. Prerequisites: EDC 610, EDC 612, EDC 613, EDC 614 and EDC 615.

EDC 617 - INTRODUCTION TO SUPERVISED FIELDWORK IN APPLIED BEHAVIOR ANALYSIS
Semester Hours: 1-3

This course will introduce students to supervised experience through the practice of applied behavior analysis in clinical and academic settings, such as an outpatient clinic and a child development center. This course may be repeated.

EDC 625 - ASSISTIVE TECHNOLOGY FOR EDUCATING INDIVIDUALS WITH ASD
Semester Hours: 3

This course provides an overview of assistive technology devices and services that are used in the instruction of students with autism spectrum disorders (ASD) and other communication disabilities.

EDC 636 - INTRODUCTION TO STUDENTS WITH AUTISM SPECTRUM DISORDERS
Semester Hours: 3

This course will provide advanced teacher candidates with an introduction to working with students diagnosed with autism spectrum disorders. Candidates will develop an understanding of the range of characteristics and behaviors associated with ASD, the effectives of early intervention on behaviors, and the theories regarding the etiology of the disorder.

EDC 645 - ASSESSMENT AND BEHAVIORAL APPLICATIONS IN ASD
Semester Hours: 3

This course focuses on assessment and intervention planning for children with ASD. Candidates will enhance their knowledge of various assessments appropriate to the ASD population and develop skills to administer and interpret assessments. The course will provide candidates with an overview of the Applied Behavioral Analysis approach to assessing and teaching students with ASD.

EDC 652 - INTRODUCTION TO ORIENTATION AND MOBILITY
Semester Hours: 3

Examines the psychosocial implications of blindness, with a particular focus on independence. Exploration of basic orientation mobility concepts including human guide and basic independent travel through the use of verbal description and tactile graphics.

EDC 653 - PRACTICUM FOR TEACHING STUDENTS WITH VISUAL IMPAIRMENTS
Semester Hours: 3

Examines the strategies used to make education accessible to students with visual impairments through the creation of high-quality accommodations and/or modifications. Topics include organization, assessment, early intervention, and the expanded core curriculum. This course is a practicum for visual impairments.

EDC 654 - INTRODUCTION TO BRAILLE LITERACY
Semester Hours: 3

Focused exploration of braille, braille literacy, and braille assessment.

EDC 655 - COLLABORATION AND TRANSITION PLANNING
Semester Hours: 3

Using case-based instructional strategies, this course is designed to assist advanced teacher candidates in learning to build supportive relationships with families, paraprofessionals, and related service providers, including community agencies, as a foundation for designing differentiated learning experiences for students with disabilities.

EDC 656 - PROGRAMS FOR STUDENTS WITH VISUAL IMPAIRMENTS AND MULTIPLE DISABILITIES/DEAFBLIND
Semester Hours: 3

Intensive examination of curricular adaptations, assessment, and intervention for students with multiple disabilities and visual impairments or deafblindness.

EDC 657 - ADVANCED BRAILLE AND ASSISTIVE TECHNOLOGY
Semester Hours: 3

Focused exploration of the braille for use in various contexts (STEM, music, foreign language), assistive technology and STEM education for students with visual impairments.

EDC 660 - PRACTICAL APPLICATIONS OF VISUAL INSTRUCTIONAL STRATEGIES
Semester Hours: 3

Advanced candidates will participate in an extensive summer clinic for children with ASD. Candidates learn how to create an appropriate learning environment, organize schedules for individual students, develop materials, engage in instruction, respond to behavioral issues, and document student progress.

EDC 662 - INTERMEDIATE ORIENTATION AND MOBILITY SEMINAR
Semester Hours: 3

Focuses on research practices and problem areas in intermediate orientation and mobility services for students with visual impairments and additional disabilities.

EDC 663 - ADVANCED ORIENTATION AND MOBILITY SEMINAR
Semester Hours: 3

Focuses on research practices and problem areas in advanced orientation and mobility services for students with visual impairments and additional disabilities.

EDC 682 - O&M AND STUDENTS WITH MULTIPLE DISABILITIES
Semester Hours: 3

Focuses on orientation and mobility planning and instruction for students with visual impairments and other disabilities.

EDC 692 - ORIENTATION AND MOBILITY INTERNSHIP
Semester Hours: 1-3

This variable hour course is the cumulative internship course where students complete the internship required to become a Certified Orientation and Mobility Specialist (COMS). The internship is composed of 350 hours working directly with a COMS.

Electrical Engineering (EE)

EE 501 - DIGITAL SIGNAL PROC ARCHITECTU
Semester Hours: 3

Introduction to digital signal processor architecture, applications, assembly language programming, and development tools for designing and implementing DSP systems.

EE 504 - INTRO DATA COMMUNICA NETWORKS
Semester Hours: 3

Overview of historic development of modern telephone and data communication system, system architecture, standards, broadband switching systems, modems, protocols, personal and mobile communications, digital modulation techniques.

EE 506 - COMMUNICATION THEORY
Semester Hours: 3

Review of elementary signals and systems including the Hilbert transform, cross and auto correlation, power density spectrum, and the Wiener-Khintchine theorem. Butterworth and Chebyshev lowpass filters. Bandpass signals and systems. The lowpass equivalent of a bandpass signal/system. Commonly used forms of linear and nonlinear modulation. Demodulation methods and circuits. Phase lock and frequency feedback techniques.

EE 510 - SELECTED TOPICS/ECE
Semester Hours: 1-6

EE 514 - ANALOG & DIGITAL FILTER DESIGN
Semester Hours: 3

Analog filter design via Butterworth, Chebyshev, and elliptical approximation. Active filter design using operational amplifiers. Digital filter design methods.

EE 516 - DIGITAL ELECTRONICS
Semester Hours: 3

Introduction to digital electronics. The Metal-Oxide-Semiconductor (MOS) transistor. MOS inverters and gate circuits. Bipolar junction transistors, ECL inverters, and bipolar digital gates. Semiconductor memories. Circuit design for VLSI.

EE 518 - NONLINEAR DYNAMICS & CHAOS
Semester Hours: 3

Topics: system stability, linearization, equilibrium/steady-state solutions, bifurcations, periodic solutions, limit cycles, oscillators, chaos, iterated maps and chaos control/synchronization. Various tools and methods used for analysis and design of nonlinear circuits and systems will be covered. Students should have prerequisite knowledge of electronics and signals and systems such as covered in EE 315 and EE 382.

EE 521 - ANTENNA DESIGN & ANALYSIS
Semester Hours: 3

Covers analytical methods and mathematical foundations for solving antenna radiation problems, based on Maxwell's equations. Different types of antennas will be studied, including wire, phased array, aperture, microstrip, and reflector antennas. Students should have prerequisite knowledge of electromagnetics, such as that covered in EE 308.

EE 525 - FUNDAMENTALS OF RADAR SYSTEMS
Semester Hours: 3

An introduction to radar systems and basic radar analysis. Topics include common radar topologies and construction methods, transmission, reception and processing of radar signals that are embedded in noise. Particular focus on analysis of the radar range equation and its various terms. Students are expected to have prerequisite knowledge of signals and systems and random signals such as covered in EE 382 and EE 385.

EE 532 - OPTICAL SYSTEMS DESIGN
Semester Hours: 3

Introduction to the geometrical design and analysis of optical systems, and to the design principles of lens systems.

EE 534 - OPTICAL FIBER COMMUNICATIONS
Semester Hours: 3

Introduction to optical fibers and their transmission characteristics, optical fiber measurements, sources and detectors, noise considerations for digital and analog communications, optical fiber systems.

EE 541 - OPTICS I
Semester Hours: 3

Foundations and physics of geometrical optics, Fermat's principles and Huygen wavelets, refraction and reflection. The many forms of Snell's Law. Optical path lengths, geometrical wavefronts and rays. Ray tracing, ynu-chart and matrix methods. Gaussian imagery and paraxial optics, conjugate elements, cardinal points, and image-object relations. Stops and pupils, chief and marginal rays, vignetting, and the optical or Lagrange invariant. The y-ybar diagram, design of common systems: objectives, magnifiers, microscopes, collimators and detectors. Optical glasses and chromatic aberrations, wavefront and transverse aberrations, spot diagrams and ray fan plots.

EE 542 - PHYSICAL OPTICS
Semester Hours: 3

Scalar and electromagnetic waves, polarization, coherence, reflection and refraction; two beam and multiple beam interference, interferometers, Fabry-Perots, thin films, diffraction, and absorption and dispersion.

EE 543 - OPTICAL COMM SYS & NETWORKS
Semester Hours: 3

EE 553 - LASER SYSTEMS
Semester Hours: 3

Spontaneous and stimulated emission, population inversion, optical resonators, three- and four-level systems, Q-switching and modelocking, semiconductor lasers, integrated optic waveguides and couplers, scanning systems, high power industrial applications. Includes a research project and oral presentation.

EE 570 - OPT & PHOTONIC SYSTEMS DESIGN
Semester Hours: 3

EE 586 - INTRO MODERN CONTROL SYSTEMS
Semester Hours: 3

The basic ideas and techniques of modern control theory. Analytical techniques for modeling, analysis and control of MIMO dynamic systems. State variable description of dynamic systems. State variable feedback control design and state observers. Kalman-filtering. Fundamentals of nonlinear systems analysis. Introduction to discrete time system modeling, analysis and control. Basics of adaptive and optimal control. Applications to aerospace and electric power systems.

EE 603 - RANDOM SIGNALS IN COMMUNICATIO
Semester Hours: 3

Random processes applied to communication and control. Concepts covered include stationarity, correlation, power spectrum, Brownian motion, thermal noise, Markov processes, and queuing theory. Emphasis on systems with noisy excitation.

EE 604 - DIGITAL IMAGE PROCESSING
Semester Hours: 3

Review of digital filters. Spatial filters and realizations. Edge and wedge detectors. Derivative matrices and u-notch, r-notch filters. Periodic images, their transformation and scanning, their two-dimensional Fourier transforms. Rational vectors and image filtering.

EE 605 - CLASSICAL CONTROL DESIGN
Semester Hours: 3

Design of feedback, feedforward, and minor-loop controllers/compensators using classical control engineering techniques and classical performance criteria. Frequency domain synthesis of lead, lag, lead-lag, etc. compensators; tuning of PD and PID controllers; error budgets; use of commercial CAD software for classical control design and performance evaluation; digital simulation techniques. CAD laboratory sessions.

EE 607 - ROBOTIC SYSTEMS CONTROL
Semester Hours: 3

In-depth study of information, decision and control problems associated with robotic system design. Sensor systems, recognition and decision algorithms, kinematics and dynamics, trajectory planning, analog and digital controllers, adaptive and optimal control.

EE 609 - ELECTROMAGNETIC FIELD THEORY
Semester Hours: 3

Mathematical approach to electromagnetic phenomena. Basic field concepts. Radiation and propagation. Waveguides and simple radiating and scattering systems. Perturbational and variational techniques.

EE 610 - SELECTED TOPICS/ECE
Semester Hours: 1-6

EE 612 - GRADUATE DESIGN PROJECT
Semester Hours: 3

Graduate design project in support of an M.S.E. program.

EE 613 - LASER ELECTRONICS
Semester Hours: 3

Resonant optical cavities. Atomic radiation. Laser oscillation and amplification. General characteristics of lasers. Laser excitation. Semiconductor lasers. Gas discharge phenomenon. Transition rates. Spectroscopy of common lasers. Detection of optical radiation.

EE 614 - DATA COMPRESSION
Semester Hours: 3

Introduction to the fundamental theories and techniques of lossless and lossy data compression. Topics include Huffman codes, arithmetic codes, Golomb-Rice code, dictionary techniques, context-based compression, scalar quantization, vector quantization, transform coding, subband coding, wavelets, compression standards, and selected advanced topics of data compression.

EE 615 - ANALOG CIRCUIT DESIGN
Semester Hours: 3

Use of operational amplifiers to synthesize special-purpose filters and circuits for analog signal processing and conditioning; linear and switching power supplies; high-frequency effects; circuits for transmitters and receivers; digital circuits from an analog viewpoint; A/D and D/A converters; selected topics.

EE 616 - MICROELECT DEV/INTE CIRC
Semester Hours: 3

Analysis and design of microelectronic devices for integrated circuits. Properties of semiconductors important to microelectronic device operation. Analysis and modeling of MOS devices and circuits. Analysis and modeling of metal semiconductor devices, junction diodes, bipolar transistors. Device fabrication technology. Prerequisite: EE 516.

EE 617 - VLS INTEGRATION DEVICES
Semester Hours: 3

Operation and modeling of the MOS transistor. Second-order considerations for a MOSFET, VLSI device fundamentals and scaling laws. Micron-length and submicron-length semiconductor devices. Basic technology and applications of VLSI. Impact of VLSI on computer architecture. VLSI computer aided design.

EE 618 - VLSI CIRCUITS
Semester Hours: 3

MOS device electronics. MOS processing and design rules. Circuit design with MOSFETS. MOS circuit technique. Combinational logic gate in CMOS. Pseudo-NMOS logic gates. Very high performance digital circuits. Sequential logic circuits. Designing semiconductor memories. Low power CMOS VLSI circuit design.

EE 619 - RADAR SYSTEMS
Semester Hours: 3

Radar range equation, noise & noise figure, radar losses, false alarm and detection probability, detection probability improvement techniques, matched filter theory, ambiguity function. Prereq: EE 525.

EE 620 - CMOS ANALOG CIRCUIT DESIGN
Semester Hours: 3

Analog circuit design in CMOS technology. CMOS processing technology. MOS transistor modeling. Basic current mirrors and single-stage amplifiers. Noise analysis and modeling. Basic OpAmp design and compensation. Advanced current mirrors and OpAmps. Bandgap references. Oscillators. CMOS technology characterization for radio-frequency (RF) design. Same as CPE 625.

EE 622 - HARDWARE RELIABILITY
Semester Hours: 3

The objective for this course is to provide students with an understanding of the essential reliability physics of electronic devices as well as some of the practical technological considerations.

EE 629 - ANAL & COMP METH IN ELEC ENG I
Semester Hours: 3

Analytic and numerical solution techniques applicable to problems arising in engineering, utilizing complex variable theory, linear algebra, matrix theory, and transform methods.

EE 630 - ANAL & COMP METHODS ELEC EG II
Semester Hours: 3

Analytical and numerical solution techniques applicable to problems arising in electrical engineering. Partial differential equations, vector differential and integral calculus, special functions, Fourier analysis with applications and integral equations.

EE 632 - FOURIER OPTICS
Semester Hours: 3

Introducing the optical system as an invariant linear system, convolution, Sommerfield's diffraction integral, Fourier Transform, angular spectrum, coherent and incoherent imaging, optical transfer function.

EE 633 - ELECTRO-OPTICAL ENGINEER
Semester Hours: 3

Propagation of optical beams in homogeneous and guiding media, optical resonators, and spectrum analyzers, theory of laser oscillation, some specific laser systems, parametric oscillators, electro-optical and acousto-optical modulators.

EE 634 - OPTICAL COMMUNICATIONS
Semester Hours: 3

Optical communication systems; counting statistics; the optical detector response process; direct detection; heterodyne detection parameter estimation in optical communications; pointing, spatial acquisition and tracking.

EE 642 - DATA & DIGITAL COMMUNICATION
Semester Hours: 3

Introduction to digital and data communications; transmission channels; modulation and coding; telephone networks; data communication standards; noise and distortion; computer interfacing; protocols. Prerequisite: EE 603.

EE 648 - DIGITAL SIGNAL PROCESSING
Semester Hours: 3

Theory and applications of signal processing by digital techniques. Difference equations, Z-transform theory, digital-filter design, fast Fourier transform, quantization effects, and discrete estimation. Applications in digital filtering, signal processing, data analysis and smoothing, and image processing. Students should have prerequisite knowledge of signals and systems such as covered in EE 383.

EE 654 - OPTICAL TESTING
Semester Hours: 3

EE 672 - DIGITAL PROC RANDOM SIGNALS I
Semester Hours: 3

Discrete signals, linear systems, spectral analysis and probability; and random discrete-time signals. Introduction to statistical interference, time-series analysis and spectral estimation of random discrete-time signals. Cross correlation and cross spectra, multitaper spectrum estimation and multivariable spectral analysis.

EE 673 - DIGITAL PROC RANDOM SIGNALS II
Semester Hours: 3

Parametric models for random signal processing; AR (autoregressive), MA (moving average), ARMA(autoregressive moving average), and Prony method. Two-dimensional spectral estimation; higher-order spectral analysis and multiresolution signal analysis.

EE 690 - UNIFORM GEOM THY DIFFRAC
Semester Hours: 3

Geometrical optics fields, geometrical optics reflected fields, two-dimensional wedge diffraction (GTD and UTD), three-dimensional wedge diffraction and corner diffraction, equivalent currents, diffraction at a smooth convex conducting surface, radar cross section.

EE 696 - GRAD INTERN EE ENGR
Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization or government agency that has particular interest and relevance to the graduate student. Permission of EE faculty member is required.

EE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of nine hours of credit is awarded upon successful completion of master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

EE 700 - SAMPLED DATA CONT SYS
Semester Hours: 3

Classical and modern methods for analysis and design of sampled data-control systems; Ztransforms, transport lags, z and w plane analysis, state variables, and the transition matrix.

EE 701 - ADV LINEAR CONTROL THRY
Semester Hours: 3

Modern techniques for analysis and design of linear control systems. Matrix formulation, multivariable control systems, state variable concepts. Linear transformation, controllability, observability, discrete-time systems. Prerequisite: EE 586.

EE 703 - MODERN CONTROL DESIGN
Semester Hours: 3

Use of modern (state-variable) control concepts and theories to design high-performance controllers for multi-input/multi-output set-point regulation and servo-tracking/pointing problems. Modeling of uncertain disturbances; design of disturbance-accommodating controllers; introduction to adaptive and stochastic control. Use of commercial CAD software for modern control design and performance evaluation. CAD laboratory sessions. Prerequisite: EE 701.

EE 704 - NONLINEAR CONTROL SYSTEM
Semester Hours: 3

Classical and modern methods for analysis and design of nonlinear automatic control systems. State variables, phase plane, limit cycles, stability, describing functions, relay control, stabilization theory. Prerequisite: EE 701.

EE 705 - THEORY OPTIMAL CONTROL
Semester Hours: 3

General theory of optimal control of dynamic processes. Calculus of variations. Hamilton-Jacobi theory. Pontryagain's maximum principle, dynamic programming.

EE 706 - KALMAN FILTERS
Semester Hours: 3

Review of continuous and discrete time systems, random variables and processes; matrix random processes; derivation of the first order, linear Kalman filter; derivation of the linear vector Kalman filter; derivation of the extended Kalman filter; design and implementation of specific Kalman filters. Prerequisite: EE 525 or EE 586.

EE 707 - INFORMATION THEORY
Semester Hours: 3

Self-information, entropy, mutual information, and channel capacity, encoding, error detecting and correcting codes. Sampling theorem. Discrete and continuous channels.

EE 710 - SELECTED TOPICS/ECE
Semester Hours: 1-6

EE 711 - ANTENNA THEORY
Semester Hours: 3

Antennas and antenna arrays. Radiation patterns and impedance characteristics. Spheres, cylinders, horns, slots, microwave lenses, traveling-wave, and frequency independent antennas.

EE 716 - DEVICE MOD INTEG CIR DSG
Semester Hours: 3

Fundamental limits in integrated circuits. Advanced and detailed development of the theory of MOS and bipolar transistors. MOS and bipolar transistor models for IC design. Numerical algorithms for modeling microelectronic devices. Device modeling and simulation for radio frequency (RF) application. Computer-aided design and VLSI device development.

EE 717 - SPACE APPLI/ELECTROMAGNE
Semester Hours: 3

Plasma as a dielectric; dielectric functions for cold, warm, isotropic and anisotropic plasmas, body-plasma interaction; space craft electrodynamics, antennas in plasmas; mode of radiation, input impedance and radiation pattern, scattering problems involving plasmas.

EE 718 - MICROWAVE TECHNIQUES
Semester Hours: 3

Network representations and analysis of microwave devices. Discontinuities from a circuit point of view. Symmetry consideration. Scattering matrices in circuit design. Cavity resonators.

EE 721 - ROBUST AND ADAPTIVE CONTROL
Semester Hours: 3

Introduction to fundamental ideas of robust and adaptive control. Effects of parameter and disturbance uncertainties, H-infinity and mu-synthesis ideas; parameter estimation techniques; adaptive control algorithms; stability considerations; model-reference and linear adaptive control techniques.

EE 722 - SLIDING MODE CONTROL
Semester Hours: 3

The basic and advanced theories and analytical techniques for modeling and analysis of systems dynamics in sliding manifolds. Traditional and High Order Sliding mode controller design. Discontinuous and equivalent control, robustness. Applications to control of electro-mechanical systems, reusable launch vehicle, air craft, spacecraft, and DC-to-DC power converters. Prerequisite: EE 701.

EE 723 - RADAR TRACKING
Semester Hours: 3

Alpha-Beta and Alpha-Beta-Gamma track filters, range, angle, Doppler frequency measurement and discriminators; implementation of range, angle, Doppler, and combined range/angle/Doppler trackers; tracking the presence of multipath, multiple target effects. Prerequisite: EE 619.

EE 724 - RADAR WAVEFORMS & SIGNAL PROCE
Semester Hours: 3

Stretch Processing. Synthetic Aperture Radar and SAR signal processing, Space-time adaptive processing (STAP). Phase coded waveforms and processing. Frequency hop waveforms Prerequisite: EE 619.

EE 725 - ADVANCED RADAR TECHNIQUE
Semester Hours: 3

Modern radar systems for search and tracking are analyzed with emphasis on signal processing. Modeling and simulation of system and environment. Advanced techniques include CFAR, binary modulation, frequency agility, polarization agility, and synthetic aperture. Prerequisite: EE 619.

EE 726 - DECIS/ESTIMATION THEORY
Semester Hours: 3

Classical detection theory, including maximum likelihood, Neyman-Pearson, Bayes and minimax criteria. Estimation theory concepts and criteria, linear estimators, Kalman filters, maximum likelihood and least-squares estimator, matched filters, Cramer-Rao lower bound. Introduction to pattern recognition.

EE 727 - NUMER METH ELECTROMAGNET
Semester Hours: 3

Review of concepts in electromagnetics, antennas and scattering problems, method of moments and applications, finite difference and finite element methods, numerical solutions of transient problems associated with broadband systems, impulse response, direct solution of field equations in time domain.

EE 733 - NONLINEAR OPTICS APPLICATIONS
Semester Hours: 3

Modeling of optical nonlinearities; Kerr, thermal and photorefractive effects; nonlinearity-induced beam distortion; applications of nonlinearities in crystals and fibers; quantum well and SEED devices; soliton-based communication system; nonlinear optical switches, deflectors and limiters; measurements of nonlinearities.

EE 734 - FIBER OPTICS
Semester Hours: 3

Propagation in dielectric slab and fibers with step and graded index of refraction; electromagnetic and ray optical methods; eikonal equations; ray trajectory; WKB method; paraxial approximation; weakly guiding structures.

EE 735 - STATISTICAL OPTICS
Semester Hours: 3

Introduction to random variables and random processes; first-order properties of light waves; coherence of optical waves, partial coherence and imaging systems, imaging in randomly inhomogeneous media, fundamental limits in photoelectric detection of light.

EE 738 - OPT TRANSF/PATTN RECOGNI
Semester Hours: 3

Systems and transforms in diffraction theory; two-dimensional Fourier transform; Hankel transforms; generalized Hankel transforms; optical signals, correlation coherence; filtering; apodization; applications to optical pattern recognition.

EE 742 - WIRELESS COMMUNICATIONS
Semester Hours: 3

Design and analysis of wireless transmission systems. Prerequisite: EE 642.

EE 744 - ERROR CONTROL CODING
Semester Hours: 3

Linear block coding techniques, convolutional codes and the Viterbi decoding algorithm, iterative decoding algorithms and the codes to which they are applied, including Turbo Codes, Low-Density Parity-Check Codes, and Serially-Concatenated Codes. Prerequisite: EE 504.

EE 745 - MOD/PHASE LOCK TECH COMM
Semester Hours: 3

Treatment of analog and digital phase locked loops. Applications in carrier regeneration, demodulation, and synthesis discussed. Linear and nonlinear PLL models and analysis. Noise analysis via Volterra Series and Fokker-Planck equation. False lock phenomenon.

EE 747 - PATTERN RECOGNITION ALGORITHMS
Semester Hours: 3

EE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

Engineering Management (EM)

EM 660 - ENGR MGMT THEORY
Semester Hours: 3

Comparison of classical management principles and theory with the current systems in high technology, research and development, and other scientific-engineering organizations. Use of people systems to accomplish goals in high technology organizations. Cases used to illustrate contemporary problems and environments.

EM 666 - ENGR PROJECT MANAGEMENT
Semester Hours: 3

Management and control of multifaceted engineering and technological projects. Coordination and interactions between client and various service organizations. Project manager selection. Typical problems associated with various phases of project life cycle. Case studies illustrate theories and concepts.

EM 679 - SELECTED TOPICS IN ENGR MGMT
Semester Hours: 3-9

EM 697 - ENGR MANAGEMENT PROJECT I
Semester Hours: 3-9

Application-oriented student project designed to show competence in engineering management.

EM 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours of credit is awarded upon successful completion of master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

EM 747 - STRATEGIC ENGINEERING MGT
Semester Hours: 3

Analysis of creating an organizational strategy for engineering and technology-based enterprises; identifying critical value streams and creating supplier and customer partnerships. Development of skills for leadership and management of innovation. Prerequisite: EM 660.

EM 760 - ENGR MGMT STRUCTURES & SYSTEMS
Semester Hours: 3

The course studies the impact of various organization structures in relation to the goals of high technology enterprises. Use and effectiveness of contemporary organizational systems as related to the knowledge worker. Cases used to illustrate contemporary problems and environments. Prerequisite: EM 660.

EM 761 - EVOL THRY ENG MGMT/IND SYS ENG
Semester Hours: 3

Development of applicable engineering management or industrial & systems engineering using classical concepts, contemporary studies, and practices at successful technology-based organizations.

EM 766 - MANAGING CHG IN HIGH TECH ORG
Semester Hours: 3

Challenges to implementing advanced technology equipment, systems, and methods in engineering organizations. Justifying technology, assimilating change, changing management roles, personnel practices and organizational structure, and dealing with impact of new technologies on business policies and strategic planning. Prerequisite: EM 666.

EM 779 - SELECTED TOPICS IN ENGR MGMT
Semester Hours: 3-9

EM 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is working and receiving direction on a doctoral dissertation. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

English (EH)

EH 500 - COMPOSITION STUDIES FOR TEACHERS
Semester Hours: 3

Introduction to effective strategies for the teaching of writing. Students will report on their own writing pedagogy as a result of reading and analyzing a range of writing research related to strategies of assigning, responding, and assessing writing.

EH 501 - THEORY AND PRACTICE IN TECHNICAL COMMUNICATION
Semester Hours: 3

Explores the relationships between common practices in technical communication and the theories that legitimize those practices. Introduction to research and theories about fundamental issues in technical communication.

EH 503 - LITERARY CRITICISM AND THEORY
Semester Hours: 3

Major texts and approaches from Plato to the present. All 500-level courses are crosslisted with 400-level courses.

EH 504 - LITERARY RESEARCH
Semester Hours: 3

Introduction to the method and practice of advanced literary studies with emphasis on the development of literary critical research skills, the building of a critical lexicon, and the application of theory and criticism.

EH 508 - HISTORY OF THE ENGLISH LANGUAGE
Semester Hours: 3

History of the emergence and development of English from the pre-Anglo-Saxon period to the present. Emphasis on cultural contexts.

EH 509 - PROPOSAL WRITING
Semester Hours: 3

This course teaches effective strategies for writing successful proposals in business, academic, research, and non-profit contexts.

EH 510 - FICTION WRITING
Semester Hours: 3

Practice in writing fiction from conception to revision. Students will read and write contemporary literary fiction. Student work will be commented on and critiqued in regular class workshops. The class culminates in a revision portfolio.

EH 511 - POETRY WRITING
Semester Hours: 3

Practice in writing poetry from conception to revision. Students will read and write contemporary poetry. Student work will be commented on and critiqued in regular class workshops. The class culminates in a revision portfolio.

EH 512 - SPECIAL TOPICS IN CREATIVE WRITING
Semester Hours: 3

Topics in creative writing, professional writing, or other advanced writing announced in advance.

EH 514 - CREATIVE NONFICTION WRITING
Semester Hours: 3

This composition class introduces students to the genre of creative non-fiction through exploring various approaches to the non-fiction writing; developing expertise in writing strategies such as revising, peer responding, prose modeling, and conferencing; and developing expertise in rhetorical writing concepts.

EH 515 - ANGLOPHONE AND/OR POSTCOLONIAL LITERATURE
Semester Hours: 3

An introduction to major concepts, figures, and works with emphasis upon historical and cultural context. Specific focus will vary.

EH 518 - REPRESENTATIVE TEXTS BY WOMEN AUTHORS
Semester Hours: 3

Focus on women's contribution to the literary tradition.

EH 520 - WRITING FOR TECHNICAL PROFESSIONALS
Semester Hour: 1

Teaches students in disciplines such as science, engineering, nursing and user experience to improve their writing skills and produce important academic and professional documents.

EH 522 - STUDIES IN THE NOVEL
Semester Hours: 3

Focuses on varying topics in the novel with special attention to form. Texts may be drawn from diverse national and cultural origins.

EH 523 - CONTEMPORARY BRITISH LITERATURE
Semester Hours: 3

Major works after 1945 with emphasis on historical and cultural contexts. Specific focus will vary.

EH 524 - POETRY AND POETICS
Semester Hours: 3

An attempt to answer (at least provisionally) the questions "What is a poem?" and "What is poetry?". How to read a poem closely and carefully, with attention to theory, history of genres, and especially the technical aspects of poetry.

EH 530 - THE AMERICAN NOVEL
Semester Hours: 3

Topics announced in advance.

EH 533 - WILLIAM FAULKNER
Semester Hours: 3

Critical study of the major novels.

EH 534 - SCIENCE FICTION
Semester Hours: 3

Selected short stories and novels, exploring the thematic and narrative concerns of both classic and contemporary science fiction. In alternate years, the course may focus on a specific problem or concern in science fiction.

EH 538 - AFRICAN AMERICAN LITERATURE
Semester Hours: 3

Themes, concepts and imagery in the Black American literary tradition.

EH 540 - SPECIAL TOPICS IN ENGLISH STUDIES
Semester Hours: 1-3

Topics announced in advance.

EH 542 - USABILITY STUDIES
Semester Hours: 3

Introduces students to the theory and practices of usability, which involves designing useful, easy-to-use websites, software, and products. The course involves group projects conducting real-world usability testing.

EH 548 - THE BIBLE AS LITERATURE
Semester Hours: 3

An introduction to the major literary forms of the Bible. Material will be approached analytically, involving both socio-historical and literary-critical perspectives.

EH 550 - CHAUCER
Semester Hours: 3

A study of Geoffrey Chaucer's Middle English works including the early dream visions, Troilus and Criseyde, and the Canterbury Tales.

EH 551 - ARTHURIAN ROMANCE
Semester Hours: 3

A study of Arthurian Literature focused on medieval Welsh, Scottish, English, and French poetry and prose, as well as later early modern and modern adaptations of Arthurian stories in poetry, prose, drama, and film.

EH 552 - USER-CENTERED DESIGN
Semester Hours: 3

Introduces students to user-centered design principles that inform the practice of user experience design. Students will use visual thinking as they complete contextual inquiries and mapping exercises.

EH 553 - COMMUNICATING WITH USERS
Semester Hours: 3

This course teaches students how to effectively research user needs and produce technical communication documents to meet those needs.

EH 554 - NEW MEDIA WRITING & RHETORIC
Semester Hours: 3

This course teaches students to consider and implement rhetorical principles across a variety of media and includes an examination of communication strategies used widely in academic and industry settings. The course focuses on new media through an exploration of digital technologies and the way digital culture and new media have dramatically impacted reading, writing and research practices.

EH 560 - SIXTEENTH-CENTURY LITERATURE
Semester Hours: 3

Selected works from the reigns of Henry VIII and Elizabeth I. Close reading of texts in their historical, intellectual, and social contexts.

EH 565 - DRAMATIC LITERATURE
Semester Hours: 3

Studies in Drama and interpretive strategies for reading plays. May be organized nationally, by genre, or by theme/topic.

EH 570 - MILTON
Semester Hours: 3

A study of the development of Miltons thought and art as it appears in his early poems, selected prose, and later poetry, with particular attention given to Paradise Lost.

EH 571 - RENAISSANCE DRAMA
Semester Hours: 3

Non-Shakespearean drama of the sixteenth and early-seventeenth centuries in social, critical, and performative contexts. Specific focus will vary from term to term.

EH 573 - EARLY MODERN LITERATURE
Semester Hours: 3

This course will examine a particular theme, issue, and/or debate within the early modern period, roughly 1500-1700. The historical and geographical scope of the course will vary depending on the term, though the course will emphasize British literature. Within this literature, constructions of subjectivity and community vary greatly due to the influence of the European Renaissance, the Protestant Reformation, the exploration of the New World, as well as the rediscovery of the natural world through scientific investigation. While the course will introduce the complexities of early modern literary constructions of identity, the course will also illumine the ways in which these habits of thought were increasingly contested, sometimes to the point of violence. The course will likely include period-specific as well as modern scholarship.

EH 575 - RHETORIC AND WRITING
Semester Hours: 3

Provides a focused look at specific issues of rhetoric in society. Students develop a historical perspective of rhetoric through academic analysis and research that will inform rhetorical strategies for contemporary contexts.

EH 585 - THE ENLIGHTENMENT
Semester Hours: 3

The European Enlightenment was an intellectual and cultural movement in the seventeenth and eighteenth centuries that emphasized the importance of reasoned, open-eyed investigations into nature and human society. Stimulated by the Scientific Revolution, Enlightenment philosophes prized skepticism and decried superstition and unquestioned faith. They are often credited with providing a theoretical basis for the American and French Revolutions. Scholars have also counted among the Enlightenment's important legacies the scientific method, the valuation of universal human rights, and the emergence of such disciplines as economics and anthropology. Authors discussed in the course may include: Bacon, Behn, Hume, Swift, Voltaire, Montagu, Franklin, Jefferson, Equiano, and Wollstonecraft.

EH 601 - ACTION RESEARCH IN WRITING STUDIES
Semester Hours: 3

Analysis of research on writing in the workplace, the community, and educational settings.

EH 602 - PRACTICUM IN TECHNICAL COMMUNICATION
Semester Hours: 3

Designed to give technical communication graduate students on-the-job experience in industry or government, either through an internship or a major research project connected with an industry problem. Prerequisites: EH 501.

EH 603 - EDITING FOR PUBLICATION
Semester Hours: 3

A comprehensive survey of best practices for editing documents for clarity, correctness, accuracy, style, design, and usability. Course involves working with writers to edit work for publication.

EH 615 - CRITICAL THEORY
Semester Hours: 3

Intensive study of a specific author or topic in literary or critical theory. Focus will vary.

EH 618 - STUDIES IN WOMEN & LITERATURE
Semester Hours: 3

Selected authors, genres, and issues.

EH 629 - TWENTIETH-CENTURY LITERATURE
Semester Hours: 3

Selected poetry and prose with an emphasis on the Anglo-American Modernist tradition.

EH 630 - AMERICAN LITERATURE TO 1865
Semester Hours: 3

Major movements from Colonial times to 1865; selected major figures or special problems.

EH 631 - AMERICAN LITERATURE SINCE 1865
Semester Hours: 3

Major movements since 1865; selected major figures or special problems.

EH 639 - ETHNIC AMERICAN LITERATURE
Semester Hours: 3

Selected authors, concepts, histories, and cultures.

EH 649 - SPECIAL TOPICS
Semester Hours: 1-3

Study of significant issues in literature, technical communication, or composition studies, announced in advance.

EH 655 - MEDIEVAL LITERATURE
Semester Hours: 3

Topics in Medieval European and Eastern Literature.

EH 660 - SHAKESPEARE
Semester Hours: 3

Selected Shakespearean plays, with special attention to the major criticism, problems of interpretation, and current issues in Shakespearean study.

EH 662 - INFORMATION ARCHITECTURE
Semester Hours: 3

This class reviews research and principles that help students understand how communities label, organize, retrieve, and ultimately use information.

EH 665 - RENAISSANCE LITERATURE
Semester Hours: 3

An in depth study of a major theme, debate or question in 16th and early 17th century literature. Includes Renaissance criticism and modern scholarship.

EH 670 - STUDIES IN SEVENTEENTH CENTURY LITERATURE
Semester Hours: 3

This course investigates one of the most volatile periods in Britain's history through a variety of literary and critical lenses, all geared toward a particular theme, issue, or debate. In this period, received bodies of knowledge and accompanying forms of authority - philosophical, religious,political and scientific - were increasingly called into question.

EH 680 - 18TH CENTURY STUDIES
Semester Hours: 3

Extensive and intensive study of various early modern texts, with attention to interdisciplinary contexts.

EH 695 - NINETEENTH-CENTURY LITERATURE
Semester Hours: 3

This class will investigate Anglophone cultural expression and literary critical traditions associated with long nineteenth century (1789-1919). Specific thematic concern or period of focus is left to the discretion of the instructor.

EH 698 - INDEPENDENT STUDY
Semester Hours: 3

Individual investigation into significant issues in linguistics, literature, technical communication, or composition studies under direct supervision of instructor. Prerequisites: Written approval by the instructor and the department chair of a project prospectus.

EH 699 - MASTER'S THESIS
Semester Hours: 3-6

Required each semester during which a student is working and receiving direction on a masters thesis. No more than 6 hours credit may be applied toward the degree. Prerequisites: approval of instructor.

English Linguistics (EHL)

EHL 509 - SP STUDIES IN APPL LINGUISTICS
Semester Hours: 3

Special topics in linguistics. Focus and emphasis of topics announced in advance. Prerequisite: instructor permission.

English Second Language (ESL)

ESL 500 - POLICY AND PRACTICE IN EDUCATIONAL LINGUISTICS
Semester Hours: 3

In this course, we investigate the sociocultural and political contexts within which linguistically diverse students encounter language across the U.S. education system. We will interrogate assumptions about language learning and teaching. Key topics include promising practices in supporting language and identity, such as translanguaging, multimodality, and multilingualism in educational and community settings.

ESL 510 - INTRODUCTION TO LANGUAGE SYSTEMS
Semester Hours: 3

In this course, we study language systems in context. Phonetics, phonology, morphology, syntax, and semantics are the units of analysis as we consider variables that impact development and usage at individual and group levels. Comprehension and production of meaning across content domains are key elements of course assignments.

ESL 520 - INSTRUCTIONAL AND ACADEMIC LANGUAGE ACROSS CONTENT DOMAINS
Semester Hours: 3

In this course, we investigate language usage through analysis of key structures, including the word, group, phrase, sentence and extended discourse. Following the system-functional framework, we will consider the design of instructional and academic language from a social semiotic perspective, highlighting the complex of options available for meaning making across multiple languages.

ESL 640 - INSTRUCTIONAL AND EVALUATION OF LANGUAGE USAGE
Semester Hours: 3

This course provides the foundation for effective instruction of linguistically diverse students. We critique the theoretical underpinnings of historical and contemporary ESOL education as well as the selection of instructional materials, course design, and lesson plans. Assignments include the design of pedagogically sound classroom instruction and lesson plans, as well as application of responsive, evidence-based evaluation methods.

ESL 650 - PRACTICUM, TESOL
Semester Hours: 3

This course review the foundations of responsive course, program, and curriculum design. Students engage in supervised instruction of English to linguistically diverse learners in target contexts.

Finance (FIN)

FIN 500 - INVESTMENT PRACTICUM
Semester Hours: 4

Small number of students work closely with finance faculty in the UAH Capital Management group (CMG) to manage actual investment portfolios. Emphasis is placed on individual stock selection and management of the portfolio to meet objectives. Prerequisite: FIN 560 and permission of instructor.

FIN 531 - ADVANCED CORPORATE FINANCE
Semester Hours: 3

Advanced corporate finance theories and their applications. Topics include long- and short-term financial planning, project valuation, capital structure policy, divident policy, mergers and acquisitions, and risk management.

FIN 554 - INTERNATIONAL FINANCE
Semester Hours: 3

An introduction to international finance for tomorrow's global business leaders, with a focus on the financial management dimensions of leading a multinational enterprise.

FIN 560 - INVESTMENTS
Semester Hours: 3

A study of standard investment securities, as well as an overall view of the investment decision process. Securities covered include equities, fixed income, options, futures, and mutual funds. Associated topics include financial markets, valuation models, and fundamental portfolio theory.

FIN 561 - PORTFOLIO MANAGEMENT
Semester Hours: 3

A continuation of FIN 560 with an emphasis on the application of investment portfolio management. An understanding of the functional areas of portfolio management is stressed, including investment policy, investment strategy, portfolio construction, performance evaluation, and portfolio protection. Prerequisite: FIN 560.

FIN 595 - INTERNSHIP IN FINANCE
Semester Hours: 1-3

With the supervision of a faculty advisor, the student serves as an intern in a position that enhances their disciplines educational goals. Subject to college's guidelines on internships.

FIN 601 - FINANCIAL DECISIONS UNDER UNCERTAINTY
Semester Hours: 3

Designed to introduce concepts and tools for financial decision-making in uncertain environments. Topics include financial statement analysis, time value of money, capital budgeting, cost of capital, and risk and return. Prerequisites: ACC 600 and ECN 600.

FIN 620 - SEMINAR IN BEHAVIORAL FINANCE
Semester Hours: 3

A study of the issues and anomalies related to the psychology of financial decision-making and the psychology of financial markets. The course content will consist of readings from the behavioral finance literature with an emphasis on student discussion.

FIN 650 - SELECTED RESEARCH TOPICS
Semester Hours: 3

Research in a particular topic in finance relevant to administrative science by one student or group of students. The research paper must be an original contribution showing a research design and results that meet the highest standards of social science research.

History (HY)

HY 501 - DAILY LIFE IN ANCIENT ROME
Semester Hours: 3

This course will re-create the daily lives of the ancient Romans using secondary readings, ancient literature, archaeology, and film. It focuses on the lives of ordinary people, with an eye to their struggles, everyday practices, beliefs, values and mentalities.

HY 510 - SPECIAL TOPICS PUBLIC HISTORY
Semester Hours: 3

Intensive examination of a particular problem, aspect, or methodology in public history.

HY 513 - THE OLD SOUTH
Semester Hours: 3

Southern society, economics, politics and culture concentrating on the nineteenth century South through Reconstruction.

HY 514 - THE NEW SOUTH
Semester Hours: 3

The post-Reconstruction South emphasizing the economic, social, and political readjustments made during the twentieth century.

HY 524 - THE ATLANTIC WORLD
Semester Hours: 3

Examines interactions across the Atlantic Ocean among Africans, Americans, and Europeans. This course meets the requirements for either American or non-American credit.

HY 526 - COLONIAL AMERICA
Semester Hours: 3

Explores the founding of New World colonies, including political, social, economic, and religious developments during the colonial period.

HY 527 - AGE OF AMERICAN REVOLUTI
Semester Hours: 3

Explores the multinational connections and conflicts that led some English colonists to revolt. Considers the political, social, and economic aspect of the time period.

HY 528 - EARLY AMERICAN REPUBLIC
Semester Hours: 3

Political, social and economic changes between the American Revolution and the nineteenth century that laid the foundation for the United States.

HY 529 - CIVIL WAR & RECONSTRUCTION
Semester Hours: 3

This course will examine the major historical events and modern historiographical interpretations of the Civil War and Reconstruction period in American history. Special focus will be given to the following themes: social, economic, military, political, constitutional, and intellectual.

HY 537 - THE RISE OF MODERN AMER
Semester Hours: 3

Economic and social changes, imperialism, and the growth of government in the United States from 1877 to the 1920s.

HY 538 - MODERN AMERICA
Semester Hours: 3

American society, politics, economics, and foreign affairs from the end of World War I to the origins of the Cold War.

HY 539 - RECENT AMERICAN HISTORY
Semester Hours: 3

Contemporary America from the 1950s to the present analyzing both domestic and foreign affairs.

HY 540 - FOREIGN REL U.S. SINCE 1920
Semester Hours: 3

The United States as a world power. American involvement in World War II, the Cold War, and in Asia, Latin America, and the Middle East.

HY 545 - COMPTVE MILITARY PLCY & STRAT
Semester Hours: 3

A comparative analysis of the military policy and strategy of states and empires in World History.

HY 572 - US MILITARY HISTORY SINCE 1920
Semester Hours: 3

The United States armed forces from 1920 to the present. The class will enhance understanding of the development and evolution of American strategy, doctrine, and operational issues.

HY 573 - US-LATIN AMERICAN RELATIONS
Semester Hours: 3

This class focuses on the history of political, economic, and cultural interactions between Latin America and the United States from 1800 to the present. Topics include military intervention, trade, cultural exchanges, the Cold War, the drug war, and immigration.

HY 574 - RENAISSANCE & REFORMATION
Semester Hours: 3

Selected topics in the Italian Renaissance and European Reformation.

HY 575 - SECTARIANISM ISLAMIC WORLD
Semester Hours: 3

This course focuses on sectarianism, the practice and rhetoric surrounding marginalization of certain social-religious groups in the Islamic world. It explores the historical foundations of sectarianism (from early 7th century to today) both within the Islamic world and across the globe.

HY 576 - BEING YOUNG MODERN MIDDLE EAST
Semester Hours: 3

This course focuses on the lives of young men and women of the Modern Middle East. It explores how children and youth experienced historical phenomena in the region, the ways in which these experiences affected the foundations of their adulthood, and how their actions shaped historical events.

HY 580 - ROMANS&BARBARIANS LATE ANTIQTY
Semester Hours: 3

This course explores the dynamic world of Late Antiquity including political developments, social and religious transformation, and exchange patterns in the Mediterranean. It is a history of cultural interaction, continuity, and change during a formative period in western civilization.

HY 581 - EMPIRES AND NATIONS
Semester Hours: 3

Thematic focus on empires and nations as political and cultural constructs in European and world history. Students may take HY581 more than once for credit ONLY IF 1) a different instructor teaches each offering, and 2) the temporal and/or geographic focus is distinct each time.

HY 582 - COMPARTVE SLAVERY & ABOLITION
Semester Hours: 3

Explore slavery around the world over time. Topics in the ancient world, Indian Ocean, Africa, the United States, and other locations from ancient times to the present.

HY 583 - GENDER & SEXUALITY IN LATIN AMERICA
Semester Hours: 3

Studies in history of women, gender and sexuality in Latin America from the colonial period to the present.

HY 584 - LATIN AMERICAN HY THROUGH FILM
Semester Hours: 3

HY 585 - NAZI GERMANY AND THE HOLOCAUST
Semester Hours: 3

Seminar course on the historiography of Nazi Germany and the Holocaust.

HY 586 - COMMUNISM &LEGACY IN RUS/E-EUR
Semester Hours: 3

Overview and analysis of communist states and post-communist legacies in Russia and Eastern Europe.

HY 590 - RESEARCH SEMINAR IN HY
Semester Hours: 3

Students will conduct primary source research, consult relevant secondary sources, and consider the historiography of their topic, and write a research paper. Students will present their research in class. MA students are required to complete HY590 or a thesis.

HY 592 - PUBLIC MEMORY & INTERP
Semester Hours: 3

Examines how public memory is created by looking at the social, political, and economic forces that shape public history and considers how historical knowledge is conveyed to the public.

HY 593 - FUNDAMENTALS OF ARCHIVES
Semester Hours: 3

Survey of basic archival theory and practice, with emphasis on the role of the archivist in contemporary society.

HY 594 - DEVELOPING DIGITAL ARCHIVES
Semester Hours: 3

Survey of the theory and practice of developing digital access tools in archives, libraries, and museums.

HY 595 - PUBLIC HISTORY INTERNSHIP
Semester Hours: 3

Students will participate in a semester-long public history internship and be responsible for completing a significant project using historical skills in a professional setting. Students must complete a minimum of 125 hours of work during their internship.

HY 598 - STUDIES IN HISTORY
Semester Hours: 1-3

A readings or research class on a particular problem, period or topic in history. This course may be repeated for credit.

HY 599 - INDEPENDENT STUDY
Semester Hours: 3

In exceptional circumstances, a student and professor may work together on a specialized topic.

HY 605 - RECENT INTERPRETA MOD HY
Semester Hours: 3

Development of the ability to appraise critical historical issues through study and discussion of recent interpretations of key historical problems in modern western history. Required for history graduate students. Fall only.

HY 614 - STUDIES IN SOUTHERN HY
Semester Hours: 3

Research, writing, and critical examination of selected topics in nineteenth- and twentieth-century southern history.

HY 618 - STUDIES EARLY AMER HY
Semester Hours: 3

Research, writing, and critical examination of selected topics in early American history from 1607-1800.

HY 619 - STUDIES 19TH CENT AM HY
Semester Hours: 3

Research, writing, and critical examination of selected topics in nineteenth-century American history.

HY 620 - STUDIES 20TH CENT AM HY
Semester Hours: 3

Research, writing, and critical examination of selected topics in twentieth-century American history.

HY 645 - READINGS AMERICAN MILITARY HY
Semester Hours: 3

Thematic course that will use readings and discussions to examine key historiographical issues in American military history from the colonial period to the present.

HY 650 - RESEARCH METHODS IN HY
Semester Hours: 3

Exploration of contemporary research methods such as archival research, paleography, quantitative methods, and state/local research techniques.

HY 680 - STUDIES/EARLY MOD EUROPE
Semester Hours: 3

Research, writing, and critical examination of selected topics in the field of early modern European history.

HY 685 - HISTORY OF SCIENCE
Semester Hours: 3

Research, writing and critical examination of selected topics in the history of science.

HY 686 - READING ANCIENT ROME HY
Semester Hours: 3

This seminar introduces the main historiographical debates in the study of ancient Rome, from the Republic to Late Antiquity. It covers the following topics: Roman institutions, politics, and strategy; Society and daily life; religious revolution and the integration of barbarians.

HY 687 - STUDIES MIDDLE EAST HISTORY
Semester Hours: 3

Research, writing, and critical examination of selected topics in modern Middle East history (late 1800s-present).

HY 690 - STUDIES IN MODERN EUROPE
Semester Hours: 3

Research, writing, and critical examination of selected topics in the field of modern European history.

HY 695 - STUDIES IN WORLD HISTORY
Semester Hours: 3

Research, writing and critical examination of selected topics in the study and teaching of world history.

HY 696 - SPECIAL TOPICS IN HISTORY
Semester Hours: 3

A readings or research class on a particular problem, period, region or topic in history. This course may be repeated for credit.

HY 698 - INDEPENDENT RESEARCH PROJECT
Semester Hours: 3

Supervised individual research project.

HY 699 - MASTER'S THESIS
Semester Hours: 1-3

Required each semester a student is working and receiving direction on a master's thesis. A minimum of two terms is required but no more than six hours credit is allowed for the thesis.

Industrial & Systems Engineering (ISE)

ISE 502 - INDUSTRIAL & ORGANIZA PSY
Semester Hours: 3

Application of basic principles of learning, motivation, and perception to typical industrial and organizational problems.

ISE 503 - HUMAN FACTORS PSYCHOLOGY
Semester Hours: 3

Study of human performance in human-technology-environment systems. Consideration of human capabilities and limitations as related to controls and displays, and the role of human cognition in decision-making and training effectiveness.

ISE 521 - IMPROVING HEALTHCARE SYSTEMS
Semester Hours: 3

Overview of healthcare systems with emphasis on departments, functions, and improving operational performance. Lean concepts and techniques are introduced as they specifically apply in a healthcare environment. Topics include workplace organization, patient and material flow, pull systems, value stream mapping, problem solving, and root cause analysis. Hands on simulations will be utilized.

ISE 522 - HEALTHCARE SYSTEMS ENGINEERING
Semester Hours: 3

This course introduces students to systematic and quantitative analysis of healthcare systems. The purpose of this class is to increase the student's understanding of how to apply proven industrial and systems engineering methods to healthcare related problems. Potential topics include: healthcare financing, health analytics, six sigma as they relate to healthcare, reliability and patient safety, capacity management, and healthcare logistics.

ISE 523 - INTR STATISTICAL QUALITY CONTR
Semester Hours: 3

This course introduces statistical theory and techniques to control quality of manufacturing products. This course will provide a solid foundation in Statistical Quality Control (SQC). The Six Sigma methodology is also introduced in this course. Students can take the certification exam to earn a Green Belt in Six Sigma. Prerequisites: ISE 690.

ISE 526 - DESIGN/ANALY OF EXPERIMENT
Semester Hours: 3

Advanced topics in statistical experiments with emphasis on design aspect. Confounding, fractional replication, factorial and nested design.

ISE 530 - MANUF SYS & FACILITIES DESIGN
Semester Hours: 3

Overview of modern manufacturing systems design with emphasis on facility location and plant layout. Includes classical systems, just-in-time systems, basic principles of integrated manufacturing systems design, as well as analysis of process flow, process productivity, and available space to determine plant layout. Includes laboratory exercises.

ISE 533 - PRODUCTION/INVENTORY CONTR SYS
Semester Hours: 3

Inventory models including classical optimal economic order quantity models, manufacturing resource planning (MRP) systems, master production scheduling, material requirements planning, and purchase order control. Emphasis on manufacturing system revision, continuous process improvement, and the implementation of lean principles. Prerequisite: ISE 690.

ISE 539 - SELECTED TOPICS/ISE
Semester Hours: 1-3

ISE 547 - INTRO TO SYSTEMS SIMULATION
Semester Hours: 3

Philosophy and elements of digital discrete-event simulation. Emphasis on modeling and analysis of stochastic systems, including probabilistic models, output analysis, and use of simulation software. Prerequisite: ISE 690.

ISE 580 - SYSTEMS ENGINEERING MODELING
Semester Hours: 3

The main goal of this course is to teach the student Model Based Systems Engineering (MBSE) fundamentals with application to real-world systems engineering problems. Students will learn (1) core systems engineering concepts and processes; (2) System Modeling Language (SysML) fundamentals and its use to develop and execute system models on a SysML based tool and (3) Architecture and physical model execution, simulation and integration.

ISE 623 - ENGR ECON ANALYSIS
Semester Hours: 3

This course is designed for graduate students in industrial engineering, systems engineering and engineering management. This course involves mathematical models for expenditure analysis under uncertainty; investment decision criteria; capital planning and budgeting; and decisions involving expansion, acquisitions, replacement, and disinvestment. Prerequisite: ISE 690.

ISE 626 - INTRO OPERATIONS RESEARCH
Semester Hours: 3

Philosophy and methodology of operations research. Includes linear programming, game theory, sequencing, and networks.

ISE 627 - ENGINEERING SYSTEMS
Semester Hours: 3

Development of a systems-scientific framework for the integration of systems theory, systems thinking, systems engineering, and systems management. Emphasis is on the conception, design, and management of systems to accommodate complex environments.

ISE 629 - OPTIMIZ AEROSPACE SYST DSGN
Semester Hours: 3

in this project course, students will learn to model an aerospace system they aer designing and optimize the system using the model. Linear, nonlinear, and discrete optimization are addressed. This course is targeted to students in systems engineering and aerospace systems engineering. Prerequisite with concurrency: ISE 627.

ISE 638 - ENGINEERING RELIABILITY
Semester Hours: 3

Methodology of reliability prediction including application of discrete and continuous distribution models. Reliability estimation, reliability logic diagrams, life testing, and reliability demonstrations.

ISE 639 - SELECTED TOPICS/ISE
Semester Hours: 1-6

ISE 641 - ADVANCED QUALITY CONTROL
Semester Hours: 3

This capstone course uses advanced statistical quality tools such as autocorrelated data, multi-variate quality controls charts, response surface methodology, ridge analysis, and evolutionary operations (EVOP). Advanced Six Sigma concepts will be taught and students will have the opportunity to earn a Black Belt in Six Sigma upon successful completion of the certification exam and an acceptable project.

ISE 690 - STATISTICAL METHODS FOR ENGR
Semester Hours: 3

Application of statistics for estimation and inference using parametric and nonparametric methods. Descriptive statistics, sampling distributions, point and interval estimates, tests of hypotheses, ANOVA, and linear regression.

ISE 696 - GRAD INTERN ISE ENGR
Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization, or government agency that has particular interest and relevance to the graduate student. Permission of ISE faculty member required.

ISE 697 - INDUS & SYSTEMS ENGR PROJECT I
Semester Hours: 3-9

Application oriented student project designed to show competence in Industrial and Systems Engineering.

ISE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours of credit is awarded upon successful completion of master's thesis. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

ISE 726 - SYSTEMS MODELING
Semester Hours: 3

The capstone course for the operations research option studies the philosophy and methodology for modeling probabilistic systems. Includes Markov processes, queueing theory, and inventory theory. Team project required. Prerequisite: ISE 690 and (ISE 626 or ISE 627).

ISE 734 - DECISION ANALYSIS
Semester Hours: 3

Decision making for systems engineering and engineering management, with an emphasis on applications to complex systems. Builds a rigorous foundation in decision making under uncertainty using expected utility theory. Topics include decision trees, value models, predictive models, preferences and bias. Prerequisite: ISE 690.

ISE 739 - SELECTED TOPICS/ISE
Semester Hours: 1-6

ISE 761 - EVOL THRY ENG MGMT/IND SYS ENG
Semester Hours: 3

Development of applicable engineering management or industrial and systems engineering theory using classical concepts, contemporary studies and practices at successful technology-based organizations.

ISE 790 - ADV STATISTICAL APPLICATIONS
Semester Hours: 3

Continuation of ISE 690 with extension to regression models and nonparametric methods. Prerequisite: ISE 690.

ISE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is working and receiving direction on a doctoral dissertation. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

Information Systems (IS)

IS 501 - CYBERSECURITY PRINCIPLES
Semester Hours: 3

This course is designed to provide a general overview of the concepts of information security to students, both from a management and a technology perspective. Students will be introduced to the complexity of the security issues facing today's networked organizations. Practices and standards will be presented to assess and plan for risks and the security needs to minimize the risks both technically and managerially. The integration of security concerns within the entire organizational planning and implementation processes and practices will be explored.

IS 512 - SYSTEMS ANALYSIS & DESIGN
Semester Hours: 3

Identifying, analyzing, developing and acquiring information systems are central to the information systems discipline. The course has to do with identifying, conceptualizing and analyzing business opportunities where information systems applications can add value followed by design, development, and implementation of such applications. Planning for and management of this core IS activity is a critical organizational competence. Prerequisites: IS 601.

IS 520 - WEB PORTALS & APPLICATIONS
Semester Hours: 3

This course bridges the boundary between consumer of Web applications and the ability of enterprises to derive value from web technologies and platforms by developing portals that integrate disparate organizational silos and databases. The course explores concepts in digital content and communication, technology infrastructure and social media. Utilization of SAP tools to develop an enterprise portal front end to organizations' back-end business systems.

IS 522 - SUPPLY CHAIN MANAGEMENT SYSTEMS
Semester Hours: 3

This course presents the main concepts of supply chain management systems and software including ERP, CRM, and SCM systems as well as the underlying technologies and managerial implications. It provides hands-on familiarity with SAP supply chain modules. Cross listed with IS 422. Prerequisite: Basic knowledge of information systems.

IS 540 - WEB PROGRAMMING AND DATABASE INTEGRATION
Semester Hours: 3

Prerequisite: IS 520.

IS 550 - CYBERSECURITY MANAGEMENT
Semester Hours: 3

Examines the management issues associated with the control and audit of information systems. Specific emphasis is on IT controls and their evaluation, computer-based auditing techniques, encryption, and security policies. Recent developments in IT, such as client-server systems and the internet and their impact on auditing control, and security, are also considered.

IS 560 - NETWORKING & IT INFRASTRUCTURE
Semester Hours: 3

An overview of the IT infrastructure in modern organizations. The course starts from basic networking concepts to digital platforms and ecosystems in the market.

IS 571 - BUSINESS ANALYTICS & AI
Semester Hours: 3

The course covers the use of data analytics to support decision-making in organizations and gain insights to support tactics and strategy. In addition to analytics, students will also be introduced to Artificial Intelligence (AI) techniques for analytics. Students will use many business analytics tools and gain experience in mining data. The course is designed to develop data-analytic thinking in the era of big data. Prerequisite: Basic skills in computer programming.

IS 577 - NETWORK DEFENSE & SECURITY
Semester Hours: 3

Provides an introduction to the area of network security. Addresses security issues and practical applications related to Network Address Translation, packet filtering, proxy servers and firewalls, and Virtual Private Networks. This course assumes familiarity with the internet and basic networking concepts such as TCP/IP, gateways, routers, and Ethernet. Prerequisites: IS 560.

IS 580 - SEMINAR IN MANAGEMENT INFORMATION SYSTEMS
Semester Hours: 3

Selected topics in Management Information Systems. Topics will reflect the contemporary issues and current technological advancements which impact the development, implementation and management of effective information systems in organizations.

IS 595 - INTERNSHIP IN INFORMATION SYSTEMS
Semester Hours: 1-3

Under the direction of a faculty advisor, student gains experience with information systems and technology professionals in industry.

IS 600 - INFORMATION SYSTEMS MANAGEMENT
Semester Hours: 3

Develops an understanding of how information technology (IT) can enable organizations to conduct business more effectively in a rapidly changing business environment. Includes strategies to manage and leverage the organization's IT capabilities to deploy digital business models and maintain efficient and profitable business operations. Students will use systems and business process thinking to create and analyze strategies for technology enabled organizational transformation. Students will also use enterprise systems like SAP and other technologies as part of the course to understand their integrative capabilities to meet the information needs of an organization.

IS 601 - MANAGEMENT OF INFORMATION TECHNOLOGY
Semester Hours: 3

This course is designed to provide an understanding of how information technology (IT) can enable organizations to conduct business more effectively in a rapidly changing business environment and to leverage the organization's IT capabilities to maintain efficient and profitable business operations.

IS 640 - DATA MANAGEMENT AND DATA MINING
Semester Hours: 3

Explores the theories, features, and capabilities of relational database management systems in a business environment. Examines how to read and interpret database design documents and how to query database driven business applications. Emphasizes the use of database management systems and data mining tools in real-world business settings and how these technologies can be applied effectively to solve business problems.

IS 650 - SELECTED RESEARCH TOPICS
Semester Hours: 3

Research in a particular topic relevant to management information systems by one student or a group of students. Each student's research paper must be an original contribution showing a research design and results that meet the highest standard of management information systems research.

IS 660 - CYBERSECURITY MANAGEMENT
Semester Hours: 3

Examines the management issues associated with the control and audit of information systems. Specific emphasis is on IT controls and their evaluation, computer-based auditing techniques, encryption, and security policies. Recent developments in IT, such as client-server systems and the internet and their impact on auditing control, and security, are also considered.

IS 663 - COMPUTER FORENSICS
Semester Hours: 3

This course covers most of the important topics in computer forensics. It examines the problems and concerns related to computer investigations. It introduces systematical problem-solving techniques and applies them to computing investigations. It implements a variety of computer forensic tools in real-life scenarios.

IS 670 - BUSINESS CONTINGENCY PLANNING
Semester Hours: 3

Introduces the theories and concepts of business contingency planning through risk analysis and disaster recovery planning. This course is designed to provide a greater understanding of the assessment and management of risk and disaster recovery within the organization. The course will emphasize the nature of risk, risk assessment, risk management, and disaster recovery and how these concepts can be addressed effectively through business contingency planning. Prerequisite: IS 601.

IS 680 - ENTERPRISE RESOURCE PLANNING SYSTEMS
Semester Hours: 3

This course examines the concepts, design, configuration and implementation of enterprise resource planning (ERP) systems with a view to integrate all aspects of an organization into one information system. Specific attention is given as to how ERP systems facilitate the flow of information supporting core business processes and the organization's supply chain. The course will emphasize the SAP configuration and strategic use of ERP systems to support the organizational structures and business processes of the particular company to efficiently and effectively manage a firm's business. Extensive use of SAP software is made in illustrating the configuration, implementation, and use of ERP systems in business and governmental organizations. Prerequisite: IS 601.

IS 691 - INFORMATION SYSTEMS STRATEGY & APPLICATIONS
Semester Hours: 3

This capstone course emphasizes the integration of various principles, theories, and techniques for developing, implementing and using information systems strategies and applications in organizations. It aims at providing a holistic view of Information Systems and Technology (IS/T)function in an organization with a view to serve an organization's mission and strategy throughout the value and supply chain. These skills will be placed in the context of business processes where they will be applied. Thus, in this course we will explore ways and means to help executives and managers make better decisions in the manufacturing and service sectors through a strategic use of IS/T. Normally taken during student's last semester. Must be completed with a grade of B or better. Prerequisites (with concurrency): IS 512, IS 560, IS 571, IS 640, and IS 680.

IS 692 - CYBERSECURITY PRACTICUM
Semester Hours: 3

A capstone course emphasizing the integration of various principles, theories, and techniques for developing, implementing and using cybersecurity tools and strategies and applications in organizations. Includes readings, lectures, situation analysis, cases, and the completion of a major practical project. Must be completed with a grade of B or better. Prerequisites: (IS 501 or CS 585 or CPE 549) , (IS 550 or IS 660), and IS 663.

IS 699 - MASTER'S THESIS
Semester Hours: 3

Required each semester a student is working and receiving direction on a masters thesis. A minimum of two terms is required but no more than six hours credit is allowed for the thesis. Credit awarded upon successful completion of thesis.

Kinesiology (KIN)

KIN 510 - RESEARCH METHODS IN KINESIOLOGY
Semester Hours: 3

This course establishes an understanding of key principles related to kinesiology-related research and methodology. Key principles will be to address applicable research techniques and designs while emphasizing the planning and preparation necessary for conducting and reporting kinesiological research.

KIN 515 - MASTER SEMINAR IN KINESIOLOGY
Semester Hours: 3

This course will provide a format for the further understanding of pertinent, valuable, and meaningful research in the field of kinesiology and human performance assessment. Students will also be prepared for the professional certifications associated with their field of study.

KIN 518 - ADVANCED HUMAN PERFORMANCE AND TESTING
Semester Hours: 3

This course will provide students with advanced knowledge in the field of human performance training and evaluation through classroom lectures and laboratory/field experiences. Topics include developing and testing in strength, speed, power, agility, endurance, stability, and flexibility.

KIN 519 - EXERCISE AND SPORT BIOMECHANICS
Semester Hours: 3

This course is designed to expose students to an understanding of biomechanics in human performance. Biomechanics is the study of forces and their effects on living systems. Sport and exercise biomechanics is specifically the study of forces and their effects on humans in sport and exercise.

KIN 520 - LABORATORY TECHNIQUES FOR SPORTS SCIENCE
Semester Hours: 3

This course expands on the prerequisite knowledge of basic biomechanics and neuromuscular control and apply it to investigate human movements and characteristics. Topics covered include: kinematics, kinetics, electromyography, isokinetics, physiological, and body composition testing.

KIN 527 - ADVANCED EXERCISE PHYSIOLOGY
Semester Hours: 3

A more in-depth review of exercise physiology, with a particular focus on musculoskeletal performance, metabolic demands, and cardiovascular function. Students should have successfully completed an undergraduate course in exercise physiology or obtain permission of the instructor prior to taking the course for credit.

KIN 540 - SCHOOL AND COMMUNITY HEALTH
Semester Hours: 3

Obtain information and skills related to school and community health programs with an emphasis on health instruction, strategies, and resources. Survey the components of a school health program: school health services, healthful school environment, principles of physical and movement education, nutrition services, counseling and social services, parent/community involvement, health promotion for staff. Examine the core functions of public health, prevention of diseases and injuries, health needs of special populations, and functions of various organizations.

KIN 564 - HEALTH AND PE FOR THE ELEMENTARY TEACHER
Semester Hours: 2

The purpose of this course is to help the future elementary classroom teacher learn to appreciate, plan, organize and conduct (if called upon to do so) a quality physical education program for children in grades pre-K-5. The pre-service teacher (PT) will be provided background knowledge about physical education content, skill themes and movement concepts, how to teach skill themes and movement concepts, and fitness concepts.

KIN 570 - ADAPTED PHYSICAL EDUCATION
Semester Hours: 3

Develop knowledge of current concepts and trends in adapted physical education as well as the ability to plan and implement a physical education program designed to meet the unique needs of individuals. Students will understand how to design and implement an Individualized Educational Program for use in an activity-based setting.

KIN 621 - INSTRUCTIONAL APPROACHES TO SPORT PEDAGOGY
Semester Hours: 3

This class is designed to expand and enrich the teaching repertoire. Special emphasis will be given to how selected models of teaching can be used to achieve multiple outcomes of teaching in physical education and other contexts (e.g., physical activity programs & youth sport). Additionally, the course will increase awareness in other instructional areas related to the profession (teaching undersevered youth, youth sports programs, etc.,) Prerequisite: ED 501.

KIN 630 - SPORTS SCIENCE PRACTICUM I
Semester Hours: 3

This course is the first of a two-semester placement with a sports team/program affiliated with UAH Kinesiology. The student will operate/assist the team's Sport Scientist and report to coaches, training staff, and athletes. The course includes monthly seminars with a faculty member. Prerequisites: KIN 510, KIN 518.

KIN 631 - SPORTS SCIENCE PRACTICUM II
Semester Hours: 3

This course is the second of a two-semester placement with a sports team/program affiliated with UAH Kinesiology. The student will operate as/assist the team's Sport Scientist and report to coaches, training staff, and athletes. The course includes monthly seminars with a faculty member. Prerequisites: KIN 510, KIN 518.

KIN 655 - MOTOR LEARNING AND DEVELOPMENT
Semester Hours: 3

Study the principles and practices that affect the learning and development of motor skills; theories of motor learning, motor control, and development; lifespan motor development perspective related to performing motor and sport skills; and professional applications of motor learning and development in exercise science, athletic training and physical education.

KIN 662 - ELEMENTARY PHYSICAL EDUCATION METHODS
Semester Hours: 3

Physical education teacher certification will acquire the ability to understand, recognize, analyze and demonstrate the range of teaching skills employed by successful physical educators in the preschool and elementary setting. Emphasis is placed on understanding the theoretical implications of different teaching skills and the contexts in which they are effective. Teacher candidates will design lessons that allow for maximum student participation while remaining aligned with Alabama Consent Standards. Field experience is required. Candidates will observe, participate in, and teach lessons in physical education classrooms.

KIN 665 - METHODS OF TEACHING PHYSICAL EDUCATION IN SECONDARY SCHOOLS
Semester Hours: 3

Physical education teacher candidates will acquire the ability to understand, recognize, analyze, and demonstrate the range of teaching skills employed by successful educators in the secondary setting. Teacher candidates will design lessons that allow for maximum student participation while remaining aligned with Alabama Consent Standards Field Experience is required. Candidates will observe, participate in, and teach lesson in physical education classrooms.

KIN 699 - SPORTS SCIENCE MASTER'S THESIS
Semester Hours: 3

Thesis credit hours are required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours requires for MSK students. A maximum of 9 hours of credit is awarded upon successful completion of a master's thesis. Requires thesis advisor permission.

Management (MGT)

MGT 501 - INTRODUCTION TO CONTRACT MANAGEMENT
Semester Hours: 3

General survey in contracting basics, covering procedures as described by Federal Acquisition Regulations, statutes, ethics, policies, and other pertinent authorities.

MGT 502 - CONTRACT EVALUATION & AWARD
Semester Hours: 3

This course introduces the student to topics related to the evaluation, award and post award portions of the contracting process. Elements of evaluation related to competitive acquisitions and past performance evaluation are reviewed. Steps related to the proposal receipt process such as contractor responsibility, debarred/suspended, and certificate of competency are covered. The award process is also covered by a discussion offeror, and preparation of award. Post award topics such as contract administration functions, contract closeout, contract modifications, remedies, claims, disputes and request for equitable adjustments are covered. Prerequisite: MGT 501.

MGT 503 - CONTRACT PRICING & COST ANALYSIS
Semester Hours: 3

Techniques for cost estimating, cost analysis, and price analysis. Sources of data, statutory requirements, rates, factors, and definitions, projection methods, factors affecting profit or fee, weighted guidelines technique, application of statistical analysis including regression analysis, and learning curve theory. Prerequisite: MGT 501 or ACC 540.

MGT 505 - NEW VENTURES STRATEGIES
Semester Hours: 3

Theory and application of both marketing and management strategies for start-up, operation and control of new ventures. The course also discusses the role of entrepreneurship in the economy.

MGT 508 - TEAMWORK & TEAM PROCESSES
Semester Hours: 3

This course provides an introduction to teams and teamwork processes. The foundation of the course is research-based; topics will be approached from the context of empirical research that has been conducted. The types of research designs that are typically used in team research are addressed. There are hands-on activities, so that students can put the theoretical material into context and into practice. This course is ideal for students who plan to work in business settings or in team-oriented fields (e.g., engineering, the military) or become involved in human resources or team training.

MGT 550 - INTERNATIONAL BUSINESS
Semester Hours: 3

This course combines theoretical and practical aspects of doing business in the global market. It addresses the complex environment of international business and the need to investigate its various economic, social, political, cultural, and legal dimensions from conceptual, methodological and applications perspectives. It then considers how these environmental factors would affect, and can be integrated into, business programs and strategies.

MGT 560 - EMPLOYEE STAFFING & DEVELOPMENT
Semester Hours: 3

Study of the fundamental concepts, issues and tools of employee staffing and development. Topics include forecasting staffing needs, recruitment strategies, development and validation of selection procedures, placement, socialization, and development of employees, and the utilization of contingent workers.

MGT 561 - STRATEGIC COMPENSATION MANAGEMENT
Semester Hours: 3

Introduction to the management of employees compensation. Provides an overview of compensation practices, behavioral and economic theories of compensation, and research on compensation programs.

MGT 562 - EMPLOYMENT LAW FOR MANAGERS
Semester Hours: 3

Analysis of the impact of government regulation on the management of human resources. Examines the implications for employer responsibilities and employee rights of evolving public policies pertaining to separations, discrimination, compensation, occupational safety and health, privacy, union-management relations, and other terms of employment.

MGT 570 - SPECIAL TOPICS SEMINAR IN MANAGEMENT OF TECHNOLOGY
Semester Hours: 3

In depth study of a selected special topic relevant to the management of technology. Different sections of this course may address different topics.

MGT 595 - INTERNSHIP IN MANAGEMENT
Semester Hours: 1-3

Under the direction of a faculty advisor, student gains experience with an entrepreneur in a small business firm or a manager in a large firm.

MGT 600 - ORGANIZATIONAL THEORY, BEHAVIOR, & ENVIRONMENT
Semester Hours: 3

Provides the conceptual tools to analyze the behavioral and organizational influences on systematic outputs such as quality, profitability, and employee well-being. Focuses both on macro-level issues (e.g. organizational design, culture, power and politics, and strategic leadership) and on micro-level issues (e.g. motivation, decision-making, socialization, and diversity). Covers these topics in the broader social, legal, regulatory, environmental, and ethical context.

MGT 601 - TECHNOLOGY & INNOVATION MANAGEMENT
Semester Hours: 3

This course covers the principles, theories, and practices to enhance an organization's competitive position through the management of technology and innovation. Topics include the environmental and industry drivers of technological change, organizational issues in the adoption of new technologies, innovation and disruption, development of technical core competencies, and leadership challenges posed by innovation and change. It includes readings, lectures, cases, and the completion of a major research/practical project.

MGT 622 - MANAGING HUMAN CAPITAL
Semester Hours: 3

An organization's people are one of the most important resources that affect organizational performance. This course examines techniques to manage a firm's human capital resources. Topics include organizational culture, incentive systems, employee motivation, team decision-making, job design, evaluating performance, information systems for managers, employment law, selection, managing innovation, and career development.

MGT 629 - LEADERSHIP: THEORY & PRACTICE
Semester Hours: 3

The course explores what is known about leadership with particular emphasis on those attributes and skills that allow leaders to be effective in a variety of organizational situations. The theories of leadership are explored in a framework that includes the relationship of the leader to followers and situations. Frequent appearances by guest speakers who are themselves leaders provide the critical linkage to real world practice and allow for student interaction.

MGT 631 - HUMAN RESOURCE MANAGEMENT & ORGANIZATIONAL BEHAVIOR
Semester Hours: 3

The major functions of human resource management are reviewed, including performance management, employment law, staffing, HR planning, compensation, labor relations, and training. Behavioral management topics include motivation, leadership, communication, managing conflict, and managing teams.

MGT 640 - PRINCIPLES OF PROJECT MANAGEMENT
Semester Hours: 3

Conceptual foundation and organization of project management. The project life cycle, planning, control, marketing, utilization of human resources, and financial management.

MGT 650 - SELECTED RESEARCH TOPICS
Semester Hours: 3

Research in a particular topic relevant to a business discipline by one student or a group of students. The research paper must be an original contribution showing a research design and results that meet the highest standards of social science research. Permission of instructor required.

MGT 690 - SEMINAR IN TECHNOLOGY MANAGEMENT
Semester Hours: 3

Practical management of technology methods and techniques from current research and successful industrial practice. Examines the state of the art in industrial new product development management. Lectures, cases, readings, and an emphasis on student discussions, presentations and interactions. The course has a strong research orientation while at the same time focusing on management policies and principles.

MGT 693 - SUPPLY CHAIN STRATEGY & PRACTICE
Semester Hours: 3

This integrative course discusses the strategic role of supply chain management in organizations and develops a working knowledge of the process of formulating and implementing supply chain strategies to gain competitive advantage in a global environment. Topics covered include the linkage of supply chain strategies with corporate strategy, customer relationship and supplier relationship strategies, outsourcing strategies and related infrastructure needs to implement supply chain strategies. A team based practicum project helps students apply concepts and methods to real world problems. Prerequisites: MGT 611, ACC 600 and MSC 605. Normally taken the last semester of the program. Must be completed with a grade B or higher.

MGT 694 - MANAGEMENT PRACTICUM
Semester Hours: 3

This course will serve as the capstone for the M.S. in Management degree. Students will work with faculty on either a research or consulting project which will allow the student to explore an area of interest in greater depth or gain additional experience by applying the concepts they have learned in the degree program to a real world challenge faced by an organization. Prerequisites: Completion (or concurrent enrollment in) all other required courses. Normally taken during the last semester of the program. Must be completed with a B grade or higher.

MGT 695 - STRATEGIC HUMAN RESOURCE MANAGEMENT
Semester Hours: 3

This course will serve as the capstone for the M.S. in Management degree. This integrative course discusses the strategic role of human resources in organizations and teaches students how to formulate and implement HR strategies to gain competitive advantage. Topics covered include strategic management, labor relations, global HRM, social responsibility and HRM, and evidence-based HRM. A team based project helps students apply concepts and methods to real world problems. Normally taken during the last semester of the program. Must be completed with a B grade or higher.

MGT 698 - STRATEGIC MANAGEMENT
Semester Hours: 3

Administrative decision-making with emphasis on analyzing a complex business situation, evaluating historical trends, current operational conditions, and environmental settings, in order to establish a unifying strategy; implementation of integrated functional policies; and a plan of action to achieve established objectives. Normally taken during the last semester of a student's program. Prerequisites: ACC 602, ECN 626, FIN 601, and MSC 600.

MGT 699 - MASTER`S THESIS
Semester Hours: 1-3

Required each semester that student is working and receiving direction on a masters thesis. A maximum of 6 hours credit may be applied toward degree.

MGT 770 - ORGANIZATIONAL RESEARCH METHODS
Semester Hours: 3

Theory and practice of research methodology for study of administrative, industrial, and consumer behavior and organizations; questionnaire, field, and laboratory experimentation and statistical analysis of pre-gathered time-series and cross-sectional data; and examples of good and poor research in business disciplines. A completed project of potentially publishable nature is formally presented in class.

Management Science (MSC)

MSC 500 - DECISION SUPPORT SYSTEMS/EXPERT SYSTEMS
Semester Hours: 3

Analysis of information support systems which aid the manager in the decision-making process.

MSC 510 - LOGISTICS MANAGEMENT
Semester Hours: 3

An analysis of transportation and logistical services to include customer service, distribution operations, purchasing, order processing, facility design and operations, carrier selection, vehicle routing, and transportation costs. Understanding of business statistics is required. Prerequisite: MSC 600 or equivalent.

MSC 512 - ARMY SENIOR LOGISTICIAN-ADVANCED
Semester Hours: 3

The Senior Logistician Advanced Course (SLAC) is part of the U.S. Army's Master Logistician Certificate Program for logistics management specialists within the 0346 occupational series. SLAC is an 80-hour academic learning experience designed to improve senior logistician competencies at the strategic level. The program is organized around the logistics management specialist's 12 competencies, and the coursework is specially designed to better develop and further enrich the thinking and skills of the Army's Senior Logisticians. Special approval and enrollment in CPCS U.S. Army Senior Logistician Advanced Course required.

MSC 550 - INTRODUCTION TO ANALYTICS AND PROGRAMMING
Semester Hours: 3

This course will have an overview on business analytics. Students will learn tools commonly used in business analytics such as R and Python. This is a prerequisite for several business analytics courses.

MSC 569 - VISUALIZATION FOR LEADERSHIP
Semester Hours: 3

In depth study of visualization theory and applications, including Tableau, Python data visualization modules, and data visualizations in R. This course will emphasize communication skills and techniques for effective technical and leadership. Prerequisite: IS 571 with concurrency.

MSC 570 - SPECIAL TOPICS IN MANAGEMENT SCIENCE
Semester Hours: 3

In depth study of a selected topic relevant to contemporary management science. Different sections of this course may address different topics.

MSC 595 - INTERNSHIP IN MANAGEMENT SCIENCE
Semester Hours: 1-3

Active involvement in a project in a business enterprise, professional organization or government agency that has particular interest and relevance to the student.

MSC 600 - QUANTITATIVE METHODS
Semester Hours: 3

An introduction to and application of several fundamental quantitative methods and business analytics tools in business. Topics include probability distributions, sampling distributions, confidence interval estimation, hypothesis testing, ANOVA, linear regression, linear optimization, and simulation. Basic proficiency in Excel is required.

MSC 605 - OPERATIONS MANAGEMENT
Semester Hours: 3

This course discusses the management of the operations function for the creation of goods and services and its relationship with other business functions in service, manufacturing, and government organizations. Topics include operations strategy and infrastructure decisions, merging process technologies, planning and scheduling, inventory management, just-in-time systems, quality management, six sigma and lean operations. Concepts are illustrated using the SAP software. Prerequisite: MSC 600.

MSC 610 - MODELING & SIMULATION
Semester Hours: 3

Broad-based introductory survey of modeling and simulation intended to provide an overview that exposes those who will be using modeling and simulation to the full range of the discipline. Surveyed items include identification, categorization, and comparison of modeling methods, applications, architectures, and environments. Also covered are appropriate applications for different simulation paradigms, and relative advantages and disadvantages of each. Model testing and validation approaches, distributed simulation, graphics and visualization, and other topics are introduced. Case studies are discussed. Prerequisite: MSC 600.

MSC 611 - SUPPLY CHAIN MANAGEMENT
Semester Hours: 3

Supply chain management focuses on networks of companies that deliver value to customers. The course focuses on understanding integrated supply chains and examines how product development and design, demand, marketing, globalization, customer locations, distribution networks, suppliers and ERP systems impact a company's supply chain design. Prerequisite: MSC 600 with concurrency.

MSC 615 - DECISION MODELING
Semester Hours: 3

This course focuses on tools and methods for modeling, analyzing and solving problems involving business decision-making. Spreadsheet analysis, optimization, and simulation techniques will be covered. Topics include linear and nonlinear optimization, network models, decision analysis and simulation of complex models in a spreadsheet environment as well as using other commercial software packages. Proficiency in Excel is required. Prerequisite: MSC 600.

MSC 622 - ANALYTICS FOR MANAGERS
Semester Hours: 3

Data has quickly become one of the most important corporate assets for many firms and should be leveraged to gain a competitive advantage. This course will teach managers to leverage data using statistical techniques including predictive modeling to improve data-driven decision-making. Prerequisite: MSC 600.

MSC 641 - ADVANCED ANALYTICS
Semester Hours: 3

This course focuses on concepts and methods in business analytics. Topics include data quality and cleaning, predictive modeling, design of experiments, segmentation, forecasting, usage and limitations of models, and interpretation and presentation of results. This course provides a hands-on environment using real data to prepare students to apply these techniques in business environments. Proficiency in Excel is required. Prerequisite: MSC 550 and MSC 600 or equivalent.

MSC 650 - SELECTED RESEARCH TOPICS
Semester Hours: 3

Research in a particular topic relevant to management science by one student or a group of students. Each student's research paper must be an original contribution showing a research design and results that meet the highest standard of management science research.

MSC 690 - MANAGING TECHNOLOGY DEVELOPMENT
Semester Hours: 3

MSC 692 - BUSINESS ANALYTICS PRACTICUM
Semester Hours: 3

A capstone course with an emphasis on rigorously interpreting the results of analytic models and intuitively communicating the derived business insights to business clients and corporate executives. The majority of this course is devoted to a major practical project in which students apply skills learned from previous analytics courses to a real world business problem, preferably in cooperation with a local organization. Prerequisite: Completion (or concurrent enrollment in) all other required courses. Normally taken during the student's last semester of studies.

MSC 693 - SUPPLY CHAIN STRATEGY
Semester Hours: 3

In this integrative capstone course, we investigate the strategic role of supply chain management in organizations and develop a working knowledge of how to formulate and implement supply chain strategies to gain competitive advantage in a global environment. This course will build upon the study of strategies and capabilities from MGT 611. Prerequisites: MSC 611 or MGT 611 with concurrency.

MSC 699 - MASTER'S THESIS
Semester Hours: 1-3

Required each semester a student is working and receiving direction on a masters thesis. A minimum of two terms is required, but no more than six hours credit is allowed for the thesis.

Marine Science (MS)

MS 501 - INTRO TO OCEANOGRAPHY
Semester Hours: 4

Physics, chemistry, biology, and geology of oceans. For graduate students and those preparing for graduate school or intending to enter marine sciences professionally.

MS 502 - MARINE BOTANY
Semester Hours: 4

Survey of marine algae, vascular, and nonvascular plants associated with marine environment. Distribution, identification, structure, ecology, and reproduction.

MS 503 - MAR INVERTERBRATE ZOO I
Semester Hours: 4

Local examples of principal groups of marine invertebrates. Reproduction, distribution, taxonomy, systematics, and ecology. Lecture, laboratory, and fieldwork. Opportunity to acquire collection of local fauna.

MS 505 - MARINE VERTEBRATE ZOO
Semester Hours: 4

Marine fishes, reptiles, and mammals. Comprehensive treatment of their systematics, zoogeography, and ecology. Lectures on nonregional basis. Field and laboratory work on vertebrate fauna of northern Gulf of Mexico. Most of course on fishes. Opportunity to assemble collection of vertebrate species.

MS 509 - MARINE ECOLOGY
Semester Hours: 4

Bioenergetics, community structure, population dynamics, predation, competition, and speciation in marine ecosystems. Lecture, laboratory, and fieldwork. Students admitted without previous marine courses. For engineers and other non-biologists interested in marine environment. Individual species as they relate to ecological principles exemplifying taxonomic and ecologic backgrounds.

MS 510 - MARSH ECOLOGY
Semester Hours: 4

Basic understanding of ecology of salt marsh. Habitat analysis, natural history studies, and population dynamics of selected vertebrates. Specific field problem terminated by a technical paper assigned to each student. For advanced undergraduates and graduate students.

MS 515 - COASTAL ORNITHOLOGY
Semester Hours: 4

Coastal and pelagic birds with emphasis on ecology, taxonomy, and distribution. Food habits, field identification, and population dynamics.

MS 520 - MARINE GEOLOGY
Semester Hours: 4

Sampling techniques, laboratory analysis of sediments, application of research process to problems in identifying sedimentary environments, topography, sediments, and history of world oceans. Beneficial for understanding sedimentary substrate on or in which a large percentage of marine organisms live. Lecture, laboratory, and fieldwork.

MS 525 - MARINE BIOL FOR TEACHERS
Semester Hours: 6

MS 599 - RESEARCH ON SPECIAL TOPICS
Semester Hours: 1-4

Enrollment by special arrangement in any subjects listed.

MS 691 - SPECIAL TOPICS IN MARINE SCIEN
Semester Hours: 1-4

Marketing (MKT)

MKT 505 - NEW VENTURE STRATEGIES
Semester Hours: 3

Theory and application of both marketing and management strategies for start-up, operation and control of new ventures. The course also discusses the role of entrepreneurship in the economy. Same as MGT 505.

MKT 515 - INTERNATIONAL MARKETING
Semester Hours: 3

Procedures and problems associated with establishing and carrying out marketing operations in or with foreign countries and companies. Institutions, principles, and methods involved in solving these business problems. Effect of national differences in business practices and regulation.

MKT 520 - SERVICES MARKETING
Semester Hours: 3

The course focuses on the unique challenges of managing services and delivering quality service to customers. The course is equally applicable to organizations whose core product is services (e.g., banks, hospitals, aerospace and defense firms, non-profit organizations) and to organizations that depend on service excellence and services for competitive advantage (high technology firms,industrial firms).

MKT 565 - NEW VENTURE CHALLENGE
Semester Hours: 3

It is the intent of this course to create teams of students who will take a technology to the next level with the potential for the creation of a venture team. The course will take students through the process of conceiving and creating a new business. The goal is to provide a solid background with practical applications of important concepts for non-business majors or business majors with limited or no experience in an entrepreneurial environment. Finance, accounting, marketing and management will be addressed from a hands-on, entrepreneurial perspective. The course will rely on Podcast discussion, participation, case analysis, and the creation of a business plan. Prerequisite: MKT 505 and MKT 604.

MKT 570 - SOCIAL MEDIA MARKETING
Semester Hours: 3

The course focuses on how to meet the challenge of brand building in a digital age. It aims to foster the students' acquisition of social media marketing skills, equipping them with relevant knowledge of how to incorporate social media into marketing strategy thus enhancing value to both companies and customers. As future marketers, students will learn how to adopt a customer centric approach to their future marketing tasks, and be guided through a number of hands-on assignments that are immediately applicable to marketing practices. Prerequisite: MKT 601 or equivalent.

MKT 572 - DIGITAL MARKETING
Semester Hours: 3

Digital marketing has become an essential component of any firms marketing strategy. This course conducts an in-depth study of display advertising, search optimization and social media marketing, at both the tactical and strategic levels. Focus will be on outcome and effectiveness measurement methods and campaign evaluation metrics. Prerequisite: MKT 601.

MKT 575 - ADVANCED MARKETING SEMINAR
Semester Hours: 3

Investigation of advanced marketing topics that are relevant to contemporary marketing practices. The course will focus on current issues related to marketing in a high technology environment, relationship marketing, channel design and strategy, transportation, and logistics. Prerequisite: MKT 600.

MKT 580 - MARKETING MANAGEMENT
Semester Hours: 3

Management of marketing function of the firm: determination of objectives, organization and controls for effective utilization of marketing resources in coordinated effort with other major functional areas. Identification and selection of market opportunities. Competitive strategies and development of marketing policies and programs.

MKT 590 - SPECIAL PROJECTS
Semester Hours: 3

Independent study in an area of interest to the student in the field of marketing.

MKT 595 - INTERNSHIP IN MARKETING
Semester Hours: 3

Active involvement in a project in a business enterprise, professional organization, or in a government agency that has particular interest and relevance to the student.

MKT 600 - SURVEY OF MARKETING MANAGEMENT
Semester Hours: 3

Seminar format with case analysis is used to introduce students to the tools and concepts necessary for planning, organizing, and controlling marketing activities. Typical topics include market analysis and segmentation, market planning, market research, and product pricing, promotion, and distribution strategies.

MKT 601 - MARKETING STRATEGY & ANALYSIS
Semester Hours: 3

A seminar format with case analysis is used to introduce students to the tools and concepts necessary for planning, organizing and controlling marketing activities. Typical topics include market analysis and segmentation, market planning, market research, product, pricing, promotion and distribution strategies.

MKT 602 - MARKETING RESEARCH DESIGN
Semester Hours: 3

Application based course exploring the principles and purposes of marketing research. Covers research design, questionnaire development, sample selection, data collection, data analysis, and report generation. Focus is on the gathering and use of information for better decision-making.

MKT 604 - NEW PRODUCT DEVELOPMENT
Semester Hours: 3

Practical management of new product development methods and techniques from current research and successful industrial practice. An in-depth review of concepts, empirical findings, and paradigms that collectively form the foundation for the design and marketing of new products. An overview of emerging concepts, analytical techniques, empirical findings and paradigms that alter the nature, scope, and practice of marketing emerging technologies.

MKT 606 - MARKETING IN HIGH TECHNOLOGY ENVIRONMENTS
Semester Hours: 3

Investigation of the many functions, strategies, systems, environmental forces, and competitive activities involved in the marketing of ideas, goods, and services to organizational customers which include businesses, industries, institutions, and governments. These issues will be evaluated within the context of a high technology environment. Using a seminar format, case analysis and class participation will be important dimensions of the course. Prerequisite: MKT 604.

MKT 650 - SELECTED RESEARCH TOPICS
Semester Hours: 3

Research on a particular topic relevant to marketing by one student or a group of students. The research paper must be an original contribution showing a research design and results that meet the highest standards of social science research.

Materials Science (MTS)

MTS 601 - NATURE OF MATERIALS
Semester Hours: 3

Fundamental chemistry and structure of metals, ceramics, semiconductors, and polymers. Mol%, wt%, ppx, number densities, and polymer molecular weights. Covalent, ionic, metallic, and intermolecular bonding. Crystallography and disorder. Point, line, and volume defects. Phase diagrams.

MTS 602 - PROPERTIES OF MATERIALS
Semester Hours: 3

Properties of metals, ceramics, semiconductors, and polymers. Elastic or plastic deformation, fracture, and strengthening. Oxidation and corrosion. Dielectrics, semiconductors, and conductors. Thermal conductivity and heat capacity. Transmission, adsorption, and reflection. Magnetic susceptibility. Prerequisites: MTS 601.

MTS 603 - STRUC COMP PROP MATLS I
Semester Hours: 3

How structure and composition determine a materials mechanical properties and performance. Topics covered include bonding and crystal structure, disorder, defects, phase diagrams, phase transitions, diffusion and other kinetic processes, deformation, fraction mechanics, strengthening processes as applied to metals, ceramics, semiconductors, polymers and composites.

MTS 604 - STRUC COMP PROP MATLS II
Semester Hours: 3

How reactive, electronic, magnetic, thermal and optical properties of metals, ceramics, semiconductors, and polymers are influenced by their structure and composition. Topics considered include corrosion, oxidation, degradation process, band structure, electrical and optical dielectric constants, magnetic susceptibility, electrical and thermal conductivity and superconductivity.

MTS 607 - MAT PROCESSING IN SPACE
Semester Hours: 3

Extensive review of solidification physics with emphasis on the role of fluid transport and its effects on the process in order to develop rationales for processing materials in space.

MTS 613 - SYNTHESIS & PROC OF MATL
Semester Hours: 3

Metals, semiconductors, polymers, ceramics and composite materials are included.

MTS 646 - THERMODYNAMICS OF MATRLS
Semester Hours: 3

Fundamental thermodynamic review, phase equilibrium, chemical reaction equilibrium, free energy, binary and ternary phase transformations, solution models and selected topics.

MTS 649 - POLYMER SYNTHESIS & CHARACTERI
Semester Hours: 3

Synthesis of commercially relevant and novel polymers. Polymer characterization and discussion of the structural dependence of polymer properties.

MTS 650 - PRINC LIQUID/SOLID INTER
Semester Hours: 3

Applies basic principles in thermodynamics and kinetics to characterize surfaces and surface phenomena. Fundamental properties of gas-liquid, liquid-liquid, solid-liquid, and solid-gas interfaces and phenomena occurring at these interfaces.

MTS 651 - INTRO QUANTUM MECH I
Semester Hours: 3

Waves and particles; Bohr?s model of the atom; de Broglie waves, wave-packets and the uncertainty principle; postulates of quantum mechanics; Schroedinger?s equation; simple systems in one, two and three dimensions; the hydrogen atom.

MTS 652 - INTRO QUANTUM MECH II
Semester Hours: 3

Angular momentum and spin; atomic structure and spectrum; time-independent perturbation theory, variational methods; time-dependent perturbation theory and interactions of light with matter; scattering theory; electronic structure of solids; relativistic quantum mechanics. Prerequisite: PH 551 or CH 553.

MTS 660 - INTRO SOLID ST PHY I
Semester Hours: 3

Crystal binding and crystal structure. Crystal structure determination. Phonons and lattice vibrations. Free electron gas. Electronic energy band theory. Prerequisite: PH 551 or CH 553 or MTS 651 or OSE 555.

MTS 661 - INTRO SOLID ST PHY II
Semester Hours: 3

Thermal properties of solids. Electronic properties, optical properties, electronic properties in a magnetic field, semiconductor devices, magnetism, superconductivity, defects and alloys, dislocations and crystal growth, non-crystalline solids, surfaces and interfaces. Prerequisite: MTS 660 or PH 560.

MTS 690 - SP TPS/MATERIAL SCIENCE
Semester Hours: 1-4

Advanced selected topics of interest in such areas as materials processing, properties, analysis and testing.

MTS 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester that a student is enrolled and receiving direction on a master's thesis. Minimum of two semesters required. The 0 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

MTS 701 - FUND SOLID ST MAT PREP I
Semester Hours: 3

Equilibrium concepts and applications. Overview of solid state preparation (crystal growth) techniques. Treats appropriate thermodynamics, chemical equilibrium solid-liquid-vapor phase diagrams and application in materials preparation; segregation and applications (doping, normal freezing, zone refining, macro and micro distributions).

MTS 721 - FUND ELECTRON/X-RAY OPTICS
Semester Hours: 3

Fundamentals of materials characterization using electron and x-ray techniques. Topics include advanced crystallography, electron optics, and interactions of energetic electrons with solids. Some applications of x-ray diffraction (SRD) will be addressed.

MTS 722 - ELECT MICROSCOPIES/X-RAY DIFF
Semester Hours: 4

Applications of materials characterization using electron and x-ray techniques. Topics include imaging and x-ray spectroscopy (EDXA) using scanning electron microscopy (SEM); imaging, diffraction, and x-ray spectroscopy using transmission electron microscopy (TEM); and advanced x-ray diffraction (XRD) techniques.

MTS 723 - ELECTRON SPECTROSC SUR CHAR
Semester Hours: 4

Principles and operation of electron spectroscopies used in surface characterization. Techniques covered include Auger electron spectroscopy (AES), x-ray photoelectron spectroscopy (XPS), and other photoemission spectroscopies, such as ultraviolet photoelectron spectroscopy (UPS) and the use of synchrotron radiation. Students will carry out analysis of samples, prepare a written report, and present the results orally as part of the laboratory assignment.

MTS 724 - INSTR METH/BIO-MTLS CHARACTERI
Semester Hours: 3

MTS 747 - POLYMER PHYSICAL CHEM
Semester Hours: 3

Introduction to structure, properties and processing of polymers. Structural types, structure property relationships, thermodynamics and kinetics of polymerization and depolymerization, polymer characterization, thermodynamics of polymer solutions and blends, and mechanical evaluation of polymers.

MTS 780 - MATERIALS SCIENCE SEMINAR
Semester Hour: 1

Required of doctoral students during each semester of residence. This course may not be used to meet minimum degree requirements.

MTS 790 - SPECIAL TOPICS/MTS
Semester Hours: 3

Offered upon demand. Advanced selected topics of interest in materials science in such areas as materials processing, materials properties and analysis, testing.

MTS 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on a doctoral dissertation. A minimum of 18 hours is required. The 0 hour option is only available to students who have successfully defended their dissertation and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 0 hour option once in their career.

Mathematics (MA)

MA 502 - INTRODUCTION TO REAL ANALYSIS
Semester Hours: 3

Sequences, limits, continuity, differentiation of functions of one real variable, Riemann integration, uniform convergence, sequences and series of functions, power series, and Taylor series.

MA 503 - INTRODUCTION TO COMPLEX ANALYSIS
Semester Hours: 3

Complex algebra, analytic functions, Cauchy-Riemann equations, exponential, trigonometric, and logarithmic functions, integration, Cauchy integral theorem, Morera's theorem, Liouville's theorem, maximum modulus theorem, residue theory, Taylor and Laurent series, and applications.

MA 506 - METHODS PARTIAL DIFFERENTIAL EQUATIONS
Semester Hours: 3

Survey of theory and methods for solving elementary partial differential equations. Topics include first-order equations and the method of characteristics, second-order equations, reduction to canonical form, the wave equation, the heat equation, Laplace's equation, separation of variables, and Fourier series.

MA 508 - APPLIED LINEAR ALGEBRA
Semester Hours: 3

Fundamental concepts of linear algebra are developed with emphasis on real and complex vector spaces, linear transformations, and matrices. Solving systems of equations, finding inverses of matrices, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors, normal matrices, canonical forms of matrices, applications to systems of linear differential equations, and use of computer software such as MATLAB.

MA 515 - INTRODUCTION TO NUMERICAL ANALYSIS
Semester Hours: 3

Rigorous analysis and derivation of numerical methods for the approximate solution of nonlinear equations; interpolation and integration of functions, and approximating solutions of ordinary differential equations.

MA 520 - INTERMEDIATE DIFFERENTIAL EQUATIONS
Semester Hours: 3

This is a second course in differential equations. Course topics include series solutions for second order differential equations and the method of Frobenious; eigenvalue and eigenvector methods for solving systems of linear first order equations; the qualitative theory of nonlinear equations; boundary value problems and the Sturm-Liouville theory. No credit given to students who have successfully completed MA 524.

MA 524 - DYNAMICAL SYSTEMS I
Semester Hours: 3

Scalar autonomous equations; existence, uniqueness, stability, elementary bifurcations; planar autonomous equations; general properties and geometry, conservative systems, elementary bifurcations linear systems, reduction to canonical forms, stability and instability from linearization. Liapunov functions, center manifolds, Hopf bifurcation.

MA 526 - PARTIAL DIFFERENTIAL EQUATIONS I
Semester Hours: 3

Introduction to the theory for solving partial differential equations. No graduate credit given to students who have completed MA 506 for graduate credit. Topics include second-order equations, reduction to canonical form, well-posedness, the classical equations (wave, heat, and Laplace's) in one and several dimensions, separation of variables, Fourier series, general eigenfunction expansions, Sturm-Liouville theory, first-order linear and quasilinear equations, and shocks. Prerequisite: MA 502.

MA 536 - INTRODUCTION TO P-ADIC ANALYSIS
Semester Hours: 3

Introduction to p-adic analysis. Topics include rings; fields, ideals, congruences, valued fields, non-archimedean valued fields, field of p-adic numbers, field of complex p-adic numbers, ultrametric Banach spaces, p-adic Hibert space, p-adic functions, strictly differentiable functions, Volkenborn Integral, Benoullli numbers, p-adic Gamma function, p-adic Riemann function, and p-adic Zeta function.

MA 538 - METRIC SPACES WITH APPLICATIONS
Semester Hours: 3

Metric spaces, continuous functions, compactness, connectedness, completeness, Arzela-Ascoli theorem, Stone-Weierstrass theorem, Hilbert spaces, contraction mappings, applications to existence and uniqueness of solutions of differential and integral equations. Prerequisites: MA 502.

MA 539 - MULTIDIMENSIONAL ANALYSIS
Semester Hours: 3

Finite-dimensional Euclidean space and sequential approach to its topology, continuous functions and their properties, differentiability and implicit function theorem, Riemann integral, elements of vector calculus, flows and their generating vector fields, introduction to metric spaces. Prerequisite: MA 544.

MA 540 - COMBINATORIAL ENUMERATION
Semester Hours: 3

Counting, pigeonhole principle, permutations and combinations, generating functions, principle of inclusion and exclusion, Polya's theory of counting.

MA 542 - ALGEBRA
Semester Hours: 3

Topics from group theory and ring theory: subgroups, normal subgroups, quotient groups, homomorphisms, isomorphism theorems, ideals, principal ideal domains, Euclidean domains, fields, extension fields, elements of Galois theory.

MA 544 - LINEAR ALGEBRA
Semester Hours: 3

Vector spaces over a field, bases, linear transformations, matrices, determinants, eigenvalues, similarity, Jordan canonical forms, dual spaces, orthogonal and unitary transformations.

MA 562 - INTERMEDIATE FOURIER ANALYSIS
Semester Hours: 3

(Formerly MA 560). Brief review of classical Fourier analysis, Parseval's equality, Gaussian test functions. Introduction to generalized functions, the generalized transform, the generalized derivative, sequences and series of generalized functions, regular periodic arrays of delta functions, sampling, the discrete transform, the fast Fourier transform (other topics as time and interest permit).

MA 565 - INTERMEDIATE MATH MODELING
Semester Hours: 3

Designed for beginning graduate students. No prior experience in formal mathematical modeling is required. In-depth discussion of some types of models from physics, the life sciences, and/or the social sciences, with formulation, analysis, and criticism of the models. Process of and factors involved in formulating a model is of prime importance. Content is divided into approximately one-half deterministic modeling and one-half stochastic modeling.

MA 585 - PROBABILITY
Semester Hours: 3

Course topics include probability spaces, random variables, conditional probability, independence, modes of convergence, and an introduction to sigma-algebras and measurability; distributions, including discrete, continuous, joint and marginal distributions, transformations of random variable, distribution and quantile functions, and convergence in distribution; expected value, including properties of general expected value, mean, variance, covariance, generating functions, and conditional expected value; special models and distributions, including Bernoulli trials and the binomial and negative binomial distributions, the Poisson model and the Poisson and gamma distributions, the normal distribution, finite sampling models and the hypergeometric distribution; the law of large numbers and the central limit theorem.

MA 590 - SELECTED TOPICS IN MATHEMATICS
Semester Hours: 3

Requested selected topics.

MA 607 - MATHEMATICAL METHODS I
Semester Hours: 3

Review of vector calculus and coordinate systems, introduction to tensors, matrices, infinite series, complex variables with applications to calculus of residues, partial differential equations, and Sturm-Liouville theory. Orthogonal functions, gamma functions, Bessel functions, Legendre functions, special functions, Fourier series, integral transform and equations. (Same as PH 607.).

MA 609 - MATHEMATICAL METHODS II
Semester Hours: 3

Continuation of MA 607. (Same as PH 609.) Prerequisite: MA 607.

MA 614 - NUMBER METHODS/LINEAR ALGEBRA
Semester Hours: 3

Norms and vector spaces, matrix factorizations and direct solution methods, stability and conditioning, iterative methods for large linear systems, the algebraic eigenvalue problem. Prerequisites: MA 515 and either MA 508 or MA 544.

MA 615 - NUMBER METHODS PARTIAL DIFFERENTIAL EQUATIONS
Semester Hours: 3

Finite difference methods for parabolic, elliptic, and hyperbolic partial differential equations, error analysis, stability, and convergence of finite difference methods. Prerequisites: MA 515 and (either MA 506 or MA 526) and (either MA 508 or MA 544 or MA 614).

MA 624 - DYNAMICAL SYSTEMS II
Semester Hours: 3

Brief review of linear systems; local theory for nonlinear systems; existence, uniqueness, differentiability, asymptotic behavior, the stable manifold theorem, Hartman-Grobman theorem, Hamiltonian systems; global theory for nonlinear systems; limit sets and attractors, the Poincare map, the Poincare-Bendixson theorem; some aspects of bifurcation theory and chaos; bifurcations at nonhyperbolic fixed points and periodic orbits, homoclinic bifurcations, Melnikov's method, chaos. Prerequisite: MA 524 and either MA 508 or MA 544.

MA 626 - PARTIAL DIFFERENTIAL EQUATIONS II
Semester Hours: 3

Continuation of MA 526. Qualitative results for solutions to the classical equations (energy inequalities, propagation of discontinuities, maximum principles, smoothness of solutions, existence and uniqueness, etc.), non-homogeneous equations, Poisson's equation, Green's functions, and the Cauchy-Kowalewski theorem. Prerequisite: MA 526.

MA 633 - GEOMETRY
Semester Hours: 3

Axioms of incidence and order, affine and metric properties, isometries, similarities, transformation groups, projective planes.

MA 638 - GENERAL TOPOLOGY
Semester Hours: 3

Set theory, logic, well-ordering principle, axiom of choice, topological spaces, product spaces, quotient spaces, continuous functions, connectedness, path connectedness, local connectedness, compactness, local compactness, countability and separation, generalized products, Tychonoff theorem.

MA 640 - GRAPH THEORY
Semester Hours: 3

Graphs, subgraphs, trees, connectivity, Euler tours, Hamilton cycles, matchings, edge colorings, independent sets, vertex colorings, planar graphs, Kuratowski's theorem, four color theorem, directed graphs, networks, cycle, and bond spaces. Prerequisite: MA 540 or MA 542.

MA 643 - GROUP THEORY
Semester Hours: 3

MA 644 - MATRIX THEORY
Semester Hours: 3

Functions of matrices, invariant polynomials, elementary divisors, similarity of matrices, normal forms of a matrix, matrix equations, generalized inverses, non-negative matrices, localization of igenvalues. Prerequisites: MA 508 or MA 503 or MA 544.

MA 645 - COMBINATORIAL DESIGN
Semester Hours: 3

Systems of distinct representatives, difference sets, coding theory, block designs, finite geometries, orthogonal Latin squares, and Hadamard matrices. Prerequisite: MA 540 and MA 544.

MA 650 - THEORY OF DISTRIBUTIONS & FOURIER ANALYSIS
Semester Hours: 3

Topics include Hilbert spaces, convolution, regulaziation, Fourier series, Fourier transform, Fourier transform of the torus, Melin transform, Hankel transform, Laplace, transform, test functions, distributions, derivatives of distributions, elementary operations on distributions, convergence of distributions, fundamental solutions to partial differential equations such as the heat, wave, Schrodinger, and telegraph equations.

MA 653 - REAL ANALYSIS I
Semester Hours: 3

Countable sets, characterization of open and closed sets, Heine-Borel theorem, Riemann integral, Lebesgue measure and outer measure, measurable functions, Lebesgue integral, Fatou's lemma, and Lebesgue-dominated convergence theorem. Prerequisite: MA 538.

MA 654 - REAL ANALYSIS II
Semester Hours: 3

Differentiability of monotone functions, functions of bounded variation, absolute continuity, convex functions, Minkowski and Holder inequalities, Lp spaces, Riesz-Fischer representation theorem, Fubini's theorem and selected topics. Prerequisite: MA 653.

MA 656 - COMPLEX ANALYSIS I
Semester Hours: 3

Topology of the complex plane, analytic functions of one complex variable, elementary functions and their mapping properties, power series, complex integration, Cauchy's theorem and its consequences, isolated singularities, Laurent series, residue theory.

MA 658 - INTRODUCTION TO FUNCTIONAL ANALYSIS
Semester Hours: 3

Normed and inner product spaces, finite dimensional spaces, product and quotient spaces, equivalent norms, Hahn-Banach theorem, principle of uniform boundedness, openmapping theorem, Riesz representation theorem, complete orthonormal sets, Bessel's inequality, Parseval's identity, and conjugate spaces. Prerequisite: MA 538.

MA 661 - SPECIAL FUNCTIONS
Semester Hours: 3

MA 662 - ASYMPTOTIC/PERTURBATION METHOD
Semester Hours: 3

Asymptotic series, regular and singular perturbation theory, asymptotic matching, Laplace's method, stationary phase, steepest descents, WKB theory. Prerequisites: MA 502, and one of the following: MA 503, MA 504, MA 624.

MA 667 - THE CALCULUS OF VARIATIONS AND OPTIMAL CONTROL
Semester Hours: 3

Euler necessary condition for local extremum, Euler-Lagrange equation, Weierstrass necessary condition, Jacobi's necessary condition, corner conditions, problems of optimal control, Pontryagin maximum principles, transversality conditions, applications.

MA 685 - STOCHASTIC PROCESSES WITH APPLICATIONS I
Semester Hours: 3

Discrete and continuous Markov chains, Poisson processes, counting and renewal processes, and applications. Prerequisite: MA 585.

MA 686 - STOCHASTIC PROCESSES WITH APPLICATIONS II
Semester Hours: 3

Gaussian and Wiener processes, general Markov processes, special types of processes from queueing and risk theory, and selected advanced topics. Prerequisite: MA 685.

MA 690 - SPECIAL TOPICS IN MATHEMATICS
Semester Hours: 3

Offered upon demand. Advanced selected topics of interest in areas such as discrete mathematics, numerical analysis, differential equations, and stochastic processes.

MA 695 - GRADUATE SEMINAR
Semester Hour: 1

Selected topics in advanced mathematics, conducted as a research seminar.

MA 699 - MASTER'S THESIS
Semester Hours: 3-9

Required each semester a student is receiving direction on a master's thesis. A minimum of two terms is required. Maximum of nine hours credit awarded upon successful completion of the master's thesis.

MA 715 - NUMBER METHODS PARTIAL DIFFERENTIAL EQUATIONS II
Semester Hours: 3

Finite element methods for parabolic, elliptic, and hyperbolic partial differential equations; error analysis stability, and convergence. Prerequisites: MA 538 and MA 615.

MA 726 - THEORY OF PARTIAL DIFFERENTIAL EQUATIONS
Semester Hours: 3

Hilbert space theory of existence, uniqueness, and regularity for partial differential equations.

MA 740 - COMBINATORIAL ALGORITHMS
Semester Hours: 3

Linear, polynomial and exponential graph theoretic algorithms, generating combinatorial objects, and NP-completeness.

MA 756 - COMPLEX ANALYSIS II
Semester Hours: 3

Applications of residue theory, harmonic functions and their applications, Mittag-Leffler theorem, infinite products, Weierstrass product theorem, conformal mapping and Riemann mapping theorem, univalent functions, analytic continuation and Riemann surfaces, Picard's theorems, and selected topics.

MA 785 - ADVANCED PROBABILITY THEORY
Semester Hours: 3

Measure and integration, probability spaces, convergence concepts, law of large numbers, random series, characteristic functions, central limit theorem, random walks, conditioning, Markov properties, conditional expectations, and elements of martingale theory.

MA 790 - SPECIAL TOPICS
Semester Hours: 3

Offered upon demand. Advanced selected topics of interest in areas such as discrete mathematics, numerical analysis, differential equations, and stochastic processes.

MA 795 - GRADUATE SEMINAR
Semester Hour: 1

Selected topics in advanced mathematics, conducted as a research seminar.

MA 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9

Required each semester a student is receiving direction on a Ph.D. dissertation.

Mechanical & Aerospace Engineering (MAE)

MAE 540 - ROCKET PROPULSION I
Semester Hours: 3

Introduction to the operation, analysis, and design of liquid and solid rockets.

MAE 541 - AIRBREATHING PROPULSION
Semester Hours: 3

Survey of airbreathing propulsion systems with special emphasis on gas turbine engines for aircraft and rotorcraft. Thermodynamic power cycles, design of components, and overall engine performance analysis. Discussion of practical design and operations considerations including engine controls, reliability, and durability.

MAE 561 - VIBRATIONS ELASTIC SYS
Semester Hours: 3

Formulation of the equations of motion of discrete and continuous systems, analytical and numerical methods of solution, eigenvalue problems, and dynamic response. (Same as MAE 461 and CE 461 / CE 561).

MAE 563 - INTERMEDIATE DYNAMICS
Semester Hours: 3

Kinematics and dynamics of particles, system of particles, and rigid-bodies. Variational principles and Lagrangian mechanics.

MAE 568 - ELEMENTS OF SPACECRAFT DESIGN
Semester Hours: 3

Fundamentals of spacecraft engineering and design. Topics include: orbital mechanics, space environment, attitude determination and control, communications, space structures, thermal control, propulsion and power, and systems and mission design. (Same as MAE 468.).

MAE 574 - APP MECHANICS OF SOLIDS
Semester Hours: 3

Stresses and strains at a point, theories of failures, stress concentration factors, thick-walled cylinders, torsion of noncircular members, curved beams, unsymmetrical bending, and shear center. (Same as MAE 474 and CE 474 / CE 574).

MAE 577 - EXP TECH SOLID MECHANICS
Semester Hours: 3

Experimental methods to determine stress, strain, displacement, velocity, and acceleration in various media. Theory and laboratory applications of electrical resistance strain gages, brittle coatings, and photoelasticity. Application of transducers and experimental analysis of engineering systems. (Same as MAE 477 and CE 477 / CE 577).

MAE 580 - AIRCRAFT STABILITY & CONTROL
Semester Hours: 3

Stability and control of aerodynamic vehicles. Design of aircraft to obtain good flying characteristics. Complete governing equations and analog solutions of linearized equations. (Same as MAE 480.).

MAE 589 - COMPUTER AIDED ENGR
Semester Hours: 3

Application of computer methods in the analysis and design of structural, thermal, and dynamical systems. Use of state-of-the-art finite element and finite difference computer programs. Practical guidelines for discrete modeling; analysis of modeling errors. Comparison of exact and approximate solutions to boundary value problems. Use of microcomputers in engineering design and analysis. (Same as MAE 489.).

MAE 595 - SELECTED TOPICS MECH & AERO EG
Semester Hours: 1-6

MAE 610 - AERODYNAMICS
Semester Hours: 3

Fundamental concepts in aerodynamics including conservation laws, complex potential theory, thin airfoil theories, finite-wing lifting-line theory, boundary layers and Von Karman momentum integral equations.

MAE 620 - COMPRESSIBLE FLOW
Semester Hours: 3

Study of compressible subsonic, transonic and supersonic flows as described by the Euler equations. Linear and nonlinear theories of shockwaves, expansion waves, and their interactions. Applications to wind tunnels, nozzles, diffusers and aerodynamic bodies.

MAE 623 - COMPUTATIONAL FLUID DYNAMICS I
Semester Hours: 3

Formulations by finite difference, finite element, finite volume, and spectral element methods for incompressible and compressible flows. Explicit and implicit methods, Von Neumann error analysis, consistency, convergence, and accuracy.

MAE 635 - AEROSPACE SYSTEMS ENGINEERING
Semester Hours: 3

Introduction to Integrated Product and Process Development (IPPD) and life cycle analysis with application to Aerospace Systems. Systems engineering and quality engineering methods and tools. Top-down design decision support process. Computer integrated environment and robust design simulation will be addressed. Prerequisite: ISE 601 or ISE 690.

MAE 640 - ROCKET PROPULSION II
Semester Hours: 3

MAE 641 - ADV THERMODYNAMICS
Semester Hours: 3

Application of classical thermodynamics. Treatment of problems involving non-ideal gases and liquids, phase equilibrium, and chemical equilibrium. (Same as CHE 641).

MAE 642 - INTRO TO ELECTRIC PROPULSION
Semester Hours: 3

Physics and performance of electrically-driven in-space propulsion for Earth satellites and deep space missions. The physics of electromagnetics, plasmas, gas kinetics as applied to electrothermal, electrostatic, electromagnetic, and other electric propulsion systems. Characteristics and performance metrics of resistojets, arcjets, ion engines, Hall effect thruster, pulsed plasma thruster, and magnetoplasmadynamic thrusters. Review of orbital mechanics including low-thrust transfers. Overview of current research efforts including plasma behavior, new thruster designs, and novel concepts. Undergraduate students may take this course with instructor permission.

MAE 643 - ADVANCED HEAT & MASS TRANSFER
Semester Hours: 3

Continuation of MAE 450 in the study of conductive, convective, and radiative heat transfer and mass transfer. Emphasis is placed on heat transfer in turbulent flows and high speed flows, combined mode heat transfer, and mass transfer in reacting flows.

MAE 644 - ADVCD SOLID ROCKET PROPUL
Semester Hours: 3

Overview of the design, manufacture and testing of solid rocket propulsion systems. Specific topics include propellant ballistics and combustion, grain design, motor case and nozzle design, thermal protection, motor performance, and reliability and failure. Prerequisite: MAE 540.

MAE 645 - COMBUSTION I
Semester Hours: 3

Combustion chemistry, introduction to mass transfer, chemical kinetics, reactors, simplified governing equations for chemically reacting flow, laminar diffusion and premixed flames.

MAE 646 - COMBUSTION I
Semester Hours: 3

Combustion chemistry, introduction to mass transfer, chemical kinetics, reactors, simplified governing equations for chemically reacting flow, laminar diffusion and premixed flames.

MAE 647 - UNCERTAINTY ANAL IN EXPER
Semester Hours: 3

Uncertainty analysis concepts and techniques; application in planning, design, construction, debugging, execution, data analysis and reporting phases of experimental programs. Discussion of national and international standards and current engineering uncertainty analysis literature.

MAE 649 - TRANSPORT PHENOMENA
Semester Hours: 3

Mass, energy, and momentum transport in steady and transient motions in real and rheological substances. (Same as CHE 649.).

MAE 651 - VISCOUS FLUID MECHANICS
Semester Hours: 3

Fundamentals of incompressible viscous fluid motion, including development of Navier Stokes equation. Exact and approximate solutions for both large and small Reynolds number. Laminar and turbulent boundary layers.

MAE 657 - HELICOPTER THEORY
Semester Hours: 3

Vertical flight, forward flight, performance, design, mathematics of rotating systems, rotary wing dynamics, rotary wing aerodynamics, helicopter aeroelasticity, stability and control, stall, and noise. Prerequisite: MAE 530.

MAE 660 - STRUCTURAL DYNAMICS
Semester Hours: 3

Application of the theory of vibrations to discrete and continuous models of structures. Numerical methods of analysis for both spatial and temporal variables. Modal synthesis and step-by-step time integration methods. Finite element applications; substructuring techniques. (Same as CE 660.).

MAE 661 - ADVANCED DYNAMICS
Semester Hours: 3

Variational methods, optimization, and dynamic stability. Lagrangian and Hamiltonian formulation for dynamical systems and Hamilton-Jacobi methods to orbital mechanics.

MAE 662 - NONLINEAR DYNAM & CHAOS
Semester Hours: 3

Nonlinear and chaotic dynamical systems, phase plane, periodic and strange attractors, stability analysis, critical points, Piapunov exponents, bifurcation points, solitons, logistic maps, Poincare and Henon iterative maps, factals, Mandelbrot and Julia sets, chaos in complex dynamical systems.

MAE 663 - ASTRODYNAMICS
Semester Hours: 3

Astronomical coordinates and time systems; the many-body problems and disturbing functions. General perturbation methods, and application of classical mechanics and Hamilton-Jacobi methods to orbital mechanics.

MAE 664 - ROBOTICS I
Semester Hours: 3

This course prepares students to analyze three-dimensional coordinate transforms, three-dimensional kinematic and dynamic modeling of multi-body systems, as applied to robotic manipulators. Topics are: Spatial descriptions and transformations, manipulator kinematics, inverse manipulator kinematics, Jacobians: velocities and static forces, manipulator dynamics, trajectory generation.

MAE 665 - ROBOTICS II
Semester Hours: 3

This course prepares students to analyze advanced robotic systems, as applied to redundant robots (highly flexible robots acting like an elephant trunk), mobile robots (self-driving cars), unmanned surface vessels (boats/ships), and unmanned aerial vehicles (drones). Topics are: Redundant and hyper-redundant manipulators, applied nonlinear control for manipulators, obstacle avoidance and path planning in 2D workspace for mobile robots, kinematics and control of mobile robots, marine robotic surface vessels dynamic modeling and control, aerial robotic vehicles dynamic modeling and control.

MAE 671 - CONTINUUM MECHANICS
Semester Hours: 3

Kinematics and kinetics, various coordinate systems, constitutive equations for continuous media; governing partial differential equations from first and second laws of thermodynamics; applications to solids, liquids, and gases. (Same as CE 671.).

MAE 672 - ELASTICITY
Semester Hours: 3

Formulation of boundary-value problems of classical elasticity. Application to plane problems, prismatic members, and axisymmetric problems. Introduction to three-dimensional problems. (Same as CE 672.).

MAE 673 - PLASTICITY
Semester Hours: 3

Fundamentals of mechanical behavior of metals and nonmetals for stress states greater than the yield stress state. Deformation and flow theories. Stress-strain relations and yield criteria. Solution of boundary value problems with plastic bodies. Limit analysis of structures. (Same as CE 673.).

MAE 674 - FINITE ELEMENT ANALYS I
Semester Hours: 3

Finite element theory, variational methods, weighted residuals; applications to linear partial differential equations in continuous media; solution of boundary-value and initial-value problems. (Same as CE 674.).

MAE 676 - VISCOELASTICITY
Semester Hours: 3

Mechanical behavior of materials having time-dependent and temperature-dependent material properties. Creep and relaxation phenomena. Elastic-viscoelastic analogies. Formulation of stressstrain laws. Solution of boundary value problems for viscoelastic bodies. (Same as CE 676.).

MAE 677 - OPTICAL TECH IN SOLID MECH
Semester Hours: 3

Overview of conventional methods for experimental stress analysis. Introduction to applied optics with emphasis on non-destructive, laser-based testing methods, fiber optic recording systems,photoelectronic-numerical data acquisition, and computer aided analysis. (Same as CE 677.).

MAE 680 - PERFORMANCE FLIGHT TESTING
Semester Hours: 3

Fundamentals of rotorcraft test and evaluation. Topics include: test planning, requirements analysis, helicopter performance evaluation, fundamentals of propulsion testing, aviation safety, use of modeling and simulation in flight testing, Department of Defense and Federal Aviation Administration requirements and procedures.

MAE 681 - MISSILE TRAJECTORY ANALYSIS
Semester Hours: 3

Methods for generating trajectories of missiles and projectiles are studied as well as control mechanisms. Point mass approximations are developed using approximations and exact representations of drag and atmospheric conditions Full six degree-of-freedoms models are developed and solved numerically. Aerodynamic models are developed for both slowly spinning missiles and spin stabilized projectiles. Projectile linear theory is developed and used to discuss gyroscopic and dynamic stability and introduce rapid trajectory generation. Prerequisite: MAE 580.

MAE 692 - GRAD ENGR ANALYSIS I
Semester Hours: 3

Ordinary differential equations (ODEs), Bessel functions, Legendre polynomials, Laplace transformations, simultaneous differential equations, application of ODEs to mechanical systems, partial differential equations (PDEs) and boundary-value problems, application of PDEs to mechanical systems.

MAE 693 - GRAD ENGR ANALYSIS II
Semester Hours: 3

Green's functions, Fourier series and integrals, linear algebra, vectors, vector analysis and integral theorems, introduction to tensor analysis, analytical functions of a complex variable, Taylor and Laurent expansions, the residue theorem, stability criteria, and Calculus of Variations. Prerequisite: MAE 692.

MAE 695 - SELECTED TOPICS MECH & AERO EG
Semester Hours: 1-9

MAE 699 - MASTER'S THESIS
Semester Hours: 9

Required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours of credit is awarded upon successful completion of master's thesis. Requires thesis advisor permission. The 1 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 1 hour option once in their career.

MAE 723 - COMPUTATIONAL FLUID DYNA II
Semester Hours: 3

Continuation of Computational Fluid Dynamics I, advanced topics in finite difference, finite element, finite volume, and spectral element methods. Prerequisite: MAE 623.

MAE 724 - COMPUTATIONAL FLUID DYNAMI III
Semester Hours: 3

Grid generation techniques with structured and unstructured meshes, adaptive meshes, domain decompositions, and parallel processing. Applications of generated meshes to any one of the following problems: turbulence, combustion, acoustics, radiation, multiphase flows, or magnetohydrodynamics. Prerequisite: MAE 723.

MAE 740 - AEROTHERMODYNAMICS
Semester Hours: 3

Description of the dynamic and thermal fluid flow environments associated with hypervelocity vehicles and propulsion systems with emphasis on thermochemical nonequilibrium behavior. Topics include thermostatistical basis for internal energies, specific heats and shock strengths in dissociated and ionized gases; formulation of reacting flow conservation equations; and recent experimental advances in aerothermodynamics.

MAE 745 - COMBUSTION II
Semester Hours: 3

Droplet evaporation and burning, introduction to turbulent flow, turbulent diffusion and premixed flames, burning of solids, pollutant emissions, and detonation. Prerequisite: MAE 645.

MAE 746 - CONVECTIVE HEAT TRANSFER
Semester Hours: 3

Advanced theory of convective transport processes in fluids, including transport of momentum and energy in laminar flow, boundary layers and turbulent transport in shear flow. Engineering applications include boiling and two phase processes.

MAE 749 - MASS TRANSPORT
Semester Hours: 3

Mass transfer in solid and fluid systems under steady and transient conditions. Integration of momentum, heat and mass transfer equations with application to reactive, rheological and multicomponent systems.

MAE 751 - BOUNDARY LAYER THEORY
Semester Hours: 3

Development of boundary layers using singular perturbation theory. Curvature and compressible effects and the order of their importance. Modern applications and computational approaches.

MAE 754 - HYPERSONIC FLOW
Semester Hours: 3

Theories for treating the laminar and turbulent boundary layers of reacting fluids, mixtures, related chemical, thermodynamic, and physical phenomena in hypersonic flows. Leading edge bluntness, shock wave interactions, and vorticity effects.

MAE 755 - ADVANCED AERODYNAMICS
Semester Hours: 3

Transonic, supersonic, and hypersonic flows. Application of compressible potential theory, similarity rules, slender body theory and Newtonian flow theory to the analysis of aerodynamics of aircraft, missiles, re-entry vehicles, and other flight vehicles.

MAE 757 - OPT TECH/FLUID MECHANICS
Semester Hours: 3

Laser sources, molecular interactions with light and diatomic spectroscopy needed fluorescence, Brillouin scattering, four wave mixing, CARS and other applications in optical fluid diagnostics. (Same as CHE 757.).

MAE 758 - TURBULENCE
Semester Hours: 3

Turbulence in gases and liquids; boundary layers, atmospheric phenomena. Prerequisites: MAE 651 and MAE 671.

MAE 762 - WAVE MOT/CONT ELAS BODIES
Semester Hours: 3

Elements of stress wave propagation in bounded elastic media. Propagation of elastic waves in infinite and semi-infinite bodies, cylinders, rods and beams. (Same as CE 762).

MAE 765 - RANDOM VIBR/ELASTIC SYSTEMS
Semester Hours: 3

Dynamic analysis of elastic systems including the response of complex structures to random excitations. Typical excitations include random wind, thermal, earthquake, aerodynamic, and ocean wave phenomena. Probabilistic mechanics methods. Concepts of reliability. Stationary and ergodic processes.

MAE 768 - DYN AEROSPACE VEHICLES
Semester Hours: 3

Elements of advanced rotational kinematics of rigid bodies. Attitude motion of space vehicles in circular and elliptic orbits. Methods of gravitation and spin stabilization of gyrostat.

MAE 772 - THEORY STRUCT STABILITY
Semester Hours: 3

Energy criterion for stability of elastic structure under conservative loading. Stability concept for general continuous systems. Rigorous and approximate methods of analysis. Buckling of structural elements under impulsive and nonconservative loading. Postbuckling behavior. Prerequisite: MAE 671.

MAE 774 - FINITE ELEM ANALY II
Semester Hours: 3

Advanced topics in finite element analysis; application to nonlinear partial differential equations in continuum mechanics; theoretical studies of convergence and stability of solutions. (Same as CE 774.) Prerequisite: MAE 674.

MAE 778 - FRACTURE MECHANICS
Semester Hours: 3

Theory of crack propagation, stress intensity factors, mapping techniques, series expansion, asymptotic approximations, field singularities, integral transforms, numerical solutions. (Same as CE 778.) Prerequisite: MAE 672.

MAE 780 - THEORY OF ACOUSTICS
Semester Hours: 3

Simple harmonic oscillators, damped and forced oscillators, 1-D wave equation, vibration of a string, 2-D wave equation, vibration of membranes, the acoustic wave equation, plane waves, cylindrical and spherical waves, reflection and transmission, radiation and reception of acoustic waves, absorption and attenuation of sound, cavities and wave guides, and architectural acoustics. Prerequisite: MAE 692.

MAE 795 - SELECTED TOPICS MECH & AERO EG
Semester Hours: 1-9

MAE 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Required each semester student is enrolled and receiving direction on doctoral dissertation.

Music Applied (MUA)

MUA 511 - STUDIO INSTR - VOICE
Semester Hour: 1.5

For Music Majors' principal instrument.

MUA 521 - STUDIO INSTR - ORGAN
Semester Hour: 1.5

For Music Majors' principal instrument.

MUA 531 - STUDIO INSTR - PIANO
Semester Hour: 1.5

For Music Majors' principal instrument.

MUA 551 - STUDIO INSTR - STRINGS
Semester Hour: 1.5

For Music Majors' principal instrument.

MUA 561 - STUDIO INSTR - WOODWINDS
Semester Hour: 1.5

For Music Majors' principal instrument.

MUA 571 - STUDIO INSTR - BRASS
Semester Hour: 1.5

For Music Majors' principal instrument.

MUA 581 - STUDIO INSTR - PERCUSSION
Semester Hour: 1.5

For Music Majors' principal instrument.

MUA 598 - GRADUATE RECITAL
Semester Hour: 1.5

For Music Majors' principal instrument. Prerequisite: One of the following: MUA 511, MUA 521, MUA 531, MUA 551, MUA 561, MUA 571, MUA 581.

Music Education (MUE)

MUE 527 - TEACHING GENERAL MUSIC
Semester Hours: 3

Materials and methods. Emphasis on developing teaching competencies in general music, with an emphasis on the elementary school level. Prerequisite: MU 301.

MUE 528 - VOCAL/CHORAL METH SEC SCH
Semester Hours: 3

Includes principles of breathing, posture and resonance; repertoire for both vocal and choral students; organizational methods for leading choral programs, rehearsal techniques; classroom management skills.

MUE 529 - ORG & DIR INSTRU GRP SEC
Semester Hours: 3

Repertoire, rehearsal techniques, organizational methods, and procedures for administering and teaching school bands and instrumental ensembles.

Music Ensembles (MUX)

MUX 590 - UAH CONCERT CHOIR
Semester Hour: 1

The Concert Choir is a performing ensemble with its daily objectives aligned to meet departmental, regional, and national collegiate performance expectations. Through repertoire, students will gain an understanding of the importance of quality literature as well as knowledge of breadth of literature form medieval to contemporary. Open by audition.

MUX 591 - UAH CHAMBER CHOIR
Semester Hour: 1

Preparation of the finest literature for choral forces. Open to all students by audition with the conductor. Required attendance at rehearsals and performances. Ensemble participation is essential for all music majors and minors, and music majors are expected to participate in an appropriate ensemble each semester the student is enrolled for degree requirements.

MUX 599 - UAH WIND ENSEMBLE
Semester Hour: 1

Preparation of the finest literature for wind ensemble and concert band. Open to all students by audition with the conductor. Required attendance at rehearsals and performances. Ensemble participation is essential for all music majors and minors, and music majors are expected to participate in an appropriate ensemble each semester the student is enrolled for degree.

Nursing (NUR)

NUR 500 - SPECIAL TOPICS
Semester Hours: 2-4

Advanced study of selected area of interest in nursing.

NUR 518 - GLOBAL HEALTH: INTERNATIONAL STUDY
Semester Hours: 3

This course will focus on a selected international health care system. The international system will be compared with the US Health Care System in relation to economic, social, cultural, policy, and environmental influences. Culmination of the course will center on international experiences with health care facilities, policy making bodies, historical, and cultural introductions in another country.

NUR 524 - HEALTH CARE AND THE LAW
Semester Hours: 3

Introduction to basic health law in the context of application to nursing practice. Content relates to involvement with legal principles in nursing and healthcare. Federal, state and local aspects of law are included. (Cross listed with NUR 424).

NUR 525 - HUMAN SEXUALITY
Semester Hours: 3

Theory and issues related to human sexuality in health and illness. Emphasis on theory and values, clarification of human sexuality needs. Elective, open to all university students. (Cross listed with NUR 425).

NUR 527 - INTRODUCTION TO FORENSIC NURSING
Semester Hours: 3

This elective course provides an overview of the field of forensic nursing. Course concepts include care for victims of violence, forensic issues in healthcare, forensic investigation, and career information for forensic nursing. Current health care practices and medical/legal/ethical issues will be discussed.

NUR 528 - GERONTOLOGICAL NURSING
Semester Hours: 3

Nursing care of older adults in multiple settings. Issues and trends are incorporated.

NUR 534 - PALLIATIVE CARE
Semester Hours: 3

Palliative care is when there is no longer a medical treatment or cure for a physical problem. This palliative care course includes meeting the physical, emotional, social, cultural, and spiritual needs of individual and their families. A course focus will be on coping, grief, bereavement, pain relief and managing living implications for individuals with life-threatening illnesses. There will be recognition of the importance of individuality, vulnerability, and resilience in the quality of living during the dying process.

NUR 537 - NURSING AS A POLITICAL FORCE
Semester Hours: 3

The course explores the historical, current, and future impact of nursing on the political process. Local, state, national, and international aspects of nursing as a political force are analyzed. Emphasis is on political systems, regulatory processes, and organizational issues influencing health care delivery. Elective, open to all university students.

NUR 539 - NURSING MEDICAL MISSIONS
Semester Hours: 3

This course will focus on global health and humanitarian concepts and issues, and the nursing care needed to impact those issues. These issues will be examined and analyzed in relation to the mission country's economic, social, cultural, policy, and environmental influences. Culmination of the course will center on international experiences with supervised nursing care for a medical mission in another country. This course is an accepted elective in the Nursing Program. Additional work is required for graduate credit.

NUR 540 - ONCOLOGY NURSING
Semester Hours: 3

This course provides a holistic approach to the nursing care of people with cancer. The nursing process is used as the basis for promoting health and facilitating adaptation in the person with cancer. The course includes clinical experiences in selected agencies.

NUR 550 - ISSUES IN TRANSPLANTATION
Semester Hours: 3

This course is designed to provide basic theoretical knowledge related to nursing care of the donor/transplantation client and their families. Course content focuses on historical and current issues in donor/transplantation nursing including the impact of legal, ethical, political, economic, and socio-cultural issues. Students will examine the roles of the professional nurse and the interdisciplinary team in the management of care for the donor/transplant client and their families. Topics of future research and critical thinking will be discussed.

NUR 602 - SCHOLARLY INQUIRY FOR ADVANCED NURSING PRACTICE
Semester Hours: 3

This course explores research methods, evidence-based practice, ethical research and frameworks to guide scholarly inquiry. The learner will analyze quality improvement studies, clinical practice guidelines, and research studies. Synthesis of learning will involve developing a clinical question, evauating evidence, and disseminating an interprofessional scholarly product with practice recommendations.

NUR 604 - ROLE DEVELOPMENT FOR THE ADVANCED PRACTICE NURSE
Semester Hours: 3

This course prepares the graduate nursing student for the transition into advanced practice. Role development includes initiating and maintaining professional working relationships, understanding of legal, financial, ethical, and professional expectations and responsibilities, analysis of pertinent health policies, and demonstration of management principles and practices expected of the advanced practice nurse.

NUR 605 - ADVANCED HEALTH ASSESSMENT
Semester Hours: 3

This course provides an opportunity for the advanced practice nurse to utilize theoretical and evidence-based clinical practice guidelines to conduct a comprehensive and systematic assessment as a foundation for decision making in caring for patients across the lifespan.

NUR 605L - CLINICAL
Semester Hours: 0

NUR 606 - ADVANCED PATHOPHYSIOLOGY
Semester Hours: 3

This course is designed to expand on the previous knowledge of anatomy, physiology, and developmental disease processes. Physiological alterations, as they affect individuals across the lifespan, are reviewed with an introduction of diagnostic reasoning as it relates to disease manifestations.

NUR 607 - PHARMACOLOGY IN ADVANCED PRACTICE
Semester Hours: 3

This course is designed to provide the advanced practice nurse with pharmacological knowledge and clinical reasoning skills necessary to analyze data obtained from the health history, pharmacological review, and evaluation of treatment plans for patients across the lifespan.

NUR 610 - FAMILY NURSE PRACTITIONER I
Semester Hours: 6

This clinical course introduces the roles of the advanced practice nurse in direct and indirect health services for assessment, health promotion, illness prevention, and health management of patients across the lifespan. Prerequisite with concurrency: NUR 605, NUR 606 and NUR 607.

NUR 610L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 611 - FAMILY NURSE PRACTITIONER II
Semester Hours: 6

This clinical course promotes the integration of advanced practice principles of evidence-based health promotion and disease prevention across the lifespan. Prerequisites: NUR 602, NUR 604, NUR 610.

NUR 611L - CLINICAL
Semester Hours: 0

NUR 612 - FAMILY NURSE PRACTITIONER III
Semester Hours: 6

This clinical course promotes the integration of principles of evidenced-based, culturally competent care in primary care, emphasizing health promotion and disease prevention across the lifespan for the advanced practice nurse. Prerequisite: NUR 611.

NUR 612L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 613 - FAMILY NURSE PRACTITIONER IV
Semester Hours: 6

This course is the capstone family nurse practitioner clinical course in which the advanced practice student assumes the professional role by integrating, translating, and applying evidence-based care while working collaboratively and respectfully within the healthcare system providing patient-centered care to improvie patient and system outcomes. Prerequisite: NUR 612.

NUR 613L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 620 - ADULT GERONTOLOGY ACTUE CARE NURSE PRACTITIONER I
Semester Hours: 6

Clinical course that introduces advanced nursing skills necessary for the assessment, health promotion, disease prevention, and health management of the complex, acute, critically and chronically ill patient across the entire spectrum of adulthood. Prerequisites with concurrency: NUR 605, NUR 606, NUR 607.

NUR 620L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 621 - ADULT GERONTOLOGY ACTUE CARE NURSE PRACTITIONER II
Semester Hours: 6

This clinical course focuses on the assessment and management of adults with acute health problems in secondary or tertiary settings. The student develops increasing interpretive skills with assessment parameters using collaborative protocols in delivering care to patients with selected acute/critical alterations in health. Prerequisites: NUR 602, NUR 604, NUR 620.

NUR 621L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 622 - ADULT GERONTOLOGY ACUTE CARE NURSE PRACTITIONER III
Semester Hours: 6

This clinical course promotes the integration of principles of evidence-based patient-centered care of critically ill adult-gerontological patients with complex comorbidities. Prerequisite: NUR 621.

NUR 622L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 623 - ADULT GERONTOLOGY ACUTE CARE NURSE PRACTITIONER IV
Semester Hours: 6

This course is the capstone adult-gerontology acute care nurse practitioner clinical course in which the advanced practice student assumes the professional role by integrating, translating, and applying evidence-based case while working collaboratively and respectfully within the healthcare system providing patient-centered care to improve patient and system outcomes. Prerequisite: NUR 622.

NUR 623L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 629 - US HEALTH CARE SYSTEM
Semester Hours: 2

The focus of this course is to explore the structure and complexity of the US health care system. Content will include underlying values, major historical developments, reimbursement methods, stakeholders, and issues driving reform. Prerequisite with concurrency: NUR 630.

NUR 630 - THEORETICAL FOUNDATIONS FOR NURSE ADMINISTRATORS
Semester Hours: 3

This course focuses on the Nurse Administrator's relationships and roles in a variety of health care systems. Theories of management and organization are analyzed from the perspective of structure, communication, dynamics, trends, and key management, responsibilities, and functions in health care delivery systems.

NUR 631 - LEADERSHIP IN RESOURCE MANAGEMENT
Semester Hours: 3

This course focuses on the role of the nurse leader in resource allocation and management in health care systems and related organizations. Content related to human resource management includes workforce development, the healthcare workforce, recruitment, selection, retention, development, and labor relations. Prerequisite: NUR 630.

NUR 632 - ECONOMIC AND POLICY IMPLICATIONS FOR LEADERS IN HEALTH CARE SYSTEMS
Semester Hours: 4

This course focuses on economic and financial implications for nurse administrators with emphasis on executive level budget management and business planning skills. The course is designed to assist nurse administrators in gaining conceptual knowledge regarding budgeting in health systems and policy factors impacting cost, quality and access to healthcare. Prerequisites: NUR 630.

NUR 634 - INTERNSHIP IN NURSING LEADERSHIP
Semester Hours: 3

This is the culminating course that provides opportunities to synthesize leadership learning, administrative theory, and operational skills in budgeting and finance, and resource management. This knowledge is applied through the identified nurse executive competencies in selected health care related organizations. Course objectives reflect the AONL competencies and QSEN standards. Clinical hours 3, Contact hours 135. Prerequisites: NUR 630.

NUR 634L - CLINICAL EXPERIENCE
Semester Hours: 0

NUR 638 - INFORMATICS FOR NURSE ADMINISTRATORS
Semester Hours: 3

The focus of this course is on the structuring and processing of health information for making decisions in health care. Prerequisite: NUR 630.

NUR 640 - CURRICULUM DEVELOPMENT IN NURSING
Semester Hours: 3

Principles and concepts of curriculum development are examined with respect to their application to development of both the theoretical and clinical components of nursing programs. Includes principle regarding theories of learning, the changing nature of knowledge and societal needs as basic considerations directing curricular planning and revision.

NUR 641 - TEACHING/LEARNING IN NURSING COURSE INFORMATION
Semester Hours: 3

Emphasis is on the development of classroom and clinical laboratory teaching skills and includes a critical appraisal of specific teaching strategies. The student is provided the opportunity to acquire knowledge in the use and design of common and innovative teaching methods including web-based and interactive delivery systems.

NUR 642 - TESTING AND EVALUATION IN NURSING
Semester Hours: 3

Major emphasis on the development of classroom and clinical skills in appraisal and evaluation methods of student performance. The student is provided with the opportunity to acquire skills in constructing various types of testing and evaluation (formative and summative) procedures as they relate to nursing education.

NUR 643 - FACULTY ROLE DEVELOPMENT IN NURSING
Semester Hours: 3

Role theory serves as the basis for the discussion and practice in developing teaching, service and research role of a faculty member in a nursing program. Discussion on legislative and professional agencies issues and policies impinging on the teaching role.

NUR 644 - PRACTICUM IN TEACHING
Semester Hours: 3

Opportunities to do practice teaching with nursing students in various phases of their basic educational programs. Learning activities will be planned on an individual basis and based on the specific teaching responsibilities of their primary course assignment. Selected baccalaureate degree and/or associate degree programs will be used as practice sites. Prerequisites with concurrency: NUR 640, NUR 641, NUR 642.

NUR 645 - CAPSTONE NURS EDUC CERTIF CRS
Semester Hours: 3

The major emphasis of this capstone education course is the development of the professional teaching role within an institutional setting. The focus is on the student's ability to function as a professional leader utilizing knowledge gained to promote change, engage in professional actives; promote continuous improvement; and serve as a mentor in an educational environment. Prerequisites: NUR 640, NUR 641, NUR 642, NUR 643, NUR 644.

NUR 646 - INSTRUCTIONAL TECHNOLOGY IN NURSING EDUCATION
Semester Hours: 3

The appropriate use of educational technology can afford faculty an opportunity to engage learners and bring concepts to life while supporting formative and summative assessment. This course will examine instructional technology, the design and integration of educational strategies, and methodological tools to engage learners to meet course and curriculum goals.

NUR 647 - STRATEGIC PLANNING
Semester Hours: 3

The focus of this course is to prepare Nursing Administration graduate students to comprehend and actively engage in organizational strategic planning. Emphasis is on the development of organizational blueprints, tracking current trends, forecasting, and innovative strategies in healthcare to achieve an organization's mission and vision, thus remaining competitive in the healthcare industry. Prerequisite with concurrency: NUR 630.

NUR 648 - CONCEPTS OF HEALTH ASSESSMENT AND PROMOTION FOR NURSE EXECUTIVES
Semester Hours: 3

This course focuses on concepts in health assessment and health promotion for individuals and populations. This course is designed for nurses preparing for leadership roles in health care organizations. Prerequisite with concurrency: NUR 630.

NUR 649 - QUALITY, SAFETY, AND RISK MANAGEMENT
Semester Hours: 3

This course focuses on the quality, safety, and risk management concepts for nurse leaders. Content includes the use of quality tools and use of data to evaluate and promote quality outcomes. Prerequisite with concurrency: NUR 630.

NUR 650 - INDEPENDENT STUDY
Semester Hours: 2-4

Planning, implementation, and evaluation of related phenomena of special interest observed in nursing practice.

NUR 652 - CLINICAL PRACTICUM
Semester Hours: 3

NUR 670 - HUMAN FACTORS IN HEALTHCARE COMPUTING
Semester Hours: 3

Overview of epidemiologic methods with discussion of application to diagnosis and choice of therapy. Concepts and mechanisms related to transmission, acquisition of disease, trends and distribution of patterns of disease discussed. The application of epidemiology to human health problems and rural settings is emphasized. Prerequisite: NUR 638.

NUR 671 - USABILITY EVAL HEALTHCARE I.T.
Semester Hours: 3

This course examines usability methods for the design and testing of healthcare information technology including health information websites, electronic health records, clinical decision support systems, and medical equipment with an emphasis on the user experience. The iterative nature of user-centered design and usability testing of health IT will be emphasized. Prerequisite: NUR 679.

NUR 698 - SPECIAL RESEARCH TOPICS
Semester Hours: 1-4

Application of activities appropriate to student program of study. Intended to expand student knowledge and enhance track specific content.

NUR 699 - PLAN I: THESIS
Semester Hours: 1-4

Independent research investigation related to practice of nursing under faculty guidance. Minimum of six hours required. Prerequisite: NUR 602.

NUR 700 - CLINICAL DATA MANAGEMENT AND ANALYSIS
Semester Hours: 3

This course provides students with the knowledge to understand, collect, manage, and measure clinical data. Students will explore data collection and management processes, level of measurement, basic statistics, and measurement for improvement in order to effectively use clinical data. Data entry exercises employed through analytical tools and statistical software packages will allow the students to practice and apply the basic data management and analysis skills needed for the evaluation of clinical data and evidence-based practice.

NUR 701 - WRITING FOR PUBLICATION
Semester Hours: 3

This course concerns the development of skills in writing, editing, and preparing manuscripts for publication from initial idea to submission of a publishable manuscript. The course emphasizes a writing process that encourages productivity and collegial peer review. Legal and ethical aspects of authorship prepare students for responsible practices expected of scholars. Students should have mastered basic writing skills, e.g. grammar, syntax, and computer skills, prior to enrolling in this course.

NUR 729 - EVIDENCE-BASED PRACTICE, DESIGN AND TRANSLATION
Semester Hours: 3

The purpose of this course is to provide students with models for evidence-based practice (EBP) design and improvement science. Students learn to formulate clinical questions in answerable format and search for and identify best research evidence. The focus of the course is to evaluate and critically appraise evidence for rigor and applicability to a clinical problem and the impact on the improvement of clinical outcomes. Students will translate evidence into practice environments for safe, quality care. Students will gain access to information that will support optimal clinical decision-making. All content and assignments are applied by the student to begin development of the DNP Project. Prerequisite: NUR 700.

NUR 731 - PHILOSOPHICAL, THEORETICAL AND CONCEPTUAL FOUNDATIONS FOR ADVANCED PRACTICE NURSING
Semester Hours: 3

This course assists students to use theory and conceptual models to guide the advanced nursing practice and scholarship at the doctoral level. The content is derived from the philosophical and scientific underpinnings of nursing, natural and psycho-social sciences. Prerequisite: NUR 701.

NUR 733 - INFORMATICS FOR ADVANCED NURSING PRACTICE
Semester Hours: 3

This course focuses on the collection, organization, and analysis of information in nursing and health care. Students are introduced to the specialty of nursing informatics, the information system life-cycle, telemedicine, and the use of technology to enhance nursing care delivery and patient safety. Students will also learn how to manipulate large and small patient databases for the analysis of patient outcomes. Prerequisite with concurrency: NUR 729.

NUR 734 - ADVANCED EXPERIENTIAL CLINICAL COURSE
Semester Hours: 1-7

This course is designed to validate Master's level competencies in clinical and organizational leadership. The course is required for post-master's DNP students who are graduates of Master of Science in Nursing programs with less than 500 clinical hours.

NUR 735 - POPULATION HEALTH IN ADVANCED PRACTICE NURSING
Semester Hours: 3

This course prepares students to implement population-based health promotion and disease prevention activities. The course applies an epidemiologic framework and focuses on a spectrum of issues affecting health which includes emerging infectious diseases, emergency preparedness, disparities in health and healthcare services, and the impact of exposomics on population health. Prerequisite with concurrency: NUR 729.

NUR 737 - INTERDISCIPLINARY LEADERSHIP AND ROLE DEVELOPMENT FOR PRACTICE EXCELLENCE
Semester Hours: 3

This course focuses on organizational and systems leadership and skills critical to role development in independent and interprofessional practice. Content includes communication, conflict resolution, collaboration and negotiation, leadership, and team functioning to enhance the experience and outcomes of patient care and to reduce the cost of care.

NUR 738 - DNP PROJECT DEVELOPMENT
Semester Hours: 3

This course is designed to assist the student in finalizing the DNP project plan and developing an application to the Institutional Review Board (IRB) for the protection of human subjects. The student will document previously acquired abilities and competencies in a professional portfolio. Students will participate in the seminar sessions to obtain guidance and receive peer suggestions about the portfolio and project plans. Prerequisites: NUR 734, NUR 742 and NUR 743.

NUR 739 - DNP PROJECT
Semester Hours: 7

The DNP project is planned, implemented, and evaluated by the DNP student in consultation with the DNP committee. The student writes a manuscript suitable for publication and makes a scholarly presentation of findings to peers and faculty. A minimum of seven credit hours for this course are distributed across several semesters as determined by the chair. Prerequisite with concurrency: NUR 738.

NUR 740 - HEALTH POLICY AND POLITICS:IMPLICATIONS IN HEALTH CARE
Semester Hours: 3

This course focuses on the unique challenges of engaging and influencing health care policy at local, state, national or international levels. It is designed to develop skills, techniques, and approaches to the critical analysis of health policy proposals, health policies, and to identify stakeholders in policy development. The health policy framework is analyzed from a governmental, institutional, and organizational perspective. Prerequisite: NUR 729.

NUR 742 - PROGRAM EVALUATION METHODS
Semester Hours: 3

The purpose of this course is to synthesize knowledge related to translation/implementation science models and strategies to improve health outcomes. The emphasis in the course is the use of program evaluation as a tool to achieve positive changes in health status, initiate and manage quality improvement, engage in risk anticipation, and facilitate organizational and system level changes. Prerequisite with concurrency: NUR 729.

NUR 743 - EVIDENCE-BASED PRACTICE STRATEGIES
Semester Hours: 3

This course expands on evidence-based design to refine a problem statement and a clinical question. Content includes conducting a systematic review of the literature to guide the selection of methods, strategies, tools and metrics needed to complete a successful DNP project. Students will develop and have approved a proposed DNP project plan. Prerequisite: NUR 742.

Nursing Science (NUS)

NUS 710 - INDEPENDENT STUDY
Semester Hours: 1-6

This course is for Joint PhD Nursing Science program students who are interested in an independent study option to identify additional literature synthesis, planning, implementation, and evaluation of related phenomena of special interest to advance nursing science.

NUS 713 - SPECIAL TOPICS
Semester Hours: 3

This course is for Joint PhD Nursing Science program students who are seeking opportunities to explore special topics that expand their knowledge and/or skills to conduct sponsored research projects. The focus of this three-credit hour didactic course will be developed in collaboration between the faculty and student(s).

NUS 741 - BSN-PHD RESEARCH SEMINAR I
Semester Hour: 1

The purpose of this course is to prepare BSN-PHD students with the foundational skills of deep reading, comprehensive literature review and critique, critical thinking, and writing skills necessary for successful advancement in a doctoral program. This course will further help students by providing more individualized support and structure to facilitate successful progression through the PhD program.

NUS 742 - BSN-PHD RESEARCH SEMINAR II
Semester Hour: 1

The purpose of this course is to aid BSN-PhD students in developing skills to assess scientific rigor, develop an argument, critique published research, professionally present (verbally and written) critique findings, develop a manuscript for publication, and will provide an opportunity to obtain hands on research experience. This course will further help students by providing more individualized support and structure to facilitate successful progression through the PhD program.

NUS 743 - BSN-PHD RESEARCH SEMINAR III
Semester Hour: 1

The purpose of this course is to prepare BSN-PhD students with the foundational skills of systematically appraising the literature to develop an appropriate and comprehensive significance section, analyzing health policy that directly relates to the students' research areas of interest, and evaluating research methodology and accompanying statistical analyses. These are important for successful advancement in a doctoral program. This course will further help students by providing more individualized support and structure to facilitate successful progression through the PhD program.

NUS 750 - PHILOSOPHY OF SCIENCE
Semester Hours: 3

The purpose of this course is to explore the evolution of philosophy and science. Epistemology, knowledge generation, knowledge acquisition, and ways of knowing will be examined. Scientific inquiry will include reasoning, logic, and persuasive argument development.

NUS 752 - INFORMATICS FOR HEALTH CARE TERMS AND SCHOLARLY INQUIRY
Semester Hours: 3

The purpose of this course is to prepare nurse scientists to use informatics, electronic tools, and healthcare technologies for the purposes of nursing research. The course will focus on the use of informatics in the data management of individuals, groups and organizations as the nurse scientist plans and executes a program of research.

NUS 754 - ETHICAL AND LEGAL ISSUES IN RESEARCH
Semester Hours: 3

The purpose of this course is to introduce the student to doctoral scholarship in support of beginning a program of responsible conduct of research. This course explores current ethical and legal issues in the science of nursing research. The course will delve into best practices in research design with regard to ethics, authorship, data management and record keeping, intellectual property and ownership of data, and human subjects research. In addition, the course will cover conflicts of interest, mentoring, collaborations, peer review, research misconduct, and current ethical issues in research.

NUS 756 - APPLICATION OF THEORETICAL MODELS
Semester Hours: 3

The purpose of this course is to provide students a foundation for contributing to theory development processes, analyzing and critiquing theoretical foundations of research, and applying theoretical models to nursing research. This course addresses the relationship between theory and research and provides an understanding of the use of theoretical models and conceptual foundations to guide nursing research and practice. Prerequisites: NUS 750.

NUS 758 - QUANTITATIVE RESEARCH METHODS
Semester Hours: 3

This course provides students with foundational knowledge and skills in the development of experimental and nonexperimental quantitative designs. Topics will include training in the choice of research questions/aims/hypotheses and a responsive approach; the development of an ethical, strategic design; the implementation of a strategic sampling plan; the choice of suitable measurements (reliable and valid) and analytic plans; issues in research such as treatment fidelity; and the drafting of research proposals. Additional content will briefly introduce more advanced concepts such as mixed methods research or community-based participatory research. Special emphasis will be placed on clinical nursing designs, such as repeated-measures intervention studies. Prerequisites: NUS 750.

NUS 760 - STATISTICS I
Semester Hours: 3

The purpose of this course is to provide the student with the skills to conduct and interpret statistical data. Emphasis will be placed on describing types of variables, testing hypotheses, selecting appropriate parametric and nonparametric statistical tests, analyzing data, and interpreting results. Prerequisite: NUS 758.

NUS 762 - HEALTH CARE POLICY FOR RURAL AND MEDICALLY UNDERSERVED POPULATIONS
Semester Hours: 3

The purpose of this course is to explore the policy environment that influences and shapes public health and health care service delivery, including rural and medically underserved communities. Students will develop skills, techniques, and approaches to identify gaps, critically analyze and research health related issues. Utilization and delivery of data to promote and impact healthcare policy changes will be an important measure of outcome. Students will develop the ability and confidence to critically assess current health policy issues in a thoughtful, comprehensive and rigorous manner and to engage in the policy process.

NUS 764 - SCIENTIFIC WRITING
Semester Hours: 3

The purpose of this course is to develop writing skills to produce scientific writing that is clear, concise, and logical. This course will also explore the publication to include abstract and manuscript development and the submission process. Additional pathways to dissemination of nursing content will be explored as well.

NUS 766 - EPIDEMIOLOGY IN RURAL AND MEDICALLY UNDERSERVED POPULATIONS
Semester Hours: 3

The purpose of this course is to introduce epidemiological methods for measuring population health, designing and implementing observational and experimental studies, critically reading the public health literature, and applying research findings to global and community health. Prerequisite: NUS 760.

NUS 768 - STATISTICS II
Semester Hours: 3

This course provides advanced coursework in applied statistical approaches to data management and analysis. With an emphasis on multivariate statistical approaches, the purpose of the course is to help nursing students to develop improved skills in conceptualizing, executing, analyzing, and interpreting advanced analytic strategies and to enhance their ability to propose strong, tailored analytic approaches for specific study designs and research aims. Students will also gain proficiency in using R software, a freely available and power statistical package. They will enhance their knowledge of regression, OEANOCOVE, MANOVA/MANCOVA, discriminant analysis, exploratory and confirmatory factor analysis, structural equation modeling, multilevel modeling, and advanced categorical approaches. Understanding the mathematics, logic, application of these techniques is emphasized. Prerequisite: NUS 760.

NUS 770 - GRANT WRITING
Semester Hours: 3

The purpose of this course is to prepare students in the foundations of writing grants for federal external funding. This course will help students identify a step-wise process to develop a grant proposal through federal funding sources. Strategies for successful grant writing include identifying funding sources for the topic, writing a competitive grant application, developing a collaborative team of researchers for the project, and understanding the review process. Prerequisite: NUS 764.

NUS 772 - QUALITATIVE RESEARCH METHODS
Semester Hours: 3

The purpose of this course is to assist the student in using selected qualitative research methods. Learning modules will explore qualitative approaches, sampling, data collection, data analysis and dissemination. The course will review and explore the use of technology to assist the qualitative researcher. Prerequisites: NUS 750, NUS 756, and NUS 758.

NUS 776 - ADVANCED RESEARCH METHODS
Semester Hours: 3

The purpose of this course is to assist students in developing the knowledge and skills to design a mixed methods research (MMR) study. MMR is an advanced method for collecting, analyzing, and "mixing" both quantitative and qualitative data within a single study to understand a research problem more completely. Prerequisites: NUS 752, NUS 758, NUS 760, NUS 768, and NUS 772.

NUS 780 - INTRODUCTION TO OMICS
Semester Hours: 3

The purpose of this course is to introduce the revolution of omics and discuss the role nurse scientists can play in precision health development. Nurse scientists are in a position to provide a unique contribution to person-centered health approaches by broadening their understanding of molecular advances to improve health outcomes. A variety of different omics will be explored and the practical advantages, limitations, and challenges in individualized health promotion will be discusses.

NUS 781 - OMICS IN NURSING RESEARCH
Semester Hours: 3

The purpose of this course is to provide an overview of advanced concepts of omics research by utilizing a biobehavioral systems approach in nursing science. The National Institute of Nursing Research's strategic plan for Genomic Nursing Science is used as the framework for integrating omics and nursing research. Practical application in omics theories, methodologies, technology, bioinformatics, and responsible conduct of research is discussed. Additionally, resources in building capacity for the next generation of omics scientists are review. Prerequisite: NUS 780.

NUS 782 - CURRICULUM DEVELOPMENT AND PROGRAM EVALUATION FOR NURSE EDUCATORS
Semester Hours: 3

The purpose of this course is to examine the procedures for designing, implementing, and evaluating nursing education curriculum. The process will be examined beginning with the program mission. Educational theories, philosophy, concepts, and program evaluation will be explored. The nurse educator's role in curriculum design and program evaluation is assessed.

NUS 783 - INSTRUCTIONAL METHODS AND ASSESSMENT IN NURSING EDUCATION
Semester Hours: 3

The purpose of this course is to discover teaching styles and implement instructional technologies to promote learning in diverse populations of students. Throughout the semester, students will explore didactic and clinical learning activities and evaluation strategies to demonstrate transfer of learning. Prerequisite: NUS 782.

NUS 784 - DATA SCIENCE AND EMERGING TECHNOLOGIES
Semester Hours: 3

The purpose of this course is to apply concepts associated with data analytic methods and the use of burgeoning technologies in healthcare. The course prepares the nurse scientist to engage with other researchers in the areas of data analytics, simulation, telehealth, and robotics. The appropriate integration of health care technologies to support nursing research will be emphasized.

NUS 785 - RESEARCH AND DEVELOPMENT (R&D) OF INNOVATIVE HEALTH CARE TECHNOLOGY
Semester Hours: 3

The purpose of this course is to develop the scientific skills to move an innovation from concept to implementation following a research and development (R&D) process. The course prepares the nurse scientist to engage with researchers inside and outside Prerequisite: NUS 784 or permission of professor.

NUS 798 - COMPETENCY ASSESSMENT
Semester Hours: 0

All students enrolled in the Joint Nursing Science PhD program are required to register for this course at the beginning of the semester during which they take the comprehensive examination. A grade will be determined entirely by an assessment of the student's performance on the comprehensive examination, and the grade will be either satisfactory/unsatisfactory. The course may be repeated once and must be passed if the student is to progress to dissertation. Prerequisite: NUS 776.

NUS 799 - DOCTORAL DISSERTATION
Semester Hours: 9

This independent research course partially fulfills required doctoral level research dissertation hours toward the PhD in the student's field. A minimum of 24 dissertation hours are required, at 1-12 hours per semester. The course is conducted under the guidance of the PhD chair. After completing requirements for admission to candidacy, the student registers for a minimum of 3 hours per semester in this course, each semester, until all dissertation requirements have been approved. Material covered will be of an advanced nature aimed at providing doctoral students with an understanding of the latest research and current developments within the field. Discussion and advisor guidance will be focused on readings of research articles and development of research methodology with the aim of producing an original research contribution that represents a novel development in the field, or a novel perspective on a pre-existing topic in the field. Prerequisite: NUS 776.

Optical Science Engineering (OSE)

OSE 506 - COMMUNICATION THEORY
Semester Hours: 3

Review of elementary signals and systems including the Hilbert transform, cross and auto correlation, power density spectrum, and the Wiener-Khintchine theorem. Butterworth and Chebyshev lowpass filters. Bandpass signals and systems. The lowpass equivalent of a bandpass signal/system. Commonly used forms of linear and nonlinear modulation. Demodulation methods and circuits. Phase lock and frequency feedback techniques.

OSE 534 - OPTICAL FIBER COMMUNICATIONS
Semester Hours: 3

Introduction to optical fibers and their transmission characteristics, optical fiber measurements, sources and detectors, noise considerations for digital and analog communications, optical fiber systems.

OSE 541 - GEOMETRICAL OPTICS
Semester Hours: 3

Foundations and physics of geometrical optics, Fermat's principles and Huygen wavelets, refraction and reflection. The many forms of Snell's Law. Optical path lengths, geometrical wavefronts and rays. Ray tracing, ynu-chart and matrix methods. Gaussian imagery and paraxial optics, conjugate elements, cardinal points, and image-object relations. Stops and pupils, chief and marginal rays, vignetting, and the optical or Lagrange invariant. The y-y bar diagram, design of common systems: objectives, magnifiers, microscopes, collimators and detectors. Optical glasses and chromatic aberrations, wavefront and transverse aberrations, spot diagrams and ray fan plots.

OSE 542 - PHYSICAL OPTICS
Semester Hours: 3

Scalar and electromagnetic waves, polarization, coherence, reflection and refraction; two beam and multiple beam interference, interferometers, Fabry-Perots, thin films, diffraction, and absorption and dispersion. (Same as OSE 542 and EE 542.) Fall, Spring.

OSE 546 - RADIOMETRY, DETECTORS & SOURCE
Semester Hours: 3

Theory and practice of radiometry and photometry. Blackbody radiation and Lambertian sources. Propagation of radiant energy in free space and through optical systems. Detector classes, responsivity, bandwidth and noise, power spectral density, properties of sources, photon noise.

OSE 555 - INTRO QUANTUM MECHANICS I
Semester Hours: 3

Waves and particles; Bohr's model of the atom; de Broglie waves, wave packets and the uncertainty principle; postulates of quantum mechanics; Schroedinger's equation; simple systems in one, two and three dimensions; the hydrogen atom.

OSE 570 - OPT & PHOTONIC SYSTEMS DESIGN
Semester Hours: 3

Review of paraxial optics, ray tracing codes, aberration and diffraction calculations; acousto- and electro-optic modulators, spatial light modulators; fibers, fiber splicers and connectors; gratings and diffractive optical elements; laser and light emitting diodes, photodetectors and CCD arrays; correlator systems; optical communication networks; signal processing systems design.

OSE 632 - FOURIER OPTICS
Semester Hours: 3

Introducing the optical system as an invariant linear system, convolution, Sommerfield's diffraction integral, Fourier Transform, angular spectrum, coherent and incoherent imaging, optical transfer function.

OSE 634 - OPTICAL COMMUNICATIONS
Semester Hours: 3

Optical communication systems; counting statistics; the optical detector response process; direct detection; heterodyne detection parameter estimation in optical communications; pointing, spatial acquisition and tracking.

OSE 645 - LASERS
Semester Hours: 3

Resonant optical cavities. Atomic radiation. Laser oscillation and amplification. General characteristics of lasers. Laser excitation. Semiconductor lasers. Gas discharge phenomenon. Transition rates. Spectroscopy of common lasers. Detection of optical radiation.

OSE 653 - OPTICAL TESTING LAB
Semester Hour: 1

Provides students with hands-on experience via the in-depth testing of an aerial reconnaissance photographic lens. The main measurement tools are a 168-inch Collimator/T-Bar nodal slide for image plane measurements, and a Fizeau phase shifting interferometer for exit pupil measurements. Measurements include: effective focal length, F-number, axial color, spherical aberration, field curvature, distortion, astigmatism, transmission, relative illumination falloff, resolution, modulation transfer function, on-axis interferometry, fringe analysis. Prerequisite: OSE 654.

OSE 654 - OPTICAL TESTING
Semester Hours: 3

Spherometry; refractive index measurements; optical bench measurements of imaging systems via T-bar nodal slide (effective focal length, f-number, axial color, field curvature and distortion, transverse ray aberrations); illumination falloff; image resolution tests (finite object); modulation transfer function; star image testing; knife edge tests; Hartmann tests; Fizeau interferometer and testing configurations; null lens testing of aspheres; wavefront measurements (point diffraction interferometer, radial shear interferometer). Prerequisites: OSE 541 and OSE 542.

OSE 655 - APPLIED QUANTUM MECHANICS
Semester Hours: 3

Application of quantum mechanics in solid state, electronics, materials science and optics. Topics to include: Hydrogen atom and molecule, excitons, phonons, Bloch's theorem, periodic boundary conditions, electrons and holes, band structure of simple semiconductors, dipole transitions, optical constants, absorption and emission processes, introduction to device physics.

OSE 656 - LENS DESIGN
Semester Hours: 3

Design of refractive imaging systems. Skills acquired include thin lens pre-design, first and third order analytical methods, and computer-based design using Zemax. Designs include: Wollaston and Chevalier landscape lenses, a 10X microscope objective, the Rapid Rectilinear and Celor lenses, Cooke triplet and Petzval portrait lenses, and a telephoto lens. Prerequisites OSE 541 or EE 541 or PH 541 or Permission of Instructor.

OSE 670 - OPT DESIGN & MANUFACTURING
Semester Hours: 3

Practical aspects of optomechanical design, material selection, fabrication and integration of precision optical components and systems for commercial, space, and military application. Topics include: fixture design, tolerance analysis, machining methods, thermal stabilization, integrated computer-aided design and analysis, diamond machining, finishing and plating techniques.

OSE 690 - SEL TOPICS IN OPT SCI & ENGR
Semester Hours: 1-3

Sample topics include optical thin films and optical instrument systems analysis.

OSE 710 - OPTICAL SYSTEM DESIGN
Semester Hours: 3

Integrated view of what it actually takes to build a real optical system. All the tools of the 'trade' are utilized, including conceptual design and computer modeling (optical and mechanical), control system design, fabrication issues, cost/schedule and system testing. Use of geometric and physical optics, radiometry, sources and detectors, electro-optics controlled positioning and feedback, environmental influences, optical systems architecture, opto-mechanical design, precision optics fabrication technologies, optical metrology, and operational and survivability testing.

OSE 742 - OPTICAL SCATTERING THEORY
Semester Hours: 3

Scattering and absorption of radiation by particles with spherical symmetry and arbitrary shapes described using Maxwell's equations, vector Helmholtz equations, the Jones and Mueller calculus, and numerical techniques. Prerequisites: PH 631, or EE 609, or ATS 561.

OSE 755 - QUANTUM DEVICES
Semester Hours: 3

Quantum aspects of optical, electronic, and semiconductor devices approached from a phenomenological/physical point of view. Topics will include: Quantum well devices, optical modulators, optical detectors, quantum Stark effects, electro-optic devices, high speed optical devices, frequency chirping in high speed devices and system applications.

OSE 790 - SEL TOPICS IN OPT SCI & ENGR
Semester Hours: 1-3

Sample topics include optical thin films and optical instrument systems analysis.

OSE 792 - OSE SEMINAR
Semester Hours: 0

This "brown bag" monthly seminar series is conducted jointly with the Huntsville Electro-Optical Society which sponsors the speakers. Presentations are given on a diverse range of optics and optics-related topics. All OSE students are expected to attend three of these seminars per semester.

OSE 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9

Required each semester student is enrolled and receiving direction on a doctoral dissertation. The following optics courses are also available to students in the OSE program. See listings under indicated departments.

Physics (PH)

PH 531 - INTRODUCTION TO PLASMA DYNAMICS
Semester Hours: 3

Single-particle motion in magnetic fields; fluid equations and fluid theory wave modes; MHD theory, stability, and wave modes; introduction to kinetic theory and hot plasma wave modes. (Same as MAE 531).

PH 541 - GEOMETRICAL OPTICS
Semester Hours: 3

Foundations and physics of geometrical optics, Fermat's principles and Huygen wavelets, refraction and reflection. The many forms of Snell's Law. Optical path lengths, geometrical wavefronts and rays. Ray tracing, ynu-chart and matrix methods. Gaussian imagery and paraxial optics, conjugate elements, cardinal points, and image-object relations. Stops and pupils, chief and marginal rays, vignetting, and the optical or Lagrange invariant. The y-ybar diagram, design of common systems: objectives, magnifiers, microscopes, collimators and detectors. Optical glasses and chromatic aberrations, wavefront and transverse aberrations, spot diagrams and ray fan plots. (Same as OSE 541 and EE 541) Fall.

PH 542 - PHYSICAL OPTICS
Semester Hours: 3

Scalar and electromagnetic waves, polarization, coherence, reflection and refraction; two beam and multiple beam interference, interferometers, Fabry-Perots, thin films, diffraction, and absorption and dispersion. (Same as OSE 542 and EE 542.) Fall, Spring.

PH 544 - OPTOELECTRONICS
Semester Hours: 3

Review of polarized light, the Jones and Mueller calculi. Propagation of light in birefringent material. Modulation of light using electro-optic effect, Kerr effect, acousto-optic effect, and Faraday effect. Elements of photodetection and detectors, signal processing, and signal-to-noise. Design and analysis of beam scanners, optical rf-spectrum analyzer, optical sensors, and optical communication systems. (Same as OPT 444 and OPE 451.) Fall even years.

PH 546 - RADIOMETRY, DETECTORS & SOURCE
Semester Hours: 3

Theory and practice of radiometry and photometry. Blackbody radiation and Lambertian sources. The propagation of radiant energy in free space and through optical systems. Detector classes, responsivity, bandwidth, and noise. Power spectral density, properties of sources, photon noise. (Same as OPT 446, OSE 546.) Spring even years.

PH 551 - QUANTUM MECHANICS I
Semester Hours: 3

Waves and particles; wave packets and the uncertainty principle; Schrodinger's equation and wave mechanics; postulates of quantum mechanics; simple systems in one, two and three dimensions; the hydrogen atom; angular momentum and spin; numerical solutions of the Schrodiner equation. Prerequisites require undergraduate quantum mechanics course(s).

PH 553 - INTRODUCTION TO PARTICLE PHYSICS
Semester Hours: 3

Survey of elementary particle physics with emphasis on the Standard Model of quarks, leptons and gauge bosons. Lorentz transformations, four-vectors and relativistic kinematics, angular momentum and spin. Lifetimes, cross-sections and Feynman rules. Quantum electro- and chromo-dynamics, Dirac equation and renormalization. Physics beyond the Standard Model. Prerequisite: PH 551 or PH 651.

PH 560 - INTRODUCTION TO SOLID STATE PHYSICS I
Semester Hours: 3

Crystal binding and crystal structure. Crystal structure determination. Phonons and lattice vibrations. Free electron gas. Electronic energy band theory. Prerequisite with concurrency: PH 551. (Same as MTS 660.) Fall, even years.

PH 561 - INTRODUCTION TO SOLID STATE PHYSICS II
Semester Hours: 3

Thermal properties of solids. Electronic properties, optical properties, electronic properties in a magnetic field, semiconductor devices, magnetism, superconductivity, defects and alloys, dislocations and crystal growth, non-crystalline solids, surfaces and interfaces. (Same as MTS 661.) Spring, odd years. Prerequisite: PH 560.

PH 570 - OPTICAL & PHOTONIC SYSTEMS DESIGN
Semester Hours: 3

Review of paraxial optics, ray tracing codes, aberration and diffraction calculations; acousto- and electro-optic modulators, spatial light modulators; fibers, fiber splicers and connectors; gratings and diffractive optical elements; laser and light emitting diodes, photodetectors and CCD arrays; correlator systems; optical communication networks; signal processing systems design. Fall, even years. Prerequisite: PH 541.

PH 571 - STELLAR ASTROPHYSICS
Semester Hours: 3

Structure and physical processes of stars from the interior to the atmosphere: energy production and transfer, atmospheric properties, and observed spectal features. Models for stellar structure. Star formation and evolution, including the effects of a companion. Prerequisites: upper level undergraduate astrophysics course, and upper level undergraduate E&M course.

PH 572 - GALAXIES & COSMOLOGY
Semester Hours: 3

Galactic structure; Oort's constants; rotation curves; galaxy types; structure formation and evolution; Hubble expansion; Friedmann equation; cosmic microwave background; radiation and matter eras; primordial nucleosynthesis; dark matter/energy issues; development of structure in the early universe; horizon & flatness problems; inflation. Prerequisite: PH 571 or advanced undergraduate Astrophysics course, suggested PH 553, PH 621. Spring, odd years.

PH 574 - INTRODUCTION TO GENERAL RELATIVITY
Semester Hours: 3

An introductory course on general relativity and gravitational physics. General relativistic phenomena as inferred from the behavior of particles and light rays for a selection of spacetimes. Major properties of such objects as black holes, wormholes, gravitational waves, and the universe as a whole. Prerequisites: Undergraduate level special relativity and classical mechanics.

PH 579 - OBSERVATIONAL ASTROPHYSICS
Semester Hours: 3

Astronomical coordinate systems and time; spherical astronomy; telescope designs; basic optics; CCDs; infrared arrays; observational calibration and noise; high resolution imaging techniques (e.g., adaptive optics); spectroscopy; and high and low energy observational techniques (e.g., X-ray telescopes, radio interferometry). Students will also conceive their own projects, write observing proposals, and convene as a Time Allocation Committee to review proposals and schedule telescope time. Students will acquire, reduce, analyze and interpret data from one of the allocated projects, and present the results in a short paper. Prerequisites: upper-level undergraduate astrophysics courses.

PH 589 - SELECTED TOPICS
Semester Hours: 3

PH 601 - CLASSICAL DYNAMICS I
Semester Hours: 3

Variational principles and Lagrangian mechanics, rigid body motion, Hamilton's equations, and theory of small oscillations. Aspects related to modern physics. Fall.

PH 607 - MATHEMATICAL METHODS I
Semester Hours: 3

Review of vector calculus and coordinate systems, introduction to tensors, matrices, infinite series, complex variables with applications to calculus of residues, partial differential equations, and Sturm-Liouville theory. Orthogonal functions, gamma functions, Bessel functions, Legendre functions, special functions, Fourier series, integral transforms and equations. Prerequisite: upper level undergraduate differential equations courses. (Same as MA 607) Fall.

PH 609 - MATHEMATICAL METHODS II
Semester Hours: 3

Continuation of PH 607. (Same as MA 609.) Spring. Prerequisite: PH 607.

PH 615 - INTRODUCTION TO RADIOLOGICAL PHYSICS
Semester Hours: 3

Prerequisite: PH 551.

PH 616 - PHYSICS OF RADIATION THERAPY
Semester Hours: 3

Operation of X-ray tubes, electron linear accelerators, cobalt-60 units, cyclotrons. Principles of accelerating waveguides, klystrons, magnetrons, electron scattering foils, flattening filters, monitor chambers, collimators. Percent-depth-dose (PDD), tissue-phantom-ratio (TPR), tissue-air-ratio (TAR), peak scatter factor (PSF). Equivalent squares, calculation of monitor units for specific dose rates, collimator scatter factor (Sc), phantom scatter factor (Sp). Principles of brachytherapy: calibration of sources, absorbed dose using AAPM TG-43 protocol. Calculation of isodose distributions: convolution/superposition, Monte Carlo calculations. Intensity modulated radiation therapy (IMRT), stereotactic radiosurgery, tomotherapy, total-body irradiation. Prerequisite: PH 615.

PH 621 - STATISTICAL MECHANICS KINETIC THEORY I
Semester Hours: 3

Statistical methods, systems of particles, statistical thermodynamics, applications of thermodynamics, methods of statistical mechanics, applications of statistical mechanics, equilibrium between phases of chemical species. Summer.

PH 622 - STATISTICAL MECHANICS KINETIC THEORY II
Semester Hours: 3

Addresses the statistical description of collective processes in gases, plasmas, and fields based on the use of transport theory. The course provides the basis for the mathematical description of the basic kinetic and continuum models used in all fields of solar, space and astrophysics. Addresses specifically the transport of gases and Chapman-Enskog theory, magnetohydrodynamics in a collisional description, energetic particle transport in collisionless plasma, the transport of low-frequency turbulence, and if time permits, the transport of radiation. Prerequisite: PH 621.

PH 631 - ELECTROMAGNETIC THEORY I
Semester Hours: 3

Electrostatic and magnetostatic fields in vacuum and materials, Maxwell's equations, electromagnetic waves. Prerequisites: upper level undergraduate E&M course(s), PH 607. Fall.

PH 632 - FOURIER OPTICS
Semester Hours: 3

Introducing the optical system as an invariant linear system, convolution, Sommerfield's diffraction integral, Fourier Transform, angular spectrum, coherent and incoherent imaging, optical transfer function. Prerequisite PH 542 (Same as OSE 632 and EE 632.) Spring.

PH 636 - INTRODUCTION TO SPACE PLASMA PHYSICS
Semester Hours: 3

Electromagnetic fields and particles in space; solar wind and solar energetic particles; currents and plasma waves in space; shocks and particle acceleration mechanisms; solar flares and coronal mass ejections. Spring, even years. Prerequisite: PH 531.

PH 642 - OPTICAL PHYSICS
Semester Hours: 3

Fundamental physics of optics and optical phenomena. Electromagnetic fields, sources and propagation. Coherence, interference, polarization, scattering, reflection, refraction, and diffraction. Optical properties of conductors and insulators. Introduction to quantum optics, lasers, and optical device physics. Offered Spring, even years. Prerequisite: PH 551.

PH 645 - LASERS I
Semester Hours: 3

Incoherent light sources; atomic and molecular energy levels; equation or motion for probability amplitudes using first-order time dependent perturbation theory; electric dipole interaction. Einstein rate equations and the Planck radiation law; induced dipole moments and frequency dependent susceptibility. Homogeneous and inhomogeneous line broadening mechanisms; laser cavities and modes, elementary laser theory, practical lasers. Prerequisite: upper level undergraduate E&M courses. (This course may be substituted for OSE 645.) Summer.

PH 651 - QUANTUM MECHANICS I
Semester Hours: 3

Free particle motion. Principles of wave mechanics. The Schrodinger equation and one-dimensional potentials. Approximation techniques: WKB, variational method, perturbation theory. Numerical methods. Prerequisites: undergraduate quantum mechanics or modern physics, some high-level programming (e.g., C++, Fortran, Mathematica) experience. Prerequisite with concurrency: PH 607.

PH 652 - QUANTUM MECHANICS II
Semester Hours: 3

Spherically-symmetric potentials, angular momentum, spin. Identical particles. Time-dependent perturbation theory. Scattering. Atomic structure. Prerequisite: PH 651 and PH 609.

PH 654 - OPTICAL TESTING
Semester Hours: 3

Spherometry; refractive index measurements; optical bench measurements of imaging systems via T-bar nodal slide (effective focal length, f-number, axial color, field curvature and distortion, transverse ray aberrations); illumination falloff; image resolution tests (finite object); modulation transfer function; star image testing; knife edge tests; Hartmann tests; Fizeau interferometer and testing configurations; null lens testing of aspheres; wavefront measurements (point diffraction interferometer, radial shear interferometer); (Same as OSE 654.) Spring.

PH 655 - APPLIED QUANTUM MECHANICS
Semester Hours: 3

Application of quantum mechanics in solid state, electronics, materials science, and optics. Topics to include: Hydrogen atom and molecule, excitons, phonons, Bloch's theorem, periodic boundary conditions, electrons and holes, band structure of simple semiconductors, dipole transitions, optical constants, absorption and emission processes. Introduction to device physics. (Same as OSE 655) Prerequisite: PH 651 or OSE 555.

PH 661 - DATA ANALYSIS & STATISTICAL METHODS FOR ASTROPHYSICS
Semester Hours: 3

Moments of a distribution, linear and non-parametric correlation, central limit theorem, error estimation, least squares modeling, estimating model parameters, Monte Carlo techniques. Bayes' theorem and likelihood methods. Energy and temporal spectral analyses. Power density spectra: periodic and quasi-periodic systems. Prerequisite: upper level undergraduate mathematics courses. Fall, even years.

PH 670 - OPTOMECHANICAL DESIGN & MANUFACTURING
Semester Hours: 3

Practical aspects of optomechanical design, material selection, fabrication and integration of precision optical components and systems for commercial, space, and military applications. Topics include: fixture design, tolerance analysis, machining methods, thermal stabilization, integrated computer-aided design and analysis, diamond machining, finishing and plating techniques. (Same as OSE 670.) Fall, even years. Prerequisite: OSE 541.

PH 671 - OPTICAL FABRICATION & TESTING
Semester Hours: 3

Fabrication and testing techniques of optical components and systems. Component measurements: refractive index, curvature, focal lengths, cardinal points and field curvature. Wavefront aberration and transverse aberration function measurements: geometric tests, interferometric tests, null tests. Basics of grinding, figuring, polishing and optical coating. Laboratory experience in manufacturing, polishing, testing, and coating reflective or transmissive optics. Offered on demand.

PH 673 - HIGH ENERGY ASTROPHYSICS
Semester Hours: 3

Radiative Transfer: Blackbody, scattering and diffusion, bremsstrahlung, synchrotron emission, Compton scattering. Relativistic electromagnetism. Plasma effects and introduction to magnetohydrodynamics. Observational aspects of white dwarves, neutron stars and black holes. Accretion and astrophysical jets. Active galactic nuclei and gamma-ray bursts. Offered Fall of odd years.

PH 674 - GENERAL RELATIVITY & GRAVITATION I
Semester Hours: 3

Special and general relativity: vector and tensor calculus; curved manifolds; elements of differential geometry; physics in curved spacetime; the Einstein equations; simple solutions of the Einstein equations; Schwarzschild geometry and the Kerr spacetime; black holes; sources, propagation, and detection of gravitational waves; a variational approach to general relativity; special topics.

PH 679 - EDUCATION CAPSTONE COURSE
Semester Hours: 3

Capstone experience for student pursuing secondary education certification option for MS degree. Student develops 1 credit, 100 level physics course on instructor-approved topic. Development includes syllabus, textbook evaluation, representative homework assignments, midterm, final, lecture outline, and lecture notes.

PH 689 - SELECTED TOPICS
Semester Hours: 1-3

Offered upon demand. Topics include: optical surface characterization, superconductivity, aeronomy, properties of solids, laser propagation, collision theory, magnetohydrodynamics. Fall, Spring, Summer.

PH 699 - MASTER'S THESIS
Semester Hours: 3-6

Minimum of 6 credit hours required for Plan I M.S. students. Maximum of nine hours credit toward Ph.D. course requirements awarded upon successful completion of master's thesis. Fall, Spring, Summer.

PH 731 - ADVANCED PLASMA THEORY
Semester Hours: 3

Vlasov theory; electrostatic and electromagnetic waves in a hot plasma; wave damping processes; micro-instabilities; quasilinear theory; numerical simulation of plasmas; applications to space and astrophysics. Spring, odd years.

PH 732 - ELECTROMAGNETIC THEORY II
Semester Hours: 3

Continuation of PH 631. Radiation from accelerated charges; Hamiltonian formulation of electrodynamics; covariant formulation of electrodynamics. Spring Prerequisite: PH 631.

PH 733 - QUANTUM DEVICES
Semester Hours: 3

Quantum aspects of optical, electronic, and semiconductor devices approached from a phenomenological/physical point of view. Topics will include: Quantum well devices, optical modulators, optical detectors, quantum Stark effects, electro-optic devices, high speed optical devices, frequency chirping in high speed devices and system applications. (Same as OSE 755.) Fall, odd years. Prerequisite: PH 551 or PH 651 or OSE 555.

PH 742 - OPTICAL SCATTERING THEORY
Semester Hours: 3

Scattering and absorption of radiation by particles with spherical symmetry and arbitrary shapes described using Maxwell's equations, vector Helmholtz equations, the Jones and Mueller calculus, and numerical techniques. Prerequisites: PH 631, or EE 609, or ATS 561.

PH 745 - LASERS II
Semester Hours: 3

The propagation of optical beams in homogeneous and lens-like media, optical resonators, interaction between radiation and atomic systems, laser oscillations and specific laser systems, switching and mode-locking of lasers, noise in laser amplifiers and oscillators, modulation of optical radiation. Fall, even years. Prerequisite: PH 645.

PH 746 - NON-LINEAR OPTICS
Semester Hours: 3

PH 751 - COMPUTATIONAL QUANTUM MECHANICS
Semester Hours: 3

Numerical methods for solving the Schrodinger equation. Numerical approximation techniques: Rayleigh-Ritz theory. Quantum scattering from a spherically-symmetric potential. Multi-electron atoms: Hartree self-consistent field theory, Hartree-Fock theory, density functional theory. Electronic structure of diatomic molecules. Ab initio treatment of molecular structure. Additional extensive application to problems in molecular, atomic, and nuclear physics. Prerequisites: PH 652, high-level programming (e.g. C++, Fortran, Mathematica) experience. Offered on demand.

PH 752 - QUANTUM MECHANICS II
Semester Hours: 3

PH 753 - QUANTUM FIELD THEORY
Semester Hours: 3

Formalism of quantum field theory, construction and evaluation of Feynman diagrams for quantum electrodynamics and the weak interaction, first-order processes, renormalization, particle scattering and decay, nucleon structure, introduction to quantum chromodynamics, accelerator experiments, and astrophysical applications. Prerequisites: PH 609 and PH 652.

PH 789 - SELECTED TOPICS
Semester Hours: 1-3

Topics include superconductivity, advanced plasma theory, properties of solids, laser propagation, collision theory, quantum electronics, gravitational theories. Fall, Spring, Summer.

PH 792 - PHYSICS SEMINAR
Semester Hour: 1

Students attend seminars by invited speakers. Two semesters are required for all M.S. students and three semesters for Ph.D. students. Does not count toward minimum degree requirements. Fall, Spring.

PH 795 - ADV PHYSICS PROJECT LAB
Semester Hours: 3-6

Advanced laboratory research in one of the departmental research groups. Student works on an independent or group project. Completion of the course requires a written report that becomes part of the student's record. Fall, Spring, Summer.

PH 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9

Prerequisites: Students must have passed the comprehensive examination at Ph.D. level and have Ph.D. advisor's approval. No more than 9 hours may be taken prior to passing the qualifying examination. Fall, Spring, Summer.

Political Science (PSC)

PSC 520 - FEDERALISM & INTERGOVERMENTAL RELATIONS
Semester Hours: 3

Designed to help students navigate complex relationships among the 90,000+ governments in the U.S., this course examines the framework of federalism and the tools available to governments to influence public policy outcomes. Students will investigate the impacts of these relationships on policy.

PSC 540 - REGIONAL STUDIES
Semester Hours: 3

An examination of the politics of Asia, Latin America, the Middle East, or Africa, depending on the term. We focus on select countries or themes within each region as part of our study of political structures, history, and culture, for a deeper understanding of each area.

PSC 551 - LAW, COURTS & PUBLIC POLICY
Semester Hours: 3

Examines the role of the courts in the making of public policy in the United States, with an emphasis on the use of the courts by interest groups seeking to achieve specific policy goals.

PSC 561 - ECONOMIC DEVELOPMENT IN THE SOUTHERN HEMISPHERE
Semester Hours: 3

Understand economic development in the developing world. Examine economic transformation & social change towards addressing poverty, inequality, & social justice. Highlight domestic & international institutional, structural, & political sources of economic dynamism/lack thereof in the Global South.

PSC 562 - DECISION-MAKING IN FOREIGN & SECURITY POLICY
Semester Hours: 3

An examination of the history, culture, policies, and structures shaping the development of U.S. foreign and national security policies. Special attention will be placed on the roles of Congress, the National Security Council, Defense Department, State Department, and the intelligence community.

PSC 564 - AMERICAN FOREIGN POLICY
Semester Hours: 3

An examination of the substance of the contemporary U.S. foreign policies and the goals the country seeks to achieve around the world. Students will attempt to evaluate the effectiveness of those policies and examine why it is often difficult for the country to achieve its goals.

PSC 566 - NATIONAL SECURITY STRATEGY & POLICY
Semester Hours: 3

An examination of current U.S. national security strategy and policy. The course will review current strategy and policy documents, examine specific responses to the variety of threats facing the United States, and evaluate whether those policies are effective at achieving their goals.

PSC 570 - ISSUES IN SECURITY POLICY
Semester Hours: 3

Examination of select security-related policy issues. The content of this course will vary during different terms, and students may take the course multiple times so long as the content differs.

PSC 580 - SPECIAL TOPICS IN POLITICAL SCIENCE
Semester Hours: 1-3

Selected topics in local, state, national and world politics. This course may be repeated for credit as long as content of course has changed.

PSC 600 - THE AMERICAN POLITY
Semester Hours: 3

Comprehensive and intensive review of the philosophical foundations; formal institutions; and social, economic, and political dynamics of the American polity, with particular emphasis on their relationship to the making of public policy.

PSC 601 - THE PUBLIC POLICY PROCESS
Semester Hours: 3

This course offers an analytical framework for critical thinking about public policy in the U.S.- the inputs, processes, and outputs of governmental activity. Also considers factors that influence policy processes, as well as impacts of decisions by different governments and actors.

PSC 610 - PUBLIC MANAGEMENT PROFESSIONS
Semester Hours: 3

Introduction to public management as a field of study and practice. Review of basic literature. Emphasis on ethics in public service.

PSC 611 - PUBLIC PERSONNEL ADMINISTRATION
Semester Hours: 3

Purposes, functions, and processes of personnel management at the national, state, and local levels.

PSC 612 - BUDGETARY PROCESS
Semester Hours: 3

Governmental revenue and expenditure policies. Budget as a method of administrative and fiscal control.

PSC 615 - SPECIAL TOPICS IN PUBLIC AFFAIRS
Semester Hours: 3

Special and advanced topics in public affairs and public policy. Students must have completed 12 hours in the Public Affairs and Policy program. Instructor permission required. This course may be repeated for credit as long as content of this course has changed.

PSC 630 - PUBLIC VALUES & PUBLIC POLICY
Semester Hours: 3

Critical examination of the value assumptions of social theoretical paradigms that influence the formation, implementation, and evaluation of public policies. Major themes include ideological biases, ethics of social policies, and moral problems of economic distribution and redistribution.

PSC 635 - PROGRAM EVALUATION & METHODS
Semester Hours: 3

This course focuses on program evaluation and methods of social science research. By learning the logic and practice of research design and methods, students will be equipped with the necessary skills and techniques to critically evaluate public policy programs and to design and execute research projects.

PSC 690 - CAPSTONE
Semester Hours: 3

Capstone projects give students the opportunity to integrate classroom learning with relevant problem solving they might face in a professional work situation. Students will conduct independent research on a policy question and formulate recommendations based on their findings. Prerequisite: Instructor Permission.

PSC 695 - INTERNSHIP IN GOVERNMENT
Semester Hours: 1-6

Students may receive academic credit for an internship with a local, state, or federal governmental agency, or with a political, legal, or public policy related organization. Students must have completed 12 hours in the Public Affairs program. Prerequisite: Instructor Permission.

PSC 698 - DIRECTED READINGS & RESEARCH
Semester Hours: 3

Supervised in-depth readings and/or individual research in an area of specialized interest to both student and instructor.

PSC 699 - MASTER'S THESIS
Semester Hours: 1-3

Required every semester a student is writing and receiving direction on a master's thesis. A minimum of two terms and six thesis hours is required for the thesis option. No more than six hours credit may be applied toward the degree.

Psychology (PY)

PY 500 - INTRODUCTION TO CLINICAL & COUNSELING
Semester Hours: 3

PY 500 introduces clinical/counseling psychology and professional psychology. History of diagnosis and treatment, theoretical models in counseling, contemporary practice models, research basis of clinical/counseling psychology, empirically validated techniques, and doctoral program models are covered.

PY 502 - INDUSTRIAL & ORGANIZATIONAL PSYCHOLOGY
Semester Hours: 3

Application of basic principles of learning, motivation, and perception to typical industrial and organizational problems. Same as ISE 502.

PY 503 - HUMAN FACTORS PSYCHOLOGY
Semester Hours: 3

Study of human performance in human-technology-environment systems. Consideration of human capabilities and limitations as related to controls and displays, and the role of human cognition in decision-making and training effectiveness. Same as ISE 503.

PY 504 - THEORIES OF COUNSELING
Semester Hours: 3

This course is designed to introduce theories of psychotherapy and the process of psychotherapy and counseling. This course is a survey of counseling/psychotherapy models and techniques with emphasis on Empirically Validated Therapies (EVT) and traditional models with substantial support in the research and clinical literature.

PY 505 - PSYCHOPHARMACOLOGY
Semester Hours: 3

Introduction to drug classification and action with emphasis on physiological and psychological interactions. Same as BYS 505.

PY 506 - PSYCHOLOGY OF WOMEN
Semester Hours: 3

Examines theory and research in the psychological functioning of women, both in the United States and other nations. Topics include achievement and education, mental and physical health issues, biological influences on women's behavior, and victimization of women.

PY 507 - CROSS-CULTURAL PSYCHOLOGY
Semester Hours: 3

Examines psychological similarities and differences between members of industrialized and non-industrialized cultures. Comparisons will include development, social interaction, personality, cognition, psychological health and treatment, work, and acculturation.

PY 508 - TEAMWORK & TEAM PROCESSES
Semester Hours: 3

This course provides a basic introduction to teams and teamwork processes. The foundation of the course is research-based; topics will be approached from the context of empirical research that has been conducted. The types of research designs that are typically used in team research are addressed.

PY 509 - PSYCHOLOGY OF AGING
Semester Hours: 3

PY 509 examines psychological processes in adulthood and aging. Emphasis is placed on contemporary theories, methodological issues and how psychological, biological, social and environmental factors interact to predict growth, maintenance or decline in abilities throughout adulthood and aging.

PY 510 - TASK ANALYSIS & PROTOTYPING
Semester Hours: 3

This course introduces students to methods for analyzing user actions as they interact with software and tools to complete tasks. Students apply a range of prototype techniques from fast, low-fidelity prototypes to interactive high-fidelity prototypes.

PY 514 - ADVANCED LEARNING
Semester Hours: 3

Analysis of learning principles from simple relationships with animals to the complexities of human language and problem solving.

PY 515 - ADVANCED DEVELOPMENTAL PSYCHOLOGY
Semester Hours: 3

Examination of cognitive, psychoanalytic, ethological, behavioral, and humanistic theories of development.

PY 520 - SPECIAL TOPICS
Semester Hours: 3

Pre-announced special areas in seminar discussion, laboratory work, or practicum. May be taken twice for credit.

PY 530 - PSYCHOMETRICS
Semester Hours: 3

History and development of psychological testing with special emphasis given to both theory and process of effective evaluation.

PY 533 - PSYCHOPATHOLOGY
Semester Hours: 3

Selected disorders such as depression, anxiety disorders, and personality disorders from different theoretical orientations with emphasis on cognitive behavioral theory.

PY 534 - PSYCHOLOGY AND LAW
Semester Hours: 3

This seminar is a survey of the major topics represented in the field of Psychology and Law. We will focus on how psychological research can contribute to a better understanding of issues related to law.

PY 537 - PSYCHOBIOLOGY OF STRESS AND ILLNESS
Semester Hours: 3

Overview of physiological stress responses and their influence on health behavior and illness. Same as BYS 537.

PY 580 - PROSEMINAR: COGNITIVE
Semester Hours: 3

Critical examination of the cognitive approach to areas of study within psychology. Students are responsible for library research, writings, and presentation of selected topics.

PY 607 - PROFESSIONAL DEVELOPMENT IN RESEARCH AND TEACHING
Semester Hour: 1

Focus on developing knowledge and skills relevant to future goals regarding teaching, either in academic or professional settings.

PY 608 - GRADUATE PRACTICE TEACHING AND CAREER EXPLORATION
Semester Hour: 1

Focus on developing knowledge and skills relevant to future goals, such as career exploration, internship opportunities, resume writing, and graduate program exploration. Required of first year students.

PY 610 - EXPERIMENTAL DESIGN
Semester Hours: 3

Design and use of the experiment as an inferential tool. Issues pertaining to reliability, validity, manipulation of independent variables, and sampling will be examined. Implementing statistical techniques for analysis of data generated by experimental designs.

PY 611 - STATISTICS FOR EXPERIMENTAL METHODS
Semester Hours: 4

Statistical techniques for analysis of data generated by experimental designs.

PY 612 - MULTIVARIATE ANALYSIS
Semester Hours: 3

Covers how to conduct, interpret, and summarize multivariate analyses. Prerequisite: PY 611 (B- or better).

PY 615 - GRADUATE SEMINAR
Semester Hours: 3

Intensive analysis of selected theoretical or applied topics relating to psychological development. May be taken more than once for credit.

PY 624 - HUMAN FACTORS IN SYSTEM DESIGN
Semester Hours: 3

Introduces basic principles of methods analysis and ergonomics. Methods analysis topics include: work measurement tools, work sampling, job analysis, job evaluation, and development and use of flow and activity charts for methods improvement. Same as ISE 624.

PY 641 - CONCENTRATED READINGS/RESEARCH SPECIALIZED AREA
Semester Hours: 3

Independent readings and/or experiments in an area within the student's field of specialization. One requirement is a research proposal, which will be reviewed by the faculty advisor. May be taken more than once for credit. Prerequisite: Instructor approval.

PY 650 - SUPERVISED RESEARCH
Semester Hours: 1-6

Laboratory or applied research concerning a particular topic, approved and supervised by a PY faculty member. The student may work on an independent or group project. May be taken more than once for credit.

PY 675 - INTERNSHIP IN APPLIED PSYCHOLOGY
Semester Hours: 1-6

Students are placed in a field setting under the supervision of a faculty member and a site supervisor. Students receive site-specific training, experience, and individual supervision.

PY 699 - MASTER'S THESIS
Semester Hours: 6

Master's Thesis (0 - 6 semester hours) Required each semester a student is working and receiving faculty direction on a master's thesis. Prerequisite: PY 641.

PY 701 - HUMAN SYSTEM INTEGRATION
Semester Hours: 3

Discover how to adress human-related issues in system development in an integrated manner. Explore principles of human factors engineering, personnel selection, training, safety, and other HSI technical domans. Learn how these activities should be integrated to reduce personnel costs and improve system performance.

PY 702 - COMPUTATIONAL CONCEPTS & INTRODUCTION TO SOFTWARE PROGRAMMING
Semester Hours: 3

Introduces basic-computational concepts and programming skills needed to work with interactive systems. Draws on topics such as log analysis, visualization, prototyping, and data mining. Students analyze data to inform user research and design.

PY 703 - COMPUTATIONAL CONCEPTS & INTRODUCTION TO SOFTWARE PROGRAMMING
Semester Hours: 3

Three broad categories of topics within human-computer interaction (HCI) are covered: (a) principles and characteristics of the interaction between humans and computers; (b) techniques for designing and evaluating user-centered systems; and (c) cutting-edge research and development in HCI.

PY 704 - HUMAN MACHINE SYSTEM DESIGN
Semester Hours: 3

Techniques for man-machine system designs in which cognitive and dynamic aspects are of major importance. Applications to computer-interface design, auto/semiautomated systems, military systems, etc. Topics include information processing, decision making, reaction times and signal detection theory.

PY 705 - USABILITY EVALUATION AND TESTING
Semester Hours: 3

This course covers all of the aspects of specifying, planning, executing, and reporting usability assessments on products, services and systems. Formative and summative assessments are covered, as are "discount" usability methods. This course is project based.

PY 706 - MANAGEMENT OF COMPLEX SYSTEMS
Semester Hours: 3

Focuses on how to design and improve complex work systems. Emphasis on agile development, including sprints using scrum teams to achieve rapid interaction design with system users, developers and owners. Investigates decision support systems, sense making and adaptation in amgibuous situations.

PY 707 - ERGONOMICS AND REGULATIONS IN USER CENTERED DESIGN
Semester Hours: 3

Covers internationa, military and occupational health and safety standard requirements, regulations and guidelines for ergonomics of human-centered design principles and activities throughout the life cycle of human interactive or work systems.

PY 708 - RAPID PROTOTYPING
Semester Hours: 3

Review fundamentals of designing and prototyping human-centered interactive systems and environments that include software and hardware components. Students build projects using electronic devices and fabrication tools. Provides hands on experience in a project-based, studio environment.

PY 709 - HUMAN ARTIFICIAL INTELLIGENCE INTERACTION
Semester Hours: 3

Addresses agency and initiative, AI and ethics, bias and transparency, confidence and errors, human augmentation and amplification, trust, mised-initiative systems, and programming by example. Students should be comfortable with programming; assignments with primarily use Javascript.

PY 710 - MACHINE LEARNING FOR SOCIAL/BEHAVIORAL RESEARCH
Semester Hours: 3

Covers a wide range of learning algorithms that can be applied to a variety of problems such as decision trees, rule-based classification, support vector machines, Bayesian networks, and clustering. This course does not assume any prior exposure to machine learning theory or practice.

PY 711 - COMPUTATIONAL PSYCHOLOGY
Semester Hours: 3

The application of computational principles to understanding human behavior. Hands on experience with modeling tools to analyze large data sets.

PY 712 - SOCIAL COGNITIVE NEUROSCIENCE
Semester Hours: 3

Addresses interactions between social-level phenomena, cognitive-level processes, and neural mechanisms that underlie these events. This course will cover basic neurophysiology and cognitive processing theory with the goal of understanding how these foster social preception, cognition and actions.

PY 713 - QUANTITATIVE STATISTICAL METHODS
Semester Hours: 3

Covers methods developed for rigorous quantitative inquiry in Psychology. Students will become familiar with various research design, measurement, and advanced analytic strategies broadly applicable to theory-driven and data-informed quantitative research, the strengths and limitations of each.

PY 714 - MULTIVARIATE STATISTIICS
Semester Hours: 3

Course covers advanced-level multivariate statistical methods (e.g., GLM, MANOVA, MANCOVA), discriminant function analysis, canonical correlation analysis, cluster analysis, and principal components analysis. The focus of this course will be on conceptual understanding and computer applications.

PY 715 - R FOR DATA SCIENCE
Semester Hours: 3

This class will learn how to manipulate larger data sets with current best practices and advancements in data science. This will all be taught using R, a programming environment that is well suited for data science.

PY 718 - ADVANCED STRUCTURAL EDUATION MODELING
Semester Hours: 3

Provides the basic theoretical background necessary for the application of Structural Equation Modeling (SEM) to research problems including model specification, identication, path analysis, estimation, testing fit, respecification, confirmatory factor analysis the interpretation of SEM results. Prerequisite: PY 611.

PY 719 - HISTORY & SYSTEMS
Semester Hours: 3

Survey of psychological systems (theory, research, perspectives) regarding human behavior and mental processes from ancient times to the present.

PY 725 - EYEWITNESS PSYCHOLOGY
Semester Hours: 3

The course covers research and application of psychology knowledge or concepts to the legal system, emphasizing eyewitness memory and topics as, description accuracy, weapon focus, line-up construction, line up administration, showup identification, confidence, and post identification feedback.

PY 730 - FORENSIC/INVESTIGATIVE INTERVIEWS
Semester Hours: 3

Covers the science of forsenic interviewing and detecting deception from an applied cognitive and social perspective. The topics will include: false confessions, The Reid method of interrogation, detecting deception, and implications of research for justice system practices and policies.

PY 735 - CHILD WITNESSES
Semester Hours: 3

Children and adolescents all too frequently become involved in the legal system as victims, witnesses, or perpetrators of crime. This course will apply relevant development research and theory to legal issues of chldren and adolescents.

PY 740 - INTERROGATION & DECEPTION
Semester Hours: 3

In this course students will learn about the science of interrogations and confessions and how to detect deception.

PY 745 - WRONGFUL CONVICTION
Semester Hours: 3

This class will examinethe contributing factors of wrongful convictions as outlined in the Innocence Projct and the National Registry of Exonerations, including eyewitness identification; false confessions, jailhouse informants, police and prosecutorial misconduct and junk science.

PY 750 - ASSESSMENT OF COMPETENCY TO STAND TRIAL
Semester Hours: 3

This course will address the various factors that courts evaluate when determining whether a defendant is competent to stand trail.

PY 762 - PERFORM MEASUR/PRODU IMPROVEMT
Semester Hours: 3

Productivity and performance defined and used to analyze current competitive position of important sectors of US industry with respect to national and international competition.

PY 775 - PROSEMINAR IN SOCIAL PSYCHOLOGY
Semester Hours: 3

Social psychological theories (e.g., attitudes, social cognition, social influence and persuasion) will be examined to understand and address several areas in legal system, including interrogations, conducting line-ups, interviewing child and adult witnesses; jury decision making, race and gender.

PY 780 - APPLIED COGNITIVE PSYCHOLOGY
Semester Hours: 3

This course introduces the basic processes involved in human information processing, including perception, attention, memory, knowledge representations, language, problem-solving, reasoning, and decision-making.

PY 799 - DISSERTATION
Semester Hours: 6

Dissertation (0-6 semester hours) Required each semester a student is working and receiving faculty direction on a dissertation.

Space Science (SPA)

SPA 522 - INTRODUCTION TO PLASMA PHYSICS
Semester Hours: 3

Provides students with an introduction to the basic physical processes associated with plasmas, which permeate all space environments. Both particle and fluid approaches are introduced, and a variety of elementary drift and wave phenomena are derived. Applications of the theory to various plasma instabilities are explored, along with specific examples of where these may occur in space science. While the goal of this course is to prepare students for more advanced topics in space physics, many of the fundamentals covered are equally relevant for students interested in plasma confinement and its associated engineering challenges.

SPA 526 - SPACE WEATHER
Semester Hours: 3

Physics of solar active regions, physics of solar flares and coronal mass ejections (CMEs), the propagation of CMEs, the acceleration and propagation of solar energetic particles, CME interaction with earth's magnetosphere.

SPA 532 - SPACE ORIENTATION EDUCATORS
Semester Hours: 3

A weeklong course at the U.S. Space and Rocket Center in Huntsville, Alabama for pre-service and in-service teachers. The inquiry based workshops are taught around the theme of space exploration include activities to be done across the curriculum. All activities are correlated to National Math, Science, Technology, Social Studies, and Reading Standards. Activities based on curriculum developed by NASA, CAP, NSATA, and the USSRC. Topics include moon, mars, rocketry, propulsion, hydroponics, math, biology, history and literature.

SPA 582 - SCIENCE CAREER PREP
Semester Hour: 1

This course will review many of the soft skills necessary to function as a successful scientist, whether in an academic career, in a federal laboratory, a for-profit research career in a company, or even a commercial career. Your career begins with graduate school, and learning the skills for a successful graduate career will carry over to your professional career. The goal of the course is impart wisdom from successful graduate students and career scientists, providing both a basis for a successful graduate career and your subsequent career. The course will help students reduce the learning things "the hard way" approach by providing guidance for your career path. Each week will focus on a different skill that a career scientist requires.

SPA 610 - ADVANCED MATH METHODS FOR SPACE SCIENCE
Semester Hours: 3

This course will focus on analytical methods for a series of advanced topics with an emphasis on practical applications to space science, such as Vector and Fourier Analysis, ODEs/PDEs in space science, and Green's functions, Spherical Harmonics, Spectral Analysis, Wavelet Transforms, Fractals and Complexity, and Inverse Problems.

SPA 622 - CLASSICAL & QUANTUM STATISTICS
Semester Hours: 3

Statistical methods, systems of particles, statistical thermodynamics, kinetic theory, methods of statistical mechanics, equilibrium between phases of chemical species. Quantum statistics of identical particles. Spin and statistics. Bose-Einstein and Fermi-Dirac distributions.

SPA 623 - TRANSPORT PROCESSES IN SPACE
Semester Hours: 3

Course presents a systematic treatment of classical and anomalous transport theory for gases, plasmas, energetic particles, and low frequency turbulence. The Chapman-Enskog approach is used to derive transport coefficients for neutral gases and collisional plasmas. The relationship between multi-fluid and MHD models is presented. Weak solutions and shock waves are discussed. The transport of energetic particles that experience scattering by magnetic field fluctuations is presented, together with basic models of the turbulence responsible for scattering turbulence transport in expanding flows such as the solar wind. Prerequisite: SPA 622 and SPA 522.

SPA 624 - SPACE PHYSICS I
Semester Hours: 3

A broad introduction to particle, MHD, and kinetic phenomena in space. This course is intended for all students interested in space, astro-, and plasma physics. Course covers fusion processes inside the Sun, solar neutrinos, solar atmosphere, coronal magnetic fields, physical mechanisms of magnetic field line reconnection and magnetic dynamo, the interaction between the solar wind with planets and the interstellar medium, corotating and merged interaction regions, collisional and collisionless shock waves in space. Includes an introduction to charged particle acceleration in the heliosphere. Examines differences between planetary magnetospheres, solar-terrestrial relationships, solar activity, climate, and culture. Prerequisite: SPA 522, SPA 631 (w/concurrency).

SPA 625 - SPACE PHYSICS II
Semester Hours: 3

The course develops a deeper understanding and knowledge of plasma instabilities, kinetic dispersion relations, microinstabilities, electrostatic and electromagnetic instabilities; advanced magnetohydrodynamics including MHD turbulence, reconnection; wave-particle interactions, including basic quasi-linear theory; weak and strong wave turbulence; nonlinear waves; collisionless shock waves. Prerequisite: SPA 624.

SPA 627 - HIGH ENERGY RADIATION DETECTION AND MEASUREMENT
Semester Hours: 3

This course will provide students with basic understanding of radiation detection for space-based missions. This course will cover the basic nuclear processes in radioactive sources and the interaction of radiation with matter. The statistical treatment of experimental data will be reviewed. General characteristics common to all types of detectors will be given. We will then cover specific classes of detectors focusing on ionization, scintillation and semiconductor detectors. Light collection and detection techniques will follow. The student will then be introduced to basic signal processing and timing techniques important to a successful instrument design. This course will be taught from a physicist point of view emphasizing the physical processes and interactions that make detection of radiation possible. This course is suitable for those students interested in detector development or astrophysical data analysis using state-of-the-art technology.

SPA 628 - SOLAR PHYSICS
Semester Hours: 3

The workings of the Sun, from its interior to the outer reaches of the corona and solar wind with emphasis on the fundamental physical processes from both observational and theoretical point of views, including energy release in core of the Sun and its transport to the solar atmosphere, dynamo theory and the generation of the magnetic field of the Sun, solar wind model and and interplanetary magnetic field, kinetic process and particle acceleration in solar flares, plasma emission and radiation transfer, electron beams and solar radio bursts, magnetic reconnection and solar flares.

SPA 629 - ASTROPHYSICAL FLUID DYNAMICS
Semester Hours: 3

Covers astrophysical phenomena occurring outside the boundaries of the solar system. Subjects include stellar structure and rotation, waves and instabilities in astrophysical plasmas, the physics of spherical and disk accretion, supernova blast waves, and charged particle transport and acceleration in cosmic plasmas. Introduction to the principles of stellar formation, helioseismology, stellar dynamo, coronal heating, and astrophysical turbulence. Prerequisite: SPA 522.

SPA 630 - WAVES IN FLUIDS
Semester Hours: 3

Comprehensive introduction to the science of wave motions in fluids. Waves and first-order (hyperbolic) equations, wave hierarchies; gas dynamics and fluid equations; acoustics, nonlinear plane waves, simple waves, shock waves and structure, shock reflection, similarity solutions, supersonic flows in gas dynamics; the wave equation, including plane, spherical and cylindrical waves, geometrical optics, including far-field approximation, caustics, nonhomogeneous media, anisotropy; water waves, including shallow water theory; group velocity, dispersion; nonlinear waves, including Korteweg-de Vries, sine-Gordon, and nonlinear Schroedinger equations, solitons. Prerequisite: SPA 610.

SPA 631 - WAVES AND FIELDS
Semester Hours: 3

This course will cover the following topics: 1) Review of static solutions of the Maxwell equations. Boundary-value applications. Green function solutions. 2) Covariant electrodynamics: Basic application of special relativity to charged particles and fields. Lienard-Wiechert potentials. Solutions to the wave equation. 3) Space Science applications: Thermal Spectra and Particle Distributions. Cyclotron and synchrotron radiation. Bremsstrahlung and collisions. Compton Scattering. Prerequisite: SPA 610.

SPA 632 - IONOSPHERIC AND MAGNETOSPHERIC
Semester Hours: 3

This course will give insights to the Earth's ionosphere and magnetosphere. Seminars cover basic concepts and fundamental plasma physics relevant to the ionosphere and magnetosphere, electrodynamics, electric circuit systems, geomatic storms, and substorms, auroras, etc. Training projects involve the use of satellite data and ground-based observations. Prerequisite: SPA 522.

SPA 634 - INTRODUCTION TO SPACE SCIENCE
Semester Hours: 3

In this course we survey a broad range of research areas that span a multitude of space environments. In each case we investigate the physical conditions of the environment, and look at some of the key current and past science questions and the techniques used to address them. We begin by studying basics of plasma physics and then apply the knowledge to the Sun, from its inner workings to its unusually hot atmosphere. This sets the stage for our subsequent survey of the solar wind and its interaction with planets that leads to the formation of magnetospheres. We also explore the techniques used to understand various space environments, from the design of detectors through the methods used to understand the collected data, to theoretical models and the computational techniques used to solve them.

SPA 636 - ADVANCED SPACE WEATHER
Semester Hours: 3

Advanced topics in Space Weather with emphasis on practical effects and impacts on human technology and society: interaction of solar disturbances with Earth's magnetosphere, Solar Energetic Particles, and their effects; Forecasting and Nowcasting of Space Weather; Space Weather at Mars and other planets. Prerequisite: SPA 522.

SPA 662 - COMPUTATIONAL PHYSICS
Semester Hours: 3

Numerical methods to solve common physics problems using C or Fortran. Numerical integration and differentiation, root finding, data fitting, introductory stochastic methods, linear and non-linear differential equations. Fourier analysis. Elliptic parabolic hyperbolic partial differential equations via finite differences, integro-differential equations. Applications to classical dynamics, electromagnetism, statistical and quantum physics.

SPA 663 - COMPUTATIONAL FLUID DYNAMICS AND MAGNETOHYDRODYNAMICS
Semester Hours: 3

Numerical simulations of various problems in space physics, astrophysics, engineering, and plasma dynamics. Finite-volume and finite-difference, shock-capturing and shock-fitting methods for hyperbolic equations, including gas dynamics, MHD, and shallow water equations. The hierarchy of numerical methods is introduced in a systematic way, starting from standard linear schemes and arriving at modern discontinuity-capturing non-linear methods. Exact and approximate Riemann solvers, characteristic analysis of underlying equations. Different implementations of boundary conditions are introduced in relation with the mathematical properties of quasilinear hyperbolic systems. Prerequisites: SPA 624, SPA 662.

SPA 685 - ANALYSIS SPACECRAFT DATA
Semester Hours: 3

This course is to prepare students for observational research using spacecraft data, especially in-situ measurements of particles and fields. Students will first learn to access spacecraft databases and use softwares of their choice. Students will be introduced to common data analysis methods such as distribution function, model fitting, spectral analysis, etc. Examples of real spacecraft data will be shown to illustrate structures in the heliosphere, such as the HCS, ICME and interplanetary shocks. Finally, students will gain practical experience by working on research projects.

SPA 689 - SELECTED TOPICS
Semester Hours: 3

Selected Topics in Space Science not covered in other courses.

SPA 699 - MASTER'S THESIS
Semester Hours: 1-6

SPA 741 - PHYSICS OF COSMIC RAYS
Semester Hours: 3

Covers two principal areas of cosmic ray physics: 1) cosmic ray origin and acceleration, and 2) cosmic ray transport and detection. Includes galactic cosmic rays, anomalous cosmic rays, and solar energetic particles. Transport theory, acceleration mechanisms and observational signatures. Prerequisite: SPA 623.

SPA 742 - GAMMA-RAY BURSTS AND JETS
Semester Hours: 3

Astrophysical jet sources: kinetic and magnetically-dominated relativistic outflows. Blandford-McKee solution. Photospheres. Relativistic shock physics. Emission in relativistic plasmas. Gamma-ray bursts; observations, theory. Prerequisite: SPA 622, SPA 624.

SPA 771 - COMPETITIVE GRANT WRITING WORKSHOP
Semester Hour: 1

This course is designed for senior level graduate students who are about to graduate and start their professional career. It will introduce students to the real and complete process of competing for grant support. It is comprised of a series of lectures (workshops), case studies, and ends with a formal proposal from each participant and a mock review process.

SPA 789 - SELECTED TOPICS
Semester Hours: 3

Selected Topics in Space Science not covered in other courses.

SPA 796 - JOURNAL CLUB
Semester Hour: 1

This course requires graduate students to read, interpret and present literature critically to fellow students, researchers, and faculty. Students stay abreast of current knowledge in the field, develop presentation skills and promote department unity. Faculty instructor will lead, assign, and provide students feedback on their presentations.

SPA 799 - DOCTORAL DISSERTATION
Semester Hours: 9

Students must have passed the Comprehensive Examination at PhD level and have PhD advisor's approval. No more than 9 hours may be taken prior to passing the Qualifying Examination.

Statistics (ST)

ST 687 - THEORY OF STATISTICS I
Semester Hours: 3

Distribution of statistics based on ordered samples, asymptotic sampling distributions, maximum likelihood, least squares, and other methods of point estimation, Rao-Blackwell theorem and Cramer-Rao inequality, confidence intervals, regions, and their optimal properties. Neyman-Pearson formulation and tests of simple hypothesis against simple alternatives.

ST 787 - THEORY OF STATISTICS II
Semester Hours: 3

Continuation of hypothesis testing, likelihood ratio and unbiased tests, uniformly most powerful tests, power function, nonparametric tests, statistical decision theory, distribution and linear models.

Faculty

A

Adan, Drew, Librarian III, Library, 2017, MLIS, Simmons Graduate School of Library and Information Science.

Adcock, Lawana, Senior Lecturer, Biological Sciences, 2016, PhD, Alabama AM University.

Adurthi, Nagavenkat, Assistant Professor, Mechanical and Aerospace Engineering, 2019, PhD, University at Buffalo.

Aguilar, Amanda, Assistant Professor, Kinesiology, 2023, PhD, University of North Carolina at Greensboro.

Ai, Shangbing, Professor, Math, 2002, PhD, University of Pittsburgh.

Al-Hamdan, Ashraf, Clinical Associate Professor, Civil and Environmental Engineering, 2007, PhD, University of Illinois at Chicago.

Aldukali, Fathi, Lecturer, Electrical and Computer Engineering, 2021, PhD, University of Alabama in Huntsville.

Alewine, Henry, Associate Professor, Accounting, 2010, PhD, University of Kentucky.

Alexander, Susan, Professor, Nursing, 2009, DNP, University of Alabama in Huntsville.

Alfonso, Cristhian, Lecturer, World Languages and Cultures, 2022, PhD, University of Georgia.

Allen, David, Professor, Economics, 1994, PhD, University of Arkansas.

Allen, Mary Beth, Senior Lecturer, Computer Science, 2017, MS, Auburn University.

Allport, Christopher, Associate Professor, Accounting, 2005, PhD, Virginia Polytechnic Institute and State University.

Amiri, Azita, Associate Professor, Nursing, 2012, PhD, University of Alabama at Birmingham.

Anderson, Michael, Associate Dean, Chair, Professor, Civil and Environmental Engineering, 1998, PhD, Iowa State University.

Argentina, Vincent, Associate Professor, Art, Art History Design, 2014, MFA, University of Georgia.

Armentrout, Daniel, Clinical Associate Professor, Mechanical and Aerospace Engineering, 2012, PhD, University of Denver.

B

Bail, Jennifer, Assistant Professor, Nursing, 2020, PhD, University of Alabama at Birmingham.

Baird, James, Professor, Chemistry, 1982, PhD, Harvard University.

Baldwin, Katie, Associate Professor, Art, Art History Design, 2013, MFA, University of the Arts, Pennsylvania.

Balla, Angela, Associate Professor, English, 2006, PhD, University of Michigan-Ann Arbor.

Banerjee Mukherjee, Chaity, Assistant Professor, Computer Science, 2022, PhD, Florida State University.

Bao, Yeqing, Department Chair and Professor, Marketing, 2001, PhD, Virginia Polytechnic Institute and State University.

Bao, Yongchuan, Associate Professor, Marketing, 2014, PhD, University of Southern California.

Bardos, Leslie, Librarian I, Library, 2021, MLIS, The University of Alabama.

Barnby, Elizabeth, Clinical Professor, Nursing, 2009, DNP, University of Alabama in Huntsville.

Barnes, Dilcu, Clinical Assistant Professor , Management, 2017, PhD, Auburn University.

Baudry, Jerome, Professor and Chan Chair, Biological Sciences, 2017, PhD, Paris - Sorbonne University.

Baun, Dylan, Associate Professor, History, 2016, PhD, University of Arizona.

Beal, Aubrey, Assistant Professor, Electrical and Computer Engineering, 2019, PhD, Auburn University.

Beavers, Larissa, Political Science, 2023, MA, American Military University.

Beck, Amy, Clinical Assistant Professor, Nursing, 2018, DNP, University of Alabama in Huntsville.

Beck, Monica, Assistant Professor, Nursing, 2009, MSN, University of Alabama in Huntsville.

Bennewitz, John, Assistant Professor, Mechanical and Aerospace Engineering, 2022, PhD, The University of Alabama in Huntsville.

Betancourt, José, Professor, Art, Art History Design, 2006, MFA, Hunter College.

Bhadani, Rahul, Assistant Professor, Electrical and Computer Engineering, 2023, PhD, The University of Arizona.

Bhatt, Paras, Information Systems, 2023, MS, Prairie View A M University.

Bianchi, Ann, Professor, Nursing, 2007, PhD, Texas Woman's University.

Biswas, Keka, Clinical Instructor, Biological Sciences, 2022, PhD, University of New Mexico.

Bitzer, Phillip, Associate Professor, Atmospheric Science, 2011, PhD, University of Alabama in Huntsville.

Black-Mead, Nilsa, Clinical Assistant Professor, Nursing, 2023, DNP, The University of Alabama in Huntsville.

Blackmon, James, Research Professor, Mechanical and Aerospace Engineering, 2001, PhD, University of California.

Bonamente, Massimiliano, Professor, Physics, 2002, PhD, University of Alabama in Huntsville.

Booth, Joshua, Assistant Professor, Computer Science, 2020, PhD, The Pennsylvania State University.

Bossaller, Daniel, Assistant Professor, Math, 2023, PhD, Ohio University.

Boswell, Beth, Lecturer, English, 2019, PhD, Middle Tennessee State University.

Bowman, Ronald, Senior Lecturer, Electrical and Computer Engineering, 2005, MSEE, Clemson University.

Boykin, Timothy, Professor, Electrical and Computer Engineering, 1992, PhD, Stanford University.

Brizendine, Bramwell, Assistant Professor, Computer Science, 2022, PhD, Dakota State University.

Brothers, Rebecca, Librarian II, Library, 2017, MA, University of Washington.

Brown, Ryan, Lecturer, English, 2020, MA, University of Alabama in Huntsville.

Bruzek, Jennifer, Assistant Professor, Education, 2019, PhD, University of Kansas.

Budisalich, Kimberly, Clinical Assistant Professor, Nursing, 2017, MSN, Samford University.

Buksa, Irena, Associate Professor, World Languages and Cultures, 1990, DA, Syracuse University.

Burel, Joshua, Associate Professor, Music, 2017, DM, Florida State University.

Burns, Laird, Associate Professor, Management, 2009, PhD, Michigan State University.

Burrows, Janice, Lecturer, Math, 2018, MS, Texas AM University.

C

Can, Ege, Clinical Assistant Professor, Economics, 2022, PhD, University of Nevada, Reno.

Carey, Lawrence, Professor, Atmospheric Science, 2012, PhD, Colorado State University.

Carey, Matthew, Associate Professor, Music, 2016, DMA, Texas Tech University.

Carlisle, Rachel, Lecturer, Art, Art History Design, 2022, PhD, Florida State University.

Cassibry, Jason, Professor, Mechanical and Aerospace Engineering, 2004, PhD, University of Alabama in Huntsville.

Chakrabarti, Sukanya, Professor and Pei-Ling Chan Endowed Chair, Physics, 2022, PhD, University of California, Berkeley.

Chamness, Joseph, Clinical Assistant Professor, Nursing, 2021, MSN, University of Alabama at Birmingham.

Che, Haihong, Assistant Professor, Space Science, 2019, PhD, University of Maryland, College Park.

Chen, Howard , Assistant Professor, Industrial Systems Engineering, 2023, PhD, The University of Iowa.

Choup, Anne Marie, Associate Professor, Political Science, 2007, PhD, University of North Carolina at Chapel Hill.

Christopher, Sundar, Professor, Atmospheric Science, 1997, PhD, Colorado State.

Christy, John, Interim Vice President of Research and Economic Development, Director of ESSC, and Distinguished Professor, Atmospheric Science, 1991, PhD, University of Illinois.

Chronis, Themistoklis, Clinical Assistant Professor and Honors Faculty Fellow, Physics, 2017, PhD, University of Connecticut.

Chung, Haeyong, Associate Professor, Computer Science, 2015, PhD, Virginia Polytechnic Institute and State University.

Clark, Stanley, Clinical Professor, Accounting, 2022, PhD, University of Kentucky.

Clarke, Nicholas, Assistant Professor, Finance, 2023, PhD, Florida State University.

Clemmons, Tammy, Clinical Instructor, Nursing, 2006, MSN, University of Alabama in Huntsville.

Cling, Andrew, Professor, Philosophy, 1988, PhD, Vanderbilt.

Coe, David, Associate Professor, Electrical and Computer Engineering, 2002, PhD, Georgia Institute of Technology.

Coley, Lorenzo, Lecturer, Mechanical and Aerospace Engineering, 2018, MS, Mississippi State University.

Conners, Ryan T., Associate Professor, Kinesiology, 2015, PhD, Middle Tennessee State University.

Conway, Joseph, Associate Professor, English, 2011, PhD, Washington University in St. Louis.

Cooper, Judy, Senior Lecturer, Biological Sciences, 2015, MS, University of Alabama in Huntsville.

Cramer, Allie, Education, 2023, EdS, The University of West Alabama.

Crook, Genevieve, Lecturer, Math, 1989, MA, University of Alabama in Huntsville.

Cross, Heather, Senior Lecturer, English, 2007, MA, University of Alabama in Huntsville.

Cruz-Vera, Luis, Associate Professor, Biological Sciences, 2007, PhD, CINVESTAV-IPN, Mexico.

Culumber, Zachary, Assistant Professor, Biological Sciences, 2018, PhD, Texas AM University.

D

Darnell, Amy, Clinical Instructor, Nursing, 2020, MSN, Auburn University.

Davis, Rebecca, Clinical Associate Professor, Nursing, 2009, MSN, University of Alabama in Huntsville.

D'Costa, Anthony, Eminent Scholar and Professor, Economics, 2018, PhD, University of Pittsburgh.

Deans, Carrie, Assistant Professor, Biological Sciences, 2024, PhD, Texas AM University.

Deverapalli, Chakri, Director IT, Lecturer, Information Systems, 2008, MBA, University of Alabama in Huntsville.

Diagana, Toka, Chair and Professor, Math, 2018, PhD, University of Claude Bernard - Lyon 1, France.

Dillihunt, Monica, Associate Professor, Education, 2004, PhD, Howard University.

Duan, Lingze, Professor, Physics, 2007, PhD, University of Maryland.

Dyess, Sarah, Associate Professor, Education, 2016, PhD, Michigan State.

E

Elgindi, Ali, Clinical Assistant Professor, Math, 2022, PhD, University of Chicago.

Elliott, Jeremy M., Faculty Athletic Representative, Department Chair, and Associate Professor, Kinesiology, 2015, PhD, University of Georgia.

Elmore, Elizabeth, Clinical Assistant Professor, Nursing, 2019, DNP, University of Alabama in Huntsville.

English, Jennifer, Associate Dean and Associate Professor, Electrical and Computer Engineering, 2000, PhD, Georgia Institute of Technology.

Etzkorn, Letha, Department Chair and Professor, Computer Science, 1993, PhD, University of Alabama in Huntsville.

F

Fahimi, Farbod, Associate Professor, Mechanical and Aerospace Engineering, 2010, PhD, Sharif U Tech, Tehran.

Fan, Xiaoti, Assistant Professor, Communication Arts, 2022, PhD, The University of Alabama.

Fikes, David, Lecturer, Mechanical and Aerospace Engineering, 2016, MS, University of Tennessee - Knoxville.

Florinski, Vladimir, Professor, Space Science, 2008, PhD, University of Arizona.

Fong, Eric, Professor, Management, 2004, PhD, University of Florida.

Foster, Melissa, Clinical Assistant Professor, Nursing, 2012, DNP, University of Alabama in Huntsville.

Frederick, Robert, Professor, Mechanical and Aerospace Engineering, 1991, PhD, Purdue.

Frendi, Kader, Professor, Mechanical and Aerospace Engineering, 1999, PhD, Brown University.

Friedman, Susan, Senior Lecturer and Honors Faculty Fellow, English, 2008, PhD, University of South Florida.

Frith, Karen, Dean and Professor, Nursing, 2007, PhD, Georgia State University.

Frost, Alanna, Associate Professor, Composition and Rhetoric, English, 2008, PhD, University of Louisville.

G

Gaede, Rhonda, Interim Associate Provost and Associate Professor, Electrical and Computer Engineering, 1992, PhD, University of Texas-Austin.

Gandila, Andrei, Associate Professor, History, 2013, PhD, University of Florida.

Gentry, Sheila, Clinical Assistant Professor, Nursing, 2018, MSN, University of Alabama in Huntsville.

Gholston, Sampson, Chair and Professor, Industrial Systems Engineering, 1997, PhD, University of Alabama in Huntsville.

Gilchrist-Petty, Eletra, Chair and Professor, Communication Arts, 2008, PhD, University of Memphis.

Giles, Amanda, Clinical Assistant Professor, Education, 2023, PhD, The University of Alabama.

Ginga, Nicholas, Assistant Professor, Mechanical and Aerospace Engineering, 2020, PhD, Georgia Institute of Technology.

Ginory, Alejandro, Lecturer, Math, 2023, PhD, Rutgers University.

Glotfelter, Angela, Assistant Professor, Composition and Rhetoric, English, 2022, PhD, Miami University of Ohio.

Gorur, Ravi, Professor, Electrical and Computer Engineering, 2015, PhD, University of Windsor.

Graham, Laura, Clinical Instructor, Nursing, 2023, MSN, The University of Alabama at Birmingham.

Graves, Sara, University Professor, Computer Science, 1978, PhD, University of Alabama in Huntsville.

Greene, Jason, Dean and Professor, Finance, 2016, PhD, Indiana University.

Greene, Nancy Michele, Lecturer and Director, ETL and Collaborative Learning Center, Chemistry, 2016, PhD, Indiana University.

Greer, Anthony, Lecturer, Communication Arts, 2019, MA, University of Alabama.

Gregory, Don, Distinguished Professor, Physics, 1992, PhD, University of Alabama in Huntsville.

Griffin, Robert, Associate Professor and Associate Dean, Atmospheric Science, 2012, PhD, Penn State University.

Grimsley, Reagan, Librarian III, Library, 2017, MA, University of Southern Mississippi.

Guerin, Amy, Associate Professor, Theatre, 2016, MFA, University of Houston.

Guerra, Donna, Clinical Associate Professor, Nursing, 2015, EdD, University of Alabama in Huntsville.

Gunn, Sinceree, Senior Lecturer, English, 2003, MA, University of Alabama in Huntsville.

Guo, Junpeng, Professor, Electrical and Computer Engineering, 2005, PhD, University of Illinois.

Gyasi, Kwaku, Associate Professor, World Languages and Cultures, 1999, PhD, Ohio State University.

H

Hakkila, Jon, Associate Provost for International Services and Academic Integrity, Dean of the Graduate School, and Professor, Physics, 2021, PhD, New Mexico State University.

Hamilton, Frances, Assistant Professor, Education, 2014, PhD, Tennessee State University.

Han, Qingyuan, Associate Professor, Atmospheric Science, 1997, PhD, Columbia University.

Hancock, Hillary, Clinical Instructor, Nursing, 2023, MSN, The University of Alabama at Birmingham.

Hannah, Linda, Lecturer, Psychology, 2019, MS, University of Central Texas, Killeen.

Hardin, Elizabeth, Lecturer, English, 2020, MA, University of Alabama in Huntsville.

Harfouch, John, Associate Professor, Philosophy, 2014, PhD, Penn State University.

Harper, Sara, Assistant Professor, Kinesiology, 2023, PhD, Kent State University.

Hart, Nichole, Lecturer, Art, Art History Design, 2021, MFA, Savannah College of Art and Design.

Harwell, David, Professor, Theatre, 2005, MFA, University of Illinois.

Hauenstein, Jacob, Assistant Professor, Computer Science, 2019, PhD, University of Alabama in Huntsville.

Hazelwood, Rebecca, Lecturer, English, 2018, PhD, University of Louisiana at LaFayette.

Heikes, Deborah, Professor, Philosophy, 1998, PhD, University of Illinois.

Henrie, Alisa, Clinical Assistant Professor, Professional and Continuing Studies, 2019, PhD, Brigham Young University.

Hession, Benjamin, Lecturer, Chemistry, 2022, MS, The University of Alabama in Huntsville.

Hile, Kimberly, Assistant Professor, Education, 2017, PhD, University of Illinois.

Hite, Dennis, Senior Lecturer, Electrical and Computer Engineering, 2005, MSE, University of Alabama in Huntsville.

Ho, Fat, Professor, Electrical and Computer Engineering, 1980, PhD, Southern Illinois University.

Hollingsworth, Angela, Clinical Assistant Professor, Nursing, 2016, DNP, University of South Alabama.

Hollingsworth, Donald (Keith), Professor, Mechanical and Aerospace Engineering, 2011, PhD, Stanford University.

Hovermale, D.J., Clinical Assistant Professor, Information Systems, 2022, PhD, Ohio State University.

Hoy, Haley, Professor, Nursing, 2006, PhD, Vanderbilt University.

Hsu, Liwu, Associate Professor, Marketing, 2012, PhD, Boston University.

Hu, Haiyang, Assistant Professor, Mechanical and Aerospace Engineering, 2023, PhD, Iowa State University.

Hu, Leiqiu, Associate Professor, Atmospheric Science, 2017, PhD, University of Kansas, Lawrence.

Hu, Qiang, Professor, Space Science, 2012, PhD, Dartmouth.

Hunter, Noelle, Lecturer, Political Science, 2019, PhD, West Virginia University.

J

Jackson, Tobin, Lecturer, Math, 2018, PhD, University of Alabama in Huntsville.

Johnson, David, Associate Professor, History, 2005, PhD, Washington University in St. Louis.

Johnson, David, Associate Professor, World Languages and Cultures, 2005, PhD, Washington University in St. Louis.

Johnson, Kathryn, Professor, Art, Art History Design, 2003, MFA, University of Georgia.

Johnson, Molly, Associate Professor, History, 2003, PhD, University of Illinois.

Johnson, Terri, Senior Lecturer, Math, 2011, PhD, University of Alabama in Huntsville.

Joiner, Laurie, Interim Chair and Associate Professor, Electrical and Computer Engineering, 1998, PhD, Clemson University.

Jones, Cynthia, Lecturer, Math, 2020, MS, University of Alabama in Huntsville.

Jones, Keith, Associate Professor, Art, Art History Design, 1996, MFA, Louisiana Tech University.

Jones, Nicholaos, Professor, Philosophy, 2007, PhD, Ohio State University.

Jovanov, Emil, Associate Professor, Electrical and Computer Engineering, 1998, PhD, University of Belgrade.

Joyce, Lillian, Associate Professor, Art, Art History Design, 1997, PhD, University of California, Los Angeles.

K

Kaiura, Leslie, Department Chair and Associate Professor, World Languages and Cultures, 2007, PhD, University of Virginia.

Kane, Michele, Assistant Professor, Nursing, 2023, PhD, Uniformed Services University.

Kang, Chang-kwon, Associate Professor, Mechanical and Aerospace Engineering, 2013, PhD, University of Michigan.

Kannan, Hanumanthrao, Assistant Professor, Industrial Systems Engineering, 2022, PhD, Iowa State University.

Kansakar, Siroj, Lecturer, Math, 2012, PhD, University of Alabama in Huntsville.

Karr, Charles, President, 2022, PhD, The University of Alabama.

Kea-Edwards, Amber, Lecturer, Management, 2021, PhD, Claremont Graduate University.

King, Andrea, Clinical Assistant Professor, Nursing, 2022, DNP, The University of Tennessee Health Science Center.

Knupp, Kevin, Professor, Atmospheric Science, 1991, PhD, Colorado State University.

Kraemer, Bradley, Assistant Professor, Biological Sciences, 2022, PhD, Vanderbilt University.

Kyle, David, Clinical Assistant Professor, Education, 2004, MA, University of North Alabama.

L

Lakin, Tracy, Clinical Assistant Professor, Nursing, 2019, DNP, The University of Alabama in Huntsville.

Lampley, Sandra, Associate Professor, Education, 2016, PhD, Middle Tennessee State.

Lane, Sean, Dean and Professor, Psychology, 2018, PhD, Kent State University.

Lanz, Amelia, Associate Dean and Clinical Associate Professor, Nursing, 2012, EdD, University of Alabama in Huntsville.

Lastinger, Anastasia, Clinical Assistant Professor, Education, 2022, PhD, Clemson University.

Lawan, Ahmed, Assistant Professor, Biological Sciences, 2019, PhD, University of Strathclyde Glasgow.

Le, Vinh Nguyen Du, Assistant Professor, Physics, 2022, PhD, McMaster University.

Le Roux, Jakobus, Professor, Space Science, 2008, PhD, Potchefstroom.

Lee, Shanhu, Professor, Atmospheric Science, 2015, PhD, University of Tokyo.

Lee, Yeolan, Associate Professor, Management, 2013, PhD, Ohio State University.

Lei, Yu, Associate Professor, Chemical and Materials Engineering, 2013, PhD, U of Illinois at Chicago.

Lenahan, Shelley, Senior Lecturer, Math, 2004, MA, Texas AM.

Li, Gang, Professor, Space Science, 2008, PhD, Indiana University-Bloomington.

Li, Xiaotong, Professor, Information Systems, 2001, PhD, University of Mississippi.

Lieu, Richard, Distinguished Professor, Physics, 1995, PhD, Imperial College - London.

Ligrani, Phillip, Eminent Scholar and Professor, Mechanical and Aerospace Engineering, 2014, PhD, Stanford University.

Lin, Mark, Associate Professor, Mechanical and Aerospace Engineering, 2000, PhD, Virginia Polytechnic Institute.

Lindquist, Robert, Interim Provost and Executive Vice President for Academic Affairs and Professor, Electrical and Computer Engineering, 2003, PhD, Pennsylvania State University.

Ling, Jie, Associate Professor, Chemistry, 2022, PhD, Auburn University.

Liu, Jianqing, Assistant Professor, Electrical and Computer Engineering, 2018, PhD, University of Florida.

Liu, Junjun, Assistant Professor, Accounting, 2020, PhD, Arizona State University.

Lloyd, Nicholas, Clinical Assistant Professor, Industrial Systems Engineering, 2019, PhD, University of Alabama in Huntsville.

Love-Rutledge, Sharifa, Assistant Professor, Chemistry, 2017, PhD, The University of Alabama.

M

Ma, Rui, Assistant Professor, Civil and Environmental Engineering, 2019, PhD, Rensselaer Polytechnic Institute.

MacKenzie, William (Ivey), Associate Professor, Management, 2010, PhD, University South Carolina.

Magnuson, Roy, Associate Professor, Biological Sciences, 1999, PhD, Massachusetts Institute of Technology.

Mahafza, Hamsa, Clinical Assistant Professor and Honors Faculty Fellow, Education, 2016, PhD, University of Texas at San Antonio.

Mahalingam, Brinda, Clinical Associate Professor, Economics, 2012, PhD, University of Colorado.

Mahalingam, Shankar, Dean and Distinguished Professor, Mechanical and Aerospace Engineering, 2010, PhD, Stanford University.

Makbul, Nur, Communication Arts, 2023, MA, Kansas State University.

Malak, Natalie, Assistant Professor, Economics, 2018, PhD, McMaster University.

Manasco, Michael, Librarian III, Library, 2012, MLIS, University of Alabama.

Marinova, Sophia, Associate Professor, Management, 2014, PhD, University of Maryland.

Marschalk, Lacy, Lecturer, English, 2014, PhD, Auburn University.

McDavid, Nicole, Senior Lecturer, Communication Arts, 2015, MA, Auburn University.

Mecikalski, John, Professor, Atmospheric Science, 2004, PhD, University of Wisconsin-Milwaukee.

Menon, Vineetha, Associate Professor, Computer Science, 2017, PhD, Mississippi State University.

Mesmer, Bryan, Director of Army Human Systems Lab and Associate Professor, Industrial Systems Engineering, 2014, PhD, University of Buffalo.

Milam, Lauren, Clinical Instructor, Nursing, 2021, MSN, University of North Alabama.

Milenkovic, Aleksander, Professor, Electrical and Computer Engineering, 2001, PhD, University of Belgrade.

Miller, Evan, Assistant Professor, Math, 2024, PhD, University of Toronto.

Miller, James, Professor, Physics, 1994, PhD, University of Maryland.

Modi, Shikha, Assistant Professor, Nursing, 2023, PhD, The University of Alabama at Birmingham.

Moe, Samantha, English, 2023, MFA, Converse College.

Mohr, John, Lecturer, History, 2018, PhD, Auburn University.

Mok, Wai Yin, Department Chair and Professor, Information Systems, 2001, PhD, Brigham Young University.

Moore, David, Director and Librarian III, Library, 2002, MLS, University of Alabama.

Morgan, Tracie, Clinical Assistant Professor, Nursing, 2016, MSN, University of Alabama in Huntsville.

Morphew, S. Melissa, Clinical Associate Professor, Professional and Continuing Studies, 2016, PhD, University of Georgia.

Morris, Kathryn, Lecturer, Math, 2023, MA, Western Governors University.

Morris, Tommy, Interim Department Chair, Eminent Scholar, and Professor, Electrical and Computer Engineering, 2015, PhD, Southern Methodist.

Morrison, Daniel, Associate Professor and Chair, Sociology, 2023, PhD, Vanderbilt University.

Morrison, Katherine , Clinical Instructor, Nursing, 2017, MSN, Samford.

Mukherjee, Tathagata, Associate Professor, Computer Science, 2018, PhD, Florida State University.

Mullins, Frank, Associate Professor, Management, 2017, PhD, Syracuse University.

N

Nachtigall, Olaf, Assistant Professor, Chemistry, 2022, PhD, Freie Universitat Berlin.

Nair, Udaysankar, Professor, Atmospheric Science, 2011, PhD, Colorado State University.

Nassar, Mohamad, Assistant Professor, Computer Science, 2023, PhD, Lorraine University.

Nelson, George, Professor, Mechanical and Aerospace Engineering, 2012, PhD, Georgia Institute of Technology.

Neuschatz, Jeffrey, Distinguished Professor and Eminent Scholars Professor, Psychology, 2000, PhD, Binghamton University.

Newchurch, Michael, Professor, Atmospheric Science, 1994, PhD, Georgia Institute of Technology.

Newman, Timothy, Professor, Computer Science, 1994, PhD, Michigan State.

Ng, Joseph, Professor, Biological Sciences, 1998, PhD, University of California, Riverside.

Ng, Ka Man (Melody), Associate Professor, Music, 2013, DMA, University of Wisconsin.

Ng, Yeow Chye, Associate Professor, Nursing, 2013, PhD, University of Alabama at Birmingham.

Nguyen, Cuong, Lecturer, Chemistry, 2022, PhD, The University of Alabama in Huntsville.

Nguyen, Dinh, Assistant Professor, Electrical and Computer Engineering, 2023, PhD, Deakin University.

Niemiller, Denise, Senior Lecturer, Biological Sciences, 2017, PhD, University of Tennessee Knoxville.

Niemiller, Matthew, Associate Professor, Biological Sciences, 2017, PhD, University of Tennessee.

Niles, Lauren, Clinical Instructor, Nursing, 2021, MSN, University of Texas at El Paso.

Noletto, Colleen, Lecturer, English, 2016, PhD, Catholic University of America.

Nouri, Sahar Ansar , Lecturer, Physics, 2022, PhD, The University of Alabama in Huntsville.

O

O'Brien, Jason, Associate Professor, Education, 2008, PhD, University of South Florida.

Ogungbe, Ifedayo Victor, Associate Professor, Chemistry, 2023, PhD, The University of Alabama in Huntsville.

O'Keefe, Louise, Associate Dean for Graduate Programs and Associate Professor, Nursing, 2006, PhD, University of Alabama at Birmingham.

Okoth, Elizabeth, Lecturer, Chemistry, 2022, PhD, Louisiana State University.

Olson, Charlotte, Librarian III, Library, 2007, MFA, University of Florida.

Ong, Belinda, Librarian III, Library, 2004, PhD, University of Kentucky.

Orman, Wafa, Associate Dean and Associate Professor, Economics, 2008, PhD, University of Arizona.

Osuga, Amalia, Assistant Professor, Music, 2018, DMA, University of Oregon.

P

Pacino, Nicole, Associate Professor, History, 2013, PhD, University of California, Santa Barbara.

Palmer, Jennifer, Clinical Assistant Professor, Nursing, 2015, EdD, University of Alabama.

Pan, David, Associate Professor, Electrical and Computer Engineering, 2002, PhD, University of Southern California.

Panchapakesan, Subramania, Assistant Professor, Space Science, 2023, PhD, University of Calicut.

Patnayakuni, Ravi, Associate Professor, Information Systems, 2004, DBA, Southern Illinois University.

Patterson, LaToya, Clinical Instructor, Nursing, 2014, MSN, University of Alabama in Huntsville.

Pavlopoulos, Vasileios, Management, 2023, MS, Washington State University.

Peiffer, Amanda, Clinical Instructor, Nursing, 2023, MSN, University of North Alabama.

Perry, Tamela, Clinical Assistant Professor, Nursing, 2021, DNP, University of Alabama at Birmingham.

Petty, Mikel, Professor, Computer Science, 2005, PhD, University of Central Florida.

Pham, Hieu, Assistant Professor, Information Systems, 2021, PhD, Iowa State University.

Pogorelov, Nickolai, Distinguished Professor, Space Science, 2008, PhD, Russian Academy of Sciences.

Poole, Jarmel, Clinical Instructor, Nursing, 2017, MSN, University of North Alabama.

Pottenger, John, Professor, Political Science, 1986, PhD, University of Maryland.

Pour, Maria, Assistant Professor, Electrical and Computer Engineering, 2015, PhD, University of Manitoba.

Preston , Kevin, Lecturer, Computer Science, 2018, MS, The University of Alabama in Huntsville.

Price, Jodi, Acting Associate Dean and Professor, Psychology, 2008, PhD, Georgia Institute of Technology.

Puleo, David, Provost and Executive Vice President for Academic Affairs, Professor, Chemical and Materials Engineering, 2022, PhD, Rensselaer Polytechnic Institute.

Pushpawela, Buddhi, Clinical Assistant Professor, Physics, 2021, PhD, Queensland University of Technology.

Pyun, Chaehyun, Assistant Professor, Finance, 2022, PhD, University of Georgia.

Q

Quick, Beth, Dean and Professor, Education, 2013, Ed.D, Vanderbilt University.

R

Ranchal, Rohit, Assistant Professor, Electrical and Computer Engineering, 2024, PhD, Purdue University.

Rani, Sarma, Professor, Mechanical and Aerospace Engineering, 2011, PhD, University of Illinois Urbana-Champaign.

Ravindran, Sivaguru, Professor, Math, 1999, PhD, Simon Fraser University, British Columbia.

Ray, Biswajit, Associate Professor, Electrical and Computer Engineering, 2016, PhD, Purdue University.

Ren, Mengfei, Electrical and Computer Engineering, 2023, MS, University of Texas, Arlington.

Reno, Alyssum, Clinical Instructor, Kinesiology, 2019, MS, The University of North Alabama.

Reynolds, Charles, Clinical Associate Professor, Nursing, 2020, MSN, University of Alabama in Birmingham.

Robertshaw, Joseph, Lecturer, English, 2018, PhD, Bowling Green State University.

Roh, Kyung-Ho, Associate Professor, Chemical and Materials Engineering, 2016, PhD, University of Michigan.

Roy, Satyaki, Assistant Professor, Math, 2023, PhD, Missouri University of Science and Technology.

S

Sadeghi, Seyed, Professor, Physics, 2007, PhD, University of British Columbia.

Sahoo, Avimanyu, Assistant Professor, Electrical and Computer Engineering, 2022, PhD, Missouri University of Science and Technology.

Salman, Abdullahi, Assistant Professor, Civil and Environmental Engineering, 2018, PhD, Michigan Technological University.

Samantaray, Paresh, Assistant Professor, Chemical and Materials Engineering, 2023, PhD, The Indian Institute of Science.

Sanders, Carolyn, Professor, Music, 1990, DM, Florida State University.

Sarazen, Alexander, Lecturer, Kinesiology, 2022, DC, Palmer College of Chiropractic-.

Saunders, John, Lecturer, Communication Arts, 2017, PhD, The Pennsylvania State University.

Schneider, Judith, Professor, Mechanical and Aerospace Engineering, 2015, PhD, University of California-Davis.

Scholz, Carmen, Professor, Chemistry, 1998, PhD, University of Technology, Dresden Germany.

Schwertfeger, Ron, Librarian III, Library, 2014, MA, University of Alabama.

Seady, Rachel, Clinical Assistant Professor, Nursing, 2023, DNP, Frontier Nursing University.

Sears, Christine, Associate Professor, History, 2007, PhD, University of Delaware.

Senn, Laura, Clinical Assistant Professor, Education, 2021, PhD, Florida Institute of Technology.

Sheikhrezaei, Kaveh, Lecturer, Industrial Systems Engineering, 2021, PhD, Louisiana State University .

Shen, Milton, Associate Professor, Accounting, 2011, PhD, University of Kentucky.

Shotorban, Babak, Professor, Mechanical and Aerospace Engineering, 2008, PhD, University of Illinois at Chicago.

Showalter, Darlene, Clinical Associate Professor, Nursing, 1998, DNP, University of Alabama in Huntsville.

Shults, Tamela, Clinical Instructor, Nursing, 2023, MS, Walden University.

Sims, Jennifer, Associate Professor, Sociology, 2017, PhD, University of Wisconsin - Madison.

Singh, Tripti, Assistant Professor, Information Systems, 2023, PhD, The University of Alabama.

Skelley, Dana, Assistant Professor, Education, 2017, EdD, University of Memphis.

Slavin, Laura, Librarian III, Library, 2017, MA, Lincoln Memorial University School of Business.

Smith, Derrick, Associate Dean and Professor, Education, 2008, EdD, Texas Tech University.

Smith, Eric, Professor, English, 2006, PhD, University of Florida.

Smith, Kelly, Lecturer, History, 2018, PhD, University of Cincinnati.

Smith, Laura, Assistant Professor, Art, Art History Design, 2019, PhD, University of Georgia.

Smith, Lenora, Associate Professor, Nursing, 2013, PhD, Medical University of South Carolina.

Smith, Miranda, Clinical Assistant Professor, Nursing, 2018, MNED, University of North Alabama.

Snow, Mary, Senior Lecturer, Chemistry, 2005, MS, University of Alabama in Huntsville.

Sommerkamp, Sandy, Clinical Assistant Professor, Nursing, 2011, MSN, Jacksonville State University.

Song, Yooseob, Assistant Professor, Civil and Environmental Engineering, 2022, PhD, Louisiana State University.

Spulak, Nathan, Assistant Professor, Mechanical and Aerospace Engineering, 2022, PhD, The Ohio State University.

St. John, David, Lecturer, English, 2020, PhD, Georgia State University.

Steidl, Christina, Interim Associate Dean and Associate Professor, Sociology, 2012, PhD, Emory University.

Steinwandt, Rainer, Dean and Professor, Math, 2021, PhD, University of Karlsruhe.

Storer, Sallyann, Clinical Assistant Professor, Nursing, 2017, DNP, University of Alabama in Huntsville.

Subramanian, Anu, Professor, Chemical and Materials Engineering, 2018, PhD, Virginia Polytechnic Institute and State University.

Sullivan, Veronica, Clinical Assistant Professor, Nursing, 2017, DNP, University of Alabama in Huntsville.

Sun, Ming, Professor, Physics, 2014, PhD, Harvard.

Sysoeva, Tatyana, Assistant Professor, Biological Sciences, 2018, PhD, The Pennsylvania State University.

T

Tan, Yi, Assistant Professor, Information Systems, 2020, PhD, University of Kansas.

Tantaris, Richard, Senior Lecturer, Mechanical and Aerospace Engineering, 2017, PhD, Vanderbilt University.

Taylor, Chris, Associate Professor, Art, Art History Design, 2014, MFA, Alfred University.

Taylor, W. Joseph, Associate Professor, English, 2010, PhD, University of Texas.

Tenhundfeld, Nathan, Associate Professor, Psychology, 2019, PhD, Colorado State University.

Thomas, Chad, Associate Professor, English, 2011, PhD, University of Michigan.

Thomas, Chad, Associate Professor, Theatre, 2011, PhD, University of Michigan.

Thomas, Dale, Eminent Scholar and Professor, Industrial Systems Engineering, 2015, PhD, University of Alabama in Huntsville.

Thomson, Robert, Assistant Professor, Sociology, 2019, PhD, Baylor University.

Thornton, Tracy, Clinical Assistant Professor, Nursing, 2013, MSN, University of Alabama in Huntsville.

Tippett, Anna Kate, Librarian I, Library, 2022, MLIS, University of South Florida.

Torres, Aurora, Assistant Professor, Psychology, 1995, PhD, University of Oklahoma.

Torres-Diaz, Isaac, Assistant Professor, Chemical and Materials Engineering, 2019, PhD, University of Puerto Rico at Mayaguez.

Truszkowska, Agnieszka, Assistant Professor, Chemical and Materials Engineering, 2022, PhD, Oregon State University.

Twigg, Pamela, Lecturer, Chemistry, 2014, PhD, Florida State University.

Tykol, Lauren, Assistant Professor, Psychology, 2023, PhD, The University of Alabama.

V

Vadrevu, Anuradha, MA, Math, 2017, MA, Mississippi State University.

Vangsness, Lisa, Assistant Professor, Psychology, 2022, PhD, Kansas State University.

Vann, Jennifer, Clinical Assistant Professor, Nursing, 2022, DNP, The University of Alabama at Birmingham.

Veasey, Roxie, Senior Lecturer, Art, Art History Design, 2005, MFA, University of Georgia.

Veres, Peter, Assistant Professor, Space Science, 2022, PhD, Eötvös Loránd University.

Verlaan, Wolfram, Associate Professor , Education, 2012, PhD, Texas AM.

Vogler, Bernhard, Associate Professor, Chemistry, 2001, PhD, University of Tuebingen.

W

Walker, Stephen, Assistant Professor, Physics, 2019, PhD, University of Cambridge.

Wallach, Karen Anne, Assistant Professor, Marketing, 2021, PhD, Emory University.

Wang, Gang, Associate Professor, Mechanical and Aerospace Engineering, 2010, PhD, University of Maryland.

Waring, Stephen, Professor, History, 1988, PhD, University of Iowa.

Watson, Joseph, Assistant Professor, Theatre, 2018, PhD, Louisiana State University.

Weber, Anna, Senior Lecturer, English, 2012, MFA, Purdue.

Weber, Ryan, Associate Professor, English, 2011, PhD, Purdue.

Weger, Kristin, Assistant Professor, Psychology, 2017, PhD, Otto-Friedrich-University.

Weimer, Jeffrey, Associate Professor, Chemistry, 1990, PhD, Massachusetts Institute of Technology.

Weimer, Jeffrey, Associate Professor, Chemical and Materials Engineering, 1990, PhD, Massachusetts Institute of Technology.

Wells, Earl, Professor, Electrical and Computer Engineering, 1992, PhD, University of Alabama.

Whitehead, Paul N., Assistant Professor, Kinesiology, 2017, PhD, University of Pittsburgh.

Wolf, Paul, Chair and Professor, Biological Sciences, 2019, PhD, Washington State University.

Wooley, Ana, Industrial Systems Engineering, 2023, MS, Auburn University.

Word-Allbritton, Andrea, Clinical Assistant Professor, Education, 2002, EdD, University of Alabama, Tuscaloosa.

Wu, Dongsheng, Professor, Math, 2006, PhD, Michigan State University.

Wu, Tingting, Associate Professor, Civil and Environmental Engineering, 2014, PhD, University of Florida.

X

Xing, Xuejing, Department Chair and Professor, Finance, 2007, PhD, University of Missouri-Columbia.

Xu, Gabe, Associate Professor, Mechanical and Aerospace Engineering, 2012, PhD, Georgia Tech.

Xu, Kim, Lecturer, Mechanical and Aerospace Engineering, 2021, PhD, Georgia Institute of Technology.

Z

Zaharia, Noemi, Clinical Assistant Professor, Kinesiology, 2021, EdD, United States Sports Academy.

Zank, Gary, Trustee and Distinguished Professor, Space Science, 2008, PhD, University of Kwazulu Natal.

Zhang, Guangsheng, Assistant Professor , Mechanical and Aerospace Engineering, 2017, PhD, Xi'an Jiaotong University.

Zhang, Guo-Hui, Associate Professor, Math, 1993, PhD, Southern Illinois University.

Zhang, Huaming, Associate Professor, Computer Science, 2005, PhD, State University of New York at Buffalo.

Zhao, Lingling, Assistant Professor, Space Science, 2021, PhD, National Space Science Center, Chinese Academy of Sciences.

Zhao, Shuang, Associate Professor, Political Science, 2015, PhD, Indiana University, Bloomington.

Zhu, Feng, Associate Professor, Computer Science, 2005, PhD, Michigan State University.

Zhu, Qingyun, Assistant Professor, Management, 2019, PhD, Worcester Polytechnic Institute.

Financial Information

In the following section you will find information pertaining to financial aspects of attending The University of Alabama in Huntsville, including how you will be billed, how to pay your bill, the estimated cost of tuition and other fees, and information regarding financial aid options. The cost of attendance for students at The University of Alabama in Huntsville will vary by their course of study, personal needs, and place of residence. Please note that all fees, charges, and costs detailed in this catalog are subject to change without notice. Financial obligations must be satisfied by the established deadlines. For additional information or questions please contact the Bursar's Office (https://www.uah.edu/bursar/).

Billing and Payment Procedures

Tuition, fees, and all associated charges are to be paid in full by the first official day of the semester (click here (p. 386) to find the first official day of the semester). Acceptable forms of payment are:

- Cash
- Personal Checks
- Money Orders
- Cashier's Checks
- Traveler's Checks
- Electronic Checks
- Credit Cards/Debit Cards (VISA, MasterCard, American Express, or Discover - 2.85% service fee applies)

Payments may be made online through the student account or in person at the Bursar's Office (SSB 123). Students who do not pay their bills in full or have an active payment plan by the first day of the semester are assessed a $50.00 late fee, and a transcript hold may be placed on the account. Students who have any remaining balance on the last official day of the semester will be dropped from any future semester registration, and an AR hold will be placed on the account. The University assumes no responsibility for students who attend classes without official enrollment. For summer sessions, please check the dates in the Academic Calendar (p. 386) and on the UAH website (http://www.uah.edu/registrar/calendars/).

Mail payments to:

The University of Alabama in Huntsville
Bursar's Office
Student Services Building, Room 123
Huntsville, AL 35899-5050

Payment Plans

Payment plans are available to students each semester. UAH partners with Flywire Payment Solutions to offer student payment plans. For more information or to set up an installment plan, click here. (https://www.uah.edu/bursar/installment-plans/)

Balances

Past due balances are a debt owed to the State of Alabama, and appropriate action will be taken to collect all balances. Holds will be placed on all student accounts that have past-due balances. This hold prevents students from receiving grades and transcripts and from registering for another semester at UAH. To the extent permitted by the laws of the State of Alabama, any costs to collect a past due account, including collection agency charges and attorney fees, will be charged back to the student, who shall be liable for payment of those charges.

Refunds

Students may drop a class through the Drop/Add period and receive a 100% tuition refund. Please check the UAH website (http://www.uah.edu/registrar/calendars/) for each semester's dates. A student desiring to drop one or more classes may do so on the UAH online registration site or by submitting a drop request form to the Registrar's Office, SSB 120. The date of the drop request is the date the written request is received at the Registrar's Office.

Financial Aid

Students who apply for financial aid are responsible for completing the necessary paperwork far enough in advance to assure aid is received in a timely manner. For further information, please check with the Office of Financial Aid, Student Services Building, Suite 124.

Graduate Student Aid

UAH has several programs to assist students in financing their college education. Comprehensive, updated information on all financial aid offered through the Office of Financial Aid is available here (https://www.uah.edu/admissions/graduate/financial-aid/). It includes detailed information about types of aid, eligibility guidelines, application procedures, criteria for awards, disbursement methods and regulations, and institutional policy followed in the administration of aid. Additional information and necessary forms are available online and in the Office of Financial Aid.

Students of academic promise who can demonstrate financial need are encouraged to apply for assistance. Realistic financial planning is an essential part of college preparation. UAH helps qualified students find employment, scholarships, and loans as resources permit.

Students should make financial plans well in advance of entering the University. There are two important priority dates for student aid: December 15 for scholarships and April 1 for federal aid (apply online at https://studentaid.gov (https://studentaid.gov/)). The priority dates are the dates by which completed scholarship applications are certain to be included in the first round of review and by which the Free Application for Federal Student Aid (FAFSA) can be processed in a timely manner. A new FAFSA application must be submitted each year aid is requested.

Types of Financial Aid

Scholarships

UAH graduate students interested in receiving scholarships should submit a scholarship application (https://apps.uah.edu/Scholarship/) by December 15th of each year for priority consideration. Students who currently have a scholarship should check the scholarship description to determine if submitting a scholarship application each year is required.

In addition to traditional scholarships, graduate students may also be eligible to receive the Graduate Student Fellowship Scholarship. Eligible students will automatically receive a discount on their tuition. No scholarship application is required.

Please visit the Graduate Financial Aid website (https://www.uah.edu/admissions/graduate/financial-aid/) for complete information and eligibility rules.

Loans

UAH participates in the William D. Ford Federal Direct Stafford Loan program. Student loan funds are made available directly from the U.S. Department of Education. Although it is sometimes necessary to borrow money to finance an education, caution is advised. Generally, a student should not rely primarily on loans and is advised not to borrow more than what is needed to meet expenses. Additional information regarding eligibility amounts, loan limits, application procedures, and suggested application timelines may be found online on the Financial Aid website (https://www.uah.edu/admissions/undergraduate/financial-aid/). This and other valuable information regarding the financial aid process are available in the Office of Financial Aid.

Federal Work-Study Program

The Federal Work-Study Program provides employment for students who need financial assistance. A participating student works part-time on campus or in a non-profit agency while attending the University. In determining eligibility, preference will be given to students with the greatest financial need.

Return of Federal Financial Aid

Federally funded financial aid awarded to a student who withdraws from all classes after registration but before the end of the refund period, or who earns no passing grades for a specific term, must be repaid to the respective program source. When withdrawal or reduction of course load occurs after the end of the refund period, all tuition charges will be paid from the awarded aid and any remaining aid must be repaid to the respective aid source. Specific regulations governing this policy may be found on the *undergraduate* financial aid website at https://www.uah.edu/admissions/undergraduate/financial-aid (https://www.uah.edu/admissions/undergraduate/financial-aid/).

For more information regarding Federal Financial Aid programs, please review the Department of Education's Federal Student Aid website regarding graduate or professional program funding: https://studentaid.gov (https://studentaid.gov/).

Housing Semester Rates

2022-23 Estimated Cost of Housing

Bevill Center	
Studio Suite (One-bedroom Suite)	$3,865
Central Campus Residence Hall (CCH)	
Private Bedroom in 4-person suite	$3,565
Frank Franz Hall (FFH)	
Private bedroom in 4-person suite	$3,665
North Campus Residence Hall (NCH)	
Private bedroom in 4-person suite	$3,800
Studio Suite (one-bedroom suite)	$4,065
Charger Village (CGV)	
Private Bedroom in 4-person suite	$3,845
Private Bedroom in 2-person suite	$3,965
Studio Suite (one-bedroom suite)	$4,145
Fraternity and Sorority Housing (FSH)	
Available for 2nd Year and Upperclassmen	
Private Bedroom in 10-bedroom house	$3,585
Southeast Campus Housing (SCH)	
Private Bedroom in 3-bedroom suite	$3,070
One Bedroom Apartment	$3,245

Note: All Housing rates include basic utilities, Internet access, and Xfinity On Campus for each suite.

Meal Plans

All UAH students (including commuters) are required to purchase a meal plan. For meal plan information, please visit University Dining (https://uah.sodexomyway.com/).

Meal Plan Rates

Graduate students are not required to purchase meal plans, but options are available if you would like to purchase a package. Please contact the charger card office for a list of meal plans. https://www.uah.edu/chargercard/meal-plans (https://www.uah.edu/chargercard/meal-plans/)

Residency

UAH Resident/Non-Resident Tuition Fee Guidelines

Introduction

All students registering at The University of Alabama in Huntsville (UAH) who do not demonstrate, by presenting satisfactory evidence, that they are "resident students" will pay a "non-resident student" tuition. "Non-resident student" tuition will be at least twice the amount of "resident student"

tuition. The residency classification of students will be made at the time of their initial registration and will continue unchanged through all subsequent registrations until satisfactory evidence to the contrary is submitted at the time of any subsequent registration. An Application for Reclassification of Residence must be submitted to the Office of the Vice President for Student Affairs no later than the last day of registration for the appropriate semester.

Demonstrating Alabama Residency

A resident student, for the purposes of this policy, is one who has established residency in Alabama and has maintained that status for at least one year immediately prior to the date of registration at any institution of higher education in the state. The policy of the Board of Trustees of The University of Alabama on non-resident tuition states that "residence" refers to that "single location at which a person resides with the intent of remaining there indefinitely as evidenced by more substantial connections with that place than with any other place." Students seeking to demonstrate that they are Alabama residents must certify to three facts:

1. that an address or location within Alabama is their residence,
2. that they intend to remain there indefinitely, and
3. that they have "more substantial connections" with Alabama than with any other state.

Though satisfying the location and statement of intent requirements are essential, demonstrating residency will depend upon the University's evaluation of the student's connections with the state. No single connection or combination will automatically result in a finding of residency. Moreover, even if one or more connections with Alabama exist, a person who is in Alabama primarily for the purpose of obtaining an education will be considered a non-resident. The Board policy lists the following as connections that may be considered:

1. Payment of Alabama state income taxes as a resident
2. Ownership of a residence or other real property in the state and payment of state ad valorem taxes thereon
3. Full-time employment (not temporary) in the state
4. Residence in the state of a spouse, parents, or children
5. Previous periods of residency in the state continuing for one year or more
6. Voter registration and voting in the state, especially registration occurring more than one year prior to the student's initial registration
7. Possession of state or local licenses to do business or practice a profession in the state
8. Ownership of personal property (e.g., automobile, boat, etc.) in the state and payment of state taxes thereon; possession of state license plates
9. Continuous physical presence in the state for a purpose other than attending school and except for temporary absences for travel, military service, temporary employment, etc.
10. Membership in religious, professional, business, civic, or social organizations in the state
11. Maintenance in the state of checking and savings accounts, safe deposit boxes, investment accounts, etc.
12. In-state address shown on selective service registration, driver's license, automobile title registration, hunting and fishing licenses, insurance policies, stock and bond registrations, last will and testament, annuities, retirement plans, etc.
13. Location within the state of the high school from which the student graduated

As stated above, a student will be classified as an Alabama resident only if the student is able to show that they became a resident one year or more prior to the date of registration at any institution of higher education in the state by identifying then existing, sufficient connections with Alabama.

Demonstrating Alabama Residency - Alternative Approach

A student who does not qualify for classification as a resident student under the foregoing requirements may possibly qualify if they (or their supporting person in the case of a minor) meets any one of the following requirements at the time of registration:

1. Is a full-time, non-temporary employee at UAH or is the spouse of such an employee.
2. Is employed by UAH as a graduate assistant or fellow (to include GA, GRA, or GTA positions) on at least a 0.5 FTE (half-time) basis.
3. Is a full-time, non-temporary employee of some other employer within the state of Alabama, or can verify such employment beginning not more than 90 days after registration, or is the spouse of such employee.
4. Is a resident of Bedford, Coffee, Franklin, Giles, Lawrence, Lincoln, Marion, Marshall, or Moore County in Tennessee and has been a resident of that County for at least one year preceding the date of registration. The requirements for a student to demonstrate that they are a "resident" of one of the foregoing counties shall be the same as set forth above with regard to demonstrating Alabama residency.

As used in these Guidelines, a "minor" refers to an individual who, because of age, lacks the capacity to contract under Alabama law. This means a single individual under age 19 and a married individual under age 18. A "supporting person" refers to either or both of the parents of a student, if they are living together, or, if the parents are divorced or living separately, then the parent providing the greater amount of financial support of the two (normally, the parent having legal custody). "Non-temporary" employment means employment that is on-going and not seasonal or for a specific period of time or for the express purpose of financing the student's college education.

Rules for Veterans and U.S. Service Members of the Uniformed Services (Army, Navy, Air Force, Marine Corps and Coast Guard) and Commissioned Officers of NOAA and the PHS

The following individuals shall be charged a rate of tuition not to exceed the in-state rate for tuition and fees purposes:

• Anyone using educational assistance under the Survivors' and Dependents' Educational Assistance Program (Chapter 35), also be charged the resident rate as outlined in Public Law 117-68. Effective for courses and terms beginning after August 1, 2022.

• A Veteran using educational assistance under either chapter 30 (Montgomery G.I. Bill® – Active Duty Program) or chapter 33 (Post-9/11 G.I. Bill), of title 38, United States Code, who lives in Alabama while attending a school located in Alabama (regardless of their formal State of residence).

• Anyone using transferred Post-9/11 GI Bill benefits (38 U.S.C. § 3319) who lives in Alabama while attending a school located in Alabama (regardless of their formal State of residence).

• Anyone described above while they remain continuously enrolled (other than during regularly scheduled breaks between courses, semesters, or terms) at the same school. The person so described must be using educational benefits under either chapter 30 or chapter 33, of title 38, United States Code.

• Anyone using benefits under the Marine Gunnery Sergeant John David Fry Scholarship (38 U.S.C. § 3311(b)(9)) who lives in Alabama while attending a school located in Alabama (regardless of their formal State of residence).

• Anyone using transferred Post-9/11 G.I. Bill benefits (38 U.S.C. § 3319) who lives in Alabama while attending a school located in Alabama (regardless of their formal state of residence) and the transferor is a member of the uniformed service who is serving on active duty.

• Anyone using educational assistance under chapter 31, Vocational Rehabilitation/Employment (VR&E), also be charged the resident rate. Effective for courses and terms beginning after March 1, 2019, a public institution of higher learning must charge the resident rate to chapter 31 participants, as well as the other categories of individuals described above. When an institution charges these individuals more than the rate for resident students, VA is required to disapprove programs of education sponsored by VA.

• The policy shall be read to be amended as necessary to be compliant with the requirements of 38 U.S.C. 3679(c) as amended.

GI Bill® is a registered trademark of the U.S. Department of Veterans Affairs (VA). More information about education benefits offered by VA is available at the official U.S. government Web site at https://www.benefits.va.gov/gibill.

Tuition and Fees

The University reserves the right to change its tuition, fees, charges, rules and regulations at the beginning of any semester and without prior notice. Generally, the Board of Trustees of the University of Alabama System considers proposals for changes in fees at the June meeting. The most current tuition and fees rates can be found on the Bursar's website under tuition rates (https://www.uah.edu/bursar/tuition/).

Graduate Hours	Resident	Non-Resident
1	$789	$1,782
2	$1,436	$3,265
3	$2,083	$4,748
4	$2,730	$6,232
5	$3,377	$7,715
6	$4,024	$9,198
7	$4,525	$10,366
8	$5,027	$11,535
9 to 15	$5,529	$12,704
16	$6,031	$13,873
17	$6,533	$15,042
18	$7,035	$16,211

Each additional semester hour is $502 for in-state students and $1,169 for out-of-state students.

The University reserves the right to change its fees, charges, rules and regulations at the beginning of any semester and without prior notice. No penalty/late fees for VA students if unable to meet financial obligation due to delayed disbursement by VA.

Infrastructure Fee

$22 per hour

Campus Course and Other Instructional Fees

College of Arts, Humanities, and Social Sciences - $24 per hour

AMS, ARH, ARS, CM, EH, EHL, FMA, GS, GY, HY, MU, MUA, MUE, MUJ, MUX, PHL, PSC, PY, SOC, TH, WGS, WLC

ARS - additional $25 fee per hour
FMA - additional $15 fee per hour
MU - Studio Fee of $125 per hour
MU 100 - additional $10 fee per hour
TH - additional $15 fee per hour

College of Business - $27 per hour

ACC, BLS, ECN, FIN, IS, MGT, MKT, MSC

Graduate Campus-Rate Program Fee $87 per hour

Graduate Online Program Fee $220 per hour

College of Education - $24 per hour

ECH, ED, EDC, HPE, KIN, SFM

HPE courses have additional fees per course as follows:
1 credit hour course - $150
2 credit hour course - $175
3 credit hour course - $200

College of Education Additional Fees per Course

ED 501	$100.00
ED 693	$400.00
ED 696	$400.00
ED 698	$400.00

College of Engineering - $46 per hour

CBS, CE, CHE, CPE, EE, EM, ISE, MAE, MTS, OPE, OSE

Office of International Services
International Fee (Fall and Spring Semesters) - $150 per semester
International Fee (Summer Semester) - $25 each 5-week term
International Fee (Summer Semester) - $50 each 10-week term
J Visa Processing Fee - $100 per request

College of Nursing - $46 per hour
NUR

College of Professional and Continuing Studies - $24 per hour
PRO

College of Science - $40 per hour
AST, ATS, BSE, BYS, CH, CS, ESS, MA, MS *(Summer only)*, MOD, MTS, OPT, PH, SPA, ST

Credit by Departmental Exam

$10 per hour

The above tuition and fees are related to graduate program offerings. Additional fees may apply such as a parking permit or a Charger ID card. Please visit the Bursar's website for a complete listing (https://www.uah.edu/bursar/tuition/).

Policies and Procedures

The University of Alabama in Huntsville has various policies and procedures that guide our faculty, staff, and students. This section of the catalog provides detailed information on these policies, with which you should be familiar. Failure to read and comply with the policies listed here will not exempt students from being held accountable to them.

Please note that the policies identified in this catalog do not represent an entire repository of University policies, as colleges and departments may implement policies that are not listed here. International graduate students are also encouraged to review the Office of International Services' (https://www.uah.edu/ois/) policies in order to maintain their immigration status. In addition, all policies may be amended at any time.

Academic Probation and Dismissal

Academic Probationary Status

Any time a student’s overall graduate GPA drops below 3.000, the student will be placed on Academic Probationary Status (APS). A student on APS is not a candidate for a degree and may not schedule a masters or doctoral defense.

A student can remove APS by raising their overall graduate GPA to 3.000 or greater within the 12 hours attempted immediately following the semester in which they are placed on APS. These 12 hours (which do not include withdrawals and/or incompletes) must be attempted within the next three consecutive Fall and Spring semesters or within one year if courses are also attempted during Summer. This timeline can be extended only by having an appeal approved by the Graduate Dean.

Conditional admission is a form of APS. Conditionally admitted students must maintain a 3.000 average through the semester in which the first 12 semester hours are completed.

Academic Dismissal and Appeal

Failure to remove APS as described above shall result in dismissal from the Graduate School.

A student may also be dismissed for failing attempted thesis, dissertation, or DNP credit courses. If a student receives more than one grade of “Unsatisfactory” in a 699- or a 799-level course, they will be dismissed from the graduate program.

Students who have been academically dismissed may, with the support of their advisor and department chair or program director, file an appeal with the graduate dean to be allowed to continue in the graduate program. The student must submit a written, signed appeal indicating the reason for their poor academic performance along with a plan for raising the overall graduate GPA to at least 3.000 within a specified timeframe. The graduate dean may stipulate additional or different conditions to the plan. If the appeal is filed within 30 days of dismissal, the student may be considered for readmission in the semester immediately following dismissal. Otherwise, the appeal must be submitted at least 14 days prior to the following deadlines for readmission: July 1 for Fall, November 15 for Spring, and April 1 for Summer.

If the appeal is approved, the student shall be readmitted on APS, with the probation duration documented as one of the readmission conditions. These conditions shall be documented in a readmission letter signed by the student’s advisor, the student’s major department chair or program director, and the graduate dean. The student shall indicate acceptance of these conditions by signing the readmission letter. A student failing to comply with readmission conditions will be academically dismissed.

A student may also be dismissed for reasons related to student misconduct, as per the UAH Code of Student Conduct and the Academic Misconduct Policy. Information about student misconduct is located on the UAH Code of Student Conduct (https://www.uah.edu/dos/office-of-student-ethics-education/code-of-student-conduct/) webpage and the UAH Academic Misconduct Policy (https://www.uah.edu/policies/02-01-67-academic-misconduct-policy/) webpage.

Graduate students who have been dismissed must sit out for a minimum of two years before they can re-apply to any UAH graduate program.

Academic Responsibility

Students at The University of Alabama in Huntsville have the following academic responsibilities:

1. To enroll in only those courses for which the stated prerequisite(s) (if any) have been satisfactorily completed. Failure to comply with this procedure may result in administrative withdrawal;
2. To attend all meetings of each class in which they are enrolled. Instructors will announce at the beginning of the semester if they consider attendance in computing final grades;
3. To observe all regulations of their college and select courses according to the requirements of that college;
4. To consult their advisors on all matters pertaining to their academic careers, including changes in their programs;
5. To answer promptly all written notices from advisors, faculty, deans, and other university officers;

6. To maintain the integrity of the classroom by practicing academic honesty. Students should refer to the UAH Academic Misconduct Policy (https://www.uah.edu/images/administrative/policies/02.01.67-aa-academic-misconduct-policy.pdf);
7. To file an "Application for Advanced Degree" or "Application for Graduate Certificate," as appropriate, through the Office of the Registrar to the Graduate School at least three months before the expected date of completion of requirements;
8. To be personally responsible for fulfilling all requirements for graduation and observing all regulations at UAH.

Academic Honesty

Plagiarism and other forms of cheating are subject to penalties as outlined in the UAH Academic Misconduct Policy (https://www.uah.edu/images/administrative/policies/02.01.67-aa-academic-misconduct-policy.pdf). A graduate student found guilty of plagiarism or falsification of research data/results is subject to dismissal from the University.

Academic Appeals Process

Academic appeals will originate in written form by the student and will be processed through the chair of the student's major department, the College Dean, and the Office of the Provost in that order. The decision of the Provost is final.

Class Attendance

Education at UAH depends upon the cooperation of students and faculty. Therefore, students are held responsible for the entire work of the course in which they are registered, including participation in the discussion and work of the class at each class meeting.

A student's final grade in each course is based on identified course requirements; therefore, regular class attendance is essential.

Confidentiality of Student Records

The Family Educational Rights and Privacy Act of 1974 (FERPA) is a federal law that protects the confidentiality of student education records. To implement FERPA, the University has formulated and adopted a written institutional policy governing the handling of these records.

The term "education records (http://www.uah.edu/registrar/ferpa/#educational_record)" under FERPA includes generally any record, whether in a printed, handwritten, audio, video, or computer media format, maintained by the University and containing information related to a student in his/her role as a student (http://www.uah.edu/registrar/ferpa/#student). Certain records are, however, excluded by FERPA from this broad definition, such as those made by instructional, supervisory, and administrative personnel and kept in their sole possession, those made by campus police, and those made by a physician or other professional medical personnel in connection with treatment of the student.

Under FERPA and University policy, a student has a right of access to his/her education records and may inspect and review the information contained in them. To exercise this right, the student should present a request to the University office where the record is located, and a response will be made no later than 45 days later. In certain cases, a copy of the record may be provided, with a copying fee, as an alternative to actual inspection. Some records are not within this right of review, such as financial information from the student's parents and confidential letters or statements of recommendation where the student has waived the right of access.

A student who believes his/her education records contain information that is inaccurate, misleading, or in violation of his/her privacy rights may bring the matter to the attention of the appropriate records official. If by informal discussion with this official the student does not obtain the corrective action desired, the student will then be entitled to a hearing at which he/she may challenge the objectionable item. Additional information about hearing procedures will be given to the student at that time. The decision of the hearing official or panel shall be final. If the decision is adverse to the student, he/she may insert in the education record an explanatory statement about the disputed item.

A student's privacy interest in the education record is further protected by the rule against unauthorized disclosure. Generally, the University may not, without the student's consent, release the education record or personally identifiable information (http://www.uah.edu/registrar/ferpa/#personally_identifiable_information) in it to other individuals or entities.

Disclosure in certain circumstances, however, is specifically excepted by FERPA from the foregoing rule. These circumstances include disclosure to certain parties–University personnel who have a legitimate educational interest in the information, officials of institutions where the student is seeking to enroll, parties to which the student is applying for financial aid, the parent of a dependent student, etc.; disclosure to comply with a judicial order or lawfully issued subpoena; or disclosure in connection with a health or safety emergency. Under the first exception, "University personnel (http://www.uah.edu/registrar/ferpa/#university_official)" includes any UAH employee, and a "legitimate educational interest (http://www.uah.edu/registrar/ferpa/#legitimate_educational_interest)" means that the employee has a need for access to the record to perform appropriate tasks clearly within the area of responsibility of the employee, to perform a task related to the education or discipline of the student, or to provide a benefit or service relating to the student. Personally identifiable information will be transmitted by the University under these exceptions only upon the condition that the recipient not permit any other party to have access to it without the student's consent.

The University may also release what is called "directory information (http://www.uah.edu/registrar/ferpa/#directory_information)" without obtaining the student's consent. Directory information is limited to the following: the student's name, address (local and permanent), telephone number, e-mail address, date and place of birth, enrollment status (full-time or part time), major field of study, participation in officially recognized activities and sports,

dates of attendance, degrees and awards received, the previous educational institution most recently attended, and a photograph of the student. However, a student may prevent the release of even this information, if he/she wishes, by completing a form provided for this purpose in the Office of Student Records.

Any student who believes that his/her rights under FERPA have been violated by the University may notify and request assistance from the Provost and Executive Vice President for Academic Affairs. The student may also file a complaint with the Family Policy Compliance Office, U.S. Department of Education, 400 Maryland Avenue, SW, Washington, DC 20202-5920.

Course Repeat Policy

Students should be aware that course repeats, for any reason, may not be looked upon favorably by some employers and by professional schools; hence, they should avoid the need for repeats.

Students may repeat any course an unlimited number of times in order to achieve a passing grade or an improved understanding of the course material.

One course may be repeated with the previous grade excluded from the calculation of the student's grade-point average. The student must declare such a course repeat before the end of the regular registration period for the semester in which the course will be repeated. Only a course for which the student has received a grade of C, D, or F may be repeated under this option. When withdrawing from a course that has been declared as a course repeat, the previous grade will still be used in the computation of the GPA, and the course will not count toward the maximum of one repeat. Until a grade other than W is reported, the previous grade will be used for the GPA. The transcript will show both the original grades and the course repeat grades, but only the grade points and credit hours earned in the repeated course will count toward graduation and will be averaged into the student's GPA. Concurrent registration for multiple sections of a course is not allowed.

For all other courses repeated at UAH, both the original grade and the course repeat grade will show on the transcript and will be calculated in the student's GPA.

A student wishing to exercise the option of repeating a course with grade replacement must file the intent to do so in the Office of the Registrar before the end of regular registration using a Course Repeat/Forgiveness Declaration (https://www.uah.edu/registrar/forms/general/) form.

Enrollment Status

Seniors Taking Graduate Courses

A student (other than a senior taking graduate courses with appropriate authorization; see "Seniors Taking Graduate Courses", or a student in a combined undergraduate/graduate program) must be admitted to the Graduate School to receive graduate credit for courses taken or to take courses at the 500 level or above.

Course Load

A full-time graduate student is one enrolled in courses totaling 9.0 to 12.0 semester hours for Fall and Spring semesters and 6.0 semester hours for Summer. The maximum course load for a graduate student is 13.0 semester hours.

A part-time student is one who is enrolled in less than 9.0 hours and is defined as follows for Fall and/or Spring:
Full time = 9.0 or more semester hours
¾ time = 6.5 to 8.5 semester hours
½ time = 4.5 to 6.0 semester hours
Less than ½ time = 0.5 to 4.0 semester hours

Graduate Students enrolled during Summer term have the following enrollment classifications:
Full time = 6.0 or more semester hours
¾ time = 4.5 to 5.5 semester hours
½ time = 3.0 to 4.0 semester hours
Less than ½ time = 0.5 to 2.5 semester hours

Thesis/Dissertation Requirements

Students working on a thesis or dissertation must register for thesis or dissertation credit each semester in which they receive supervision or during which they are engaged in the formal preparation of the thesis/dissertation. **Students must register for 3.0 credit hours of either 699 or 799 in the semester that they defend**. Thesis and dissertation supervision courses are graded on satisfactory/unsatisfactory basis.

Continuous Registration Requirement

Students pursuing a doctoral degree must register for a minimum of 3.0 semester hours of graduate credit (to include dissertation credit) each Fall and Spring semester until all degree requirements are complete and the dissertation is complete and defended.

Credit to Audit

A student is permitted to change a course from credit to audit only during the first four weeks of classes. For students whose tuition is paid by the University through graduate assistantships or tuition scholarships, changing a course from credit to audit will require the student to reimburse the University for that course's tuition.

Graduate Non-Standard Terms for Federal VA Certification Purposes

The VA instructs institutions to enter the training time (full, ¾, etc.) in the TT/FT box for the enrollment period based on the school's academic policy when submitting the federal VA certification for graduate level terms. The VA also depends on the institutional determination of what is considered full time in these cases. The VA has an undergraduate matrix for students that is used for non-standard terms. However, this matrix does not adequately apply to graduate students in a fair and equitable manner when graduate students take courses in non-standard terms due to the weight of semester hours being affected by the number of hours the institution considers full time for graduate level coursework as compared to the undergraduate equivalent (12.0 hours for UG = FT vs. 9.0 hours Fall and Spring; 6.0 hours Summer for GR = FT). Furthermore, the academic policy does not subdivide the semester credit hours into smaller parts in order to apply the academic policy appropriately and in an equitable manner as compared to the undergraduate counterpart and due to the way the federal VA requires institutions to certify benefits to the VA.

To bring clarity and equity to this situation, the following policy has been established and will be applied when certifying graduate students in non-standard semesters that takes the academic policy of what the institution considers full time and allocates the policy's equivalent to the individual parts of the semester when certifying benefits to the VA and is publishing this certification policy guidance to bring the institution into federal compliance by having this information published in the University's catalog. Otherwise, graduate students using benefits would be unfairly subjected to the lesser-weighted undergraduate hours.

The University's determination for VA purposes of how the academic policy for full-time status would apply to VA students for determining rate of pursuit for VA purposes follows:

Graduate Policy for Full-Time Status Within a Semester:

9.0 hours Fall & Spring and 6.0 hours Summer

VA Non-standard part of term full-time status:
Fall / Spring semesters

Full time = 9.0 hours
10 week classes = 6.0 semester hours
7 week classes = 4.0 semester hours
5 week classes = 3.0 semester hours

VA Non-standard part of term full-time status:
Summer

Full time = 6.0 semester hours
12 week classes = 6.0 semester hours
10 week classes = 6.0 semester hours
7 week classes = 4.0 semester hours
6 week classes = 3.5 semester hours
5 week classes = 3.0 semester hours

Maymester (3 week classes) = 3.0 semester hours

Examinations

During each semester, one or more announced examinations of class period length may be held. At the end of each semester, a final examination period is scheduled for each course. Absences from a scheduled final examination without previous arrangement with the course instructor (except in extenuating circumstances) will be classified unexcused and a failing grade in the course will be assigned.

Any student whose final examination schedule is such that they are scheduled to take three or more examinations during a single day shall have the right to have the middle examination rescheduled. The date and time of the rescheduled examination shall be by mutual agreement between the student and the affected faculty member and must be agreed upon prior to the final week of the semester. It is the student's responsibility to notify the instructor of this type of conflict, and it is the instructor's responsibility to verify that the conflict actually exists. If a student is scheduled to take four examinations during a single day, then the same procedure applies except that the student shall now have the right to have both the second and fourth examinations rescheduled.

Graduate Degree Requirements

The following scholastic requirements are those of the Graduate School. Individual colleges and/or departments may list additional requirements.

1. Overall grade point average must be B (3.000) or better on all graduate credit hours at UAH. In addition, the grade point average must be B (3.000) or better on courses taken in the current graduate degree program;
2. No grade of D or F may be counted toward a graduate degree;
3. At least 30 percent of the hours required for a graduate degree must be completed in courses numbered 600 or above;
4. A majority of the credit hours (including dissertation credits) toward a doctoral degree must have been earned at UAH (or, in the case of joint/shared programs, at the participating institutions).
5. In the case of joint/shared programs, at least 33 percent of all hours earned for a degree must be earned at UAH.

The Master's Degree as First Graduate Degree

Students may follow one of two plans for the master's degree, except where modified by individual departments. Students should submit a Program of Study (https://www.uah.edu/graduate/resources/forms/) with the help of an academic advisor before the completion of 18 semester hours of graduate coursework, in order to ensure that courses taken will apply to the degree.

Thesis Plan

Degree requirements under this plan include completion of at least 24 semester credit hours of graduate coursework and at least six thesis credit hours of graduate coursework (699) toward the writing of an acceptable thesis. Students working on a thesis must register for thesis credit each semester in which they receive supervision or during which they are engaged in the formal preparation and/or defense of the thesis. The thesis should show evidence of the student's capability for research, independent thought, and analysis. Furthermore, the thesis should be written in fluent, acceptable English. The subject must be in the major field. All theses must be accessible to the general public.

Master’s thesis supervisory committees shall be appointed by the Chair of the department or program, with approval of the Graduate Dean, and must be composed of at least three members. Committee members shall all have been approved as graduate faculty, with at least half being full members of the graduate faculty and at least half being from the major department/program. The Committee Chair, who oversees the thesis process, must be a full-time UAH graduate faculty member. If the Research Advisor, who oversees the research project, is not a full member of the UAH graduate faculty, then there must be a separate Committee Chair.

A completed copy of the thesis must be submitted to the major department and the thesis defended according to the dates set by the Graduate School, typically at least eight weeks before the end of the semester in which degree requirements are expected to be completed. The specific dates and detailed procedures for submission of theses can be found on the Graduate School website (https://www.uah.edu/graduate/). After the student has passed their thesis defense, a copy of the thesis signature page signed by the committee members, Department Chair, and College Dean must be submitted to the Graduate School for final copyediting and approval by the Graduate Dean. Theses must comply with the regulations set forth in the Graduate School's Thesis, Dissertation, and DNP Project Manual. Students must be in good academic standing (3.000 or better) to schedule a thesis defense.

In exceptional cases, theses may be written in absentia. Before leaving the University, students must 1) select a thesis subject, 2) submit to the major Department Chair a satisfactory outline of the thesis, and 3) submit satisfactory evidence that adequate facilities are available where research is to be done. The student's Committee Chair, the Department Chair, and the Graduate Dean must then approve such a plan.

Non-Thesis Plan

Degree requirements for the master's degree under this plan include the completion of a minimum of 30 semester credit hours of graduate coursework. Individual colleges and/or departments may have specific or additional requirements. A thesis is not required; however, a candidate working under this option may be required to participate successfully in a seminar or other courses for acquaintance with research methods and appreciation of the place and function of original investigation in the field. Credit hours in 699 do not count as acceptable coursework toward a non-thesis plan.

Transfer Credit

With permission from the major department, students may transfer up to 12 semester hours of acceptable graduate credit from an incomplete degree program earned at an approved institution and may count it toward a master's degree. No transferred credit may be more than 10 years old at the time of a student's graduation from UAH. Such credit may be transferred with the approval of the major department if completed with a grade of B or better.

In some circumstances, a student may need to take a graduate course at another institution while enrolled in a UAH degree program. The transfer of such credit back to UAH must be approved by the department and by the Graduate Dean prior to the student enrolling at the other institution. (This does not apply to joint/shared programs with other institutions).

Time Limit

The degree must be earned within 10 years or by the end of the 30th semester. There are three semesters a year: Fall, Spring, and Summer. The time clock starts when the first course is taken (including transfer credit).

Application for Degree

All candidates for a master's degree must apply for the degree by submitting the Application for Graduate Degree (https://www.uah.edu/registrar/commencement/apply-to-graduate/) and fee to the Registrar's Office at least three months before the degree is to be conferred. Consult the Graduate School website (https://www.uah.edu/graduate/) for specific deadline dates.

Final Examination/Degree Completion

Candidates for a non-thesis master's degree may be required to take a final comprehensive examination or attain satisfactory performance (B or better) in a capstone course. Capstone courses must be designated as such by the department/program during the course approval process and be approved by the College Dean, the Graduate Council Curriculum Committee, the Graduate Dean, and the Provost. Final examinations for non-thesis candidates may be written, oral, or both.

Thesis option candidates must pass a final examination that includes an oral presentation of the thesis in the form of a seminar before the student's supervisory committee; the oral presentation is open to the members of the University community. Immediately following the oral presentation, the candidate will be examined by the committee in a closed meeting. The examination must be given within the semester in which degree requirements are to be completed, according to the dates set by the Graduate School. The results must be reported to the Graduate Dean within two working days. A written notice of the time and place of the examination must be sent to the Graduate Dean at least two weeks before the examination date. The Graduate Dean may appoint an additional member of the graduate faculty to act as an observer for each thesis defense. Once set, the examination becomes an official Graduate School matter; the date cannot be changed without prior arrangement among the supervisory committee members and the student, and without approval of the Graduate Dean.

After approval by the Graduate Dean, the department must send a copy of the written notice to the candidate and each member of the supervisory committee. A student may take the final examination no more than twice.

Thesis Submission

After the student has passed their thesis defense, and before the published deadline on the Graduate School website (https://www.uah.edu/graduate/), the thesis signature form (with supervisory committee, Department/Program Chair, and College Dean signatures) must be submitted to the Graduate School. Once the signature form is received, the Graduate School will contact the student with directions for creating an account in ProQuest. The student will upload the final thesis draft to ProQuest by the posted deadline on the Graduate School website and will then work with the UAH copyeditor to finalize the manuscript. All copyedits must be finished by the Registrar's deadline before the published graduation date, or the student will not graduate in that semester. Theses must comply with the regulations set forth in the Graduate School's (https://www.uah.edu/graduate/) Thesis, Dissertation, and DNP Project Manual. Upon completion of the copyediting process and the Graduate School's acceptance of a student's thesis, the Graduate Dean will sign the thesis signature form. All theses must be accessible to the general public. Detailed procedures for submission can be found on the Graduate School website. (https://www.uah.edu/graduate/) For specific questions call (256) 824-6055.

Late Submission

Students who miss the published deadlines but submit all required documents to the Graduate School by the end of the current semester will not graduate in the current semester; instead they will fall under the thesis deadlines of the subsequent semester. These students qualify for a 0-credit-hour option the subsequent semester if the 0-credit-hour option is offered by their departments. Students may only take the 0-credit-hour option once and must consult with their Committee Chairs in order to register for the 0-credit-hour option. All copyediting in ProQuest must be completed by the Registrar's deadline at least one week prior to the published graduation date in the semester during which the student plans to graduate.

Second Master's Degree

A student is permitted to apply no more than six semester hours of credit earned for one completed graduate degree toward an additional master's degree. Such permission is granted at the discretion of the major department and approved by the Graduate Dean.

Summary of Checkpoints toward Completion of all Master's Degree Requirements

The following checkpoints have been established to assist a student in proceeding from admission to graduation. Timely completion of these forms (https://www.uah.edu/graduate/resources/forms/), in sequence, will help to ensure that a student's degree program is in order.

Program of Study (POS): This form (https://www.uah.edu/graduate/resources/forms/) must be filed as early as possible and definitely before the completion of 18 semester hours. If a supervisory committee develops the program, the student should be invited to the committee meeting. Once approved, changes in the POS must be submitted on a Change of Program form and approved by the Committee Chair, Department Chair, and Graduate Dean. A valid reason must be given for the change.

Application for Graduate Degree: This is to be filed at least three months before the end of the semester in which degree requirements are expected to be completed. The application is available on the Registrar's website (https://www.uah.edu/registrar/commencement/apply-to-graduate/).

Notification of Thesis Defense/Final Examination: Notification of the examination date (https://www.uah.edu/graduate/resources/forms/) must be submitted to the Graduate School at least two weeks in advance of the examination. The examination must be given according to the dates published on the Graduate School website (https://www.uah.edu/graduate/), and the results reported within two working days to the Graduate Dean before the end

of the semester in which degree requirements are expected to be completed. The Graduate Dean may appoint an additional member of the graduate faculty to act as an observer for each thesis defense.

Report of Thesis Defense/Final Exam: Following the thesis defense/final exam, the supervisory committee shall submit a signed report (https://www.uah.edu/graduate/resources/forms/) to the Graduate School.

Thesis Signature Form: The thesis signature form with supervisory committee, Department/Program Chair, and College Dean signatures must be submitted to the Graduate School by the deadline posted on the website (https://www.uah.edu/graduate/resources/dates-deadlines/). After the signature form is received, the Graduate School will contact the student with directions for creating an account in ProQuest. The student will upload the final thesis draft to ProQuest by the Graduate School deadline, and then the student will work with the UAH copyeditor to finalize the manuscript. All copyedits must be finished by the Registrar's deadline before the published graduation date, or the student will not graduate in that semester.

Doctoral Degrees

UAH offers doctoral-level programs in the Colleges of Engineering, Science, and Nursing. For specific information regarding Nursing's Doctor of Philosophy (Ph.D.) or Doctor of Nursing Practice (DNP) degrees, please visit the College of Nursing website (https://www.uah.edu/nursing/graduate-programs/).

The Doctor of Philosophy Degree

The doctor of philosophy degree is a research-oriented degree awarded upon the demonstration of scholarly competence. The degree program at UAH is based on the successful completion of a POS designed by the student and a faculty committee. The program may include mastery of certain research skills (*e.g.,* languages, computer programming, statistics, and others approved by the Graduate Council), and must include an independent research project, the results of which are presented in the form of a dissertation.

Degree Requirements

The following specific degree requirements are applicable to all Ph.D. degree programs within the University. Additional requirements may be specified by individual colleges and/or departments as shown in this catalog under the appropriate section.

Course Requirements

Course requirements, including at least 48 hours of graduate coursework (excluding dissertation research), are defined in the POS and are determined by the appropriate department. Usually, the student will take a majority of the courses in a given field with the remainder in a cognate field. This, however, is not a requirement. A maximum of nine semester hours credit in thesis/research work from the master's degree may be allowed to count toward the 48-hour requirement. Students must also satisfactorily complete a minimum of 18 semester hours of dissertation research (799). Students must register for dissertation research each semester in which they receive faculty supervision. The approval of the POS should be accomplished as early as possible, but no later than one year after admission to the Ph.D. program. Once approved, the program may be amended only with the approval of the supervisory committee upon submission of the Change to Program of Study (https://www.uah.edu/graduate/resources/forms/) form and approval of the Graduate Dean.

Continuous Registration Requirement

All students who have completed the minimum coursework requirements for the doctoral degree they are pursuing (excluding dissertation hours) must register for a minimum of three semester hours of graduate credit (to include dissertation credit) each Fall and Spring semester until all degree requirements are complete.

Transfer Credit

All credit toward the Ph.D., which has not been earned at UAH, must be acceptable graduate credit from an approved institution. Such credit may be transferred with the approval of the major Department Chair if completed with a grade of B or better. A majority of the credit hours (including dissertation credits) toward a doctoral degree must have been earned at UAH (or, in the case of joint/shared programs, at the participating institutions).

Academic Residence Requirement

Residence at UAH as a doctoral student is required for evaluation of the student's investigative abilities, independent thought, and scholastic progress by faculty members other than the major Advisor. Residence may be established through either 1) being enrolled as a full-time student (at least nine graduate semester hours) either for one continuous academic year, or for Spring and Fall semesters in the same calendar year, or 2) being enrolled in at least six hours of graduate course work in at least three of four consecutive semesters. Colleges and/or departments may have more stringent requirements, and students should refer to the appropriate section of this catalog for details. All research effort presented for residence credit toward the Ph.D. degree must be performed under the direction of a full member of the graduate faculty.

Supervisory Committee

A supervisory committee is appointed for each student working toward the Ph.D., usually after satisfactory completion of a preliminary examination administered by the major department. The Ph.D. supervisory committee, which is composed of at least five members, shall be appointed by the Department/Program Chair, with approval of the Graduate Dean as part of the POS approval. Committee members shall all have been approved as graduate faculty, with at least half being full members of the graduate faculty and at least half being from the major department/program. The Committee

Chair, who oversees the dissertation process, must be a full-time UAH graduate faculty member. If the Research Advisor, who oversees the research project, is not a full member of the UAH graduate faculty, then there must be a separate Committee Chair.

Qualifying Examination

The Qualifying Examination is given under the auspices of the Graduate School and must be administered by the supervisory committee within one year of the date the student completes the formal coursework on the POS. It is conducted in two distinct stages which may be separated by a length of time deemed appropriate by the supervisory committee. The first stage is a demonstration through written and oral examination that the student is proficient in the subject matter in the POS. The final stage is the dissertation proposal review in which the student prepares a written report and makes a subsequent oral presentation describing the proposed dissertation research. Both the dissertation topic and expected approach(es) must be clearly delineated to the committee's satisfaction in order for a pass to be granted. The presentation of the oral dissertation research proposal must be scheduled through the Graduate School at least two weeks in advance. Once this review is complete, the results of the Qualifying Examination are reported to the Graduate School within two working days on the prescribed form. The presentation of the oral dissertation proposal may be given no more than twice.

Time Limit

The doctoral degree must be earned within 10 years (or by the end of the 30th consecutive semester, where consecutive semesters are Fall, Spring, and Summer). The clock starts when the graduate program's first credits are completed (if credits are transferred in, then the clock starts on the date the student is accepted into the program. All requirements must be completed no more than five years (or 15 consecutive semesters) after the student has passed the qualifying examination. Failure to meet this time requirement requires the student to take and pass another qualifying examination and (if required by the program) another implementation review.

Application for Degree

All candidates for a Ph.D. degree must apply for the degree by submitting the Application for Graduate Degree (https://www.uah.edu/registrar/commencement/apply-to-graduate/) and fee to the Registrar's Office at least three months before the end of the semester in which degree requirements are expected to be completed.

Dissertation

The dissertation is evidence that the student can independently identify a problem of contemporary significance through familiarity with the current literature in the major field, organize and execute a program of research, recognize and analyze the results, and present them in cogent, well-written exposition. Furthermore, the dissertation should be written in fluent, acceptable English. Dissertation results are expected to be submitted for refereed scholarly publication. All dissertations must be accessible to the general public. A completed copy of the dissertation must be submitted to the major department by the deadlines published on the Graduate School website (https://www.uah.edu/graduate/) before the end of the semester in which degree requirements are expected to be completed. Dissertations must comply with the regulations set forth in the Graduate School's Thesis, Dissertation, and DNP Project Manual.

Final Examination

Ph.D. candidates must pass a final examination that includes an oral presentation of the dissertation in the form of a seminar before the student's supervisory committee; the oral presentation is open to the members of the University community. Immediately following the oral presentation, the candidate will be examined by the supervisory committee in a closed meeting. The examination must be given within the semester in which degree requirements are to be completed, according to the dates set by the Graduate School. The results must be reported to the Graduate Dean within two working days. A written notice of the time and place of examination must be sent to the Graduate Dean at least two weeks before the examination date. The Graduate Dean may appoint an additional member of the graduate faculty to act as an observer for each dissertation defense. Once set the examination becomes an official Graduate School matter; the date cannot be changed without prior arrangement among the supervisory committee members and the student, and without approval of the Graduate Dean. After approval by the Graduate Dean, the department sends a copy of the written notice to the candidate and each member of the supervisory committee. A student may take the final examination no more than twice. Students must be in good academic standing (3.000 or better) to schedule a dissertation defense.

Summary of Checkpoints toward Completion of Degree Requirements

The following checkpoints have been established to assist a student in proceeding from admission to graduation. Timely completion of the forms, in sequence, will help to ensure that a student's degree program is in order.

POS: The supervisory committee and the student should meet to develop a complete POS (https://www.uah.edu/graduate/resources/forms/) for the student. The approval of the POS should be accomplished as early as possible, but no later than one year after admission to the Ph.D. program. Once approved, changes in the POS must be submitted on a Change to Program of Study (https://www.uah.edu/graduate/resources/forms/) form and approved by the Committee Chair, Department Chair, and Graduate Dean. A valid reason must be given for the change.

Notification of Qualifying Examination: Notification of the qualifying examination (https://www.uah.edu/graduate/resources/forms/) must be submitted to the Graduate School at least two weeks before the examination date.

Report of Qualifying Examination: Following the examination, the supervisory committee shall submit a signed report (https://www.uah.edu/graduate/resources/forms/) to the Graduate School.

Application for Graduate Degree: This should be filed three months before the end of the semester in which degree requirements are expected to be completed. The application (https://www.uah.edu/registrar/commencement/apply-to-graduate/) is available on the Registrar's website.

Notification of Dissertation Defense: Notification of the defense (https://www.uah.edu/graduate/resources/forms/) must be submitted to the Graduate School at least two weeks before the examination date. This examination must be taken by the deadlines published on the Graduate School website (https://www.uah.edu/graduate/) before the end of the semester in which degree requirements are expected to be completed. The Graduate Dean may appoint an additional member of the graduate faculty to act as an observer for each dissertation defense.

Report of Dissertation Defense: Following the defense, the supervisory committee shall submit a signed report (https://www.uah.edu/graduate/resources/forms/) to the Graduate School.

Dissertation Signature Form: The dissertation signature form with supervisory committee, Department/Program Chair, and College Dean signatures must be submitted to the Graduate School by the deadline posted on the website. After the signature form is received, the Graduate School will contact the student with directions for creating an account in ProQuest. The student will upload the final dissertation draft to ProQuest by the posted deadline on the Graduate School website (https://www.uah.edu/graduate/), and then the student will work with the UAH copyeditor to finalize the manuscript. All copyedits must be finished by the Registrar’s deadline before the published graduation date, or the student will not graduate in that semester.

Dissertation Submission

After the student has passed their dissertation defense, and by the published deadline on the Graduate School website (https://www.uah.edu/graduate/), the dissertation signature form (with supervisory committee, Department/Program Chair, and College Dean signatures) must be submitted to the Graduate School. After the signature form is received, the Graduate School will contact the student with directions for creating an account in ProQuest. The student will upload the final dissertation draft to ProQuest by the posted deadline on the Graduate School website (https://www.uah.edu/graduate/), and then the student will work with the UAH copyeditor to finalize the manuscript. All copyedits must be finished by the Registrar’s deadline before the published graduation date, or the student will not graduate in that semester. Dissertations must comply with the regulations set forth in the Graduate School's Thesis, Dissertation, and DNP Project Manual. Upon completion of the copyediting process and the Graduate School’s acceptance of a student's dissertation, the Graduate Dean will sign the dissertation signature form.

All dissertations must be accessible to the general public. Detailed procedures (https://www.uah.edu/graduate/) for submission can be found on the Graduate School website. For specific questions call (256) 824-6055.

Late Submission

Students who miss the published dissertation/DNP project deadlines but submit all required documents to the Graduate School by the end of the current semester will not graduate in the current semester; instead they will fall under the dissertation/DNP project deadlines of the subsequent semester. These students qualify for a 0-credit-hour option the subsequent semester if the 0-credit-hour option is offered by their departments. Students may only take the 0-credit-hour option once and must consult with their Committee Chairs in order to register for the 0-credit-hour option. All copyediting in ProQuest must be completed by the Registrar’s deadline at least one week prior to the published graduation date in the semester during which the student plans to graduate.

Registration

Registration is the process enrolling in credit hours within an academic semester. A credit hour is an academic unit of credit awarded for the completion of educational activities. The amount of credit awarded depends on the expected amount of time required to complete in-class and out-of-class work during a semester for a course that is passed. For example, each credit hour awarded for a lecture course at UAH requires at least one hour of classroom or direct faculty instruction and a minimum of two hours out-of-class student work each week for approximately 15 weeks for one semester. At least three hours of work per week is required for each credit hour awarded for practica, internships, activity courses, laboratory experiences, and distance-learning courses, although there will be variations in the amount and type of instruction and the minimum amounts of outside student work to accommodate differences among academic disciplines and the natures of particular subject matters and courses. The institution reserves the right to make credit hour assignments that exceed the minimum time requirements stated. Time expectations for work outside of class are minimums and may be higher depending on the nature and level of the course as well as the ability, commitment, and learning style of the student.

Schedule Adjustments

After the beginning of an academic term, students seeking to change their course schedules must follow the Schedule Adjustment Process. Schedule adjustments fall into seven categories: Drop/Add, Late Addition, Credit/Audit, Withdrawal, Retroactive Withdrawal, and Medical Withdrawal. The following definitions and procedures will govern the Schedule Adjustment Process.

Drop/Add

After classes have begun, students should consult with their academic advisor and other university officials for advice and approval before making any schedule changes. Students are advised to check the impact of dropping courses on things like financial aid, athletics eligibility, visa status, etc.

Through the sixth day of classes for a ten-week or fifteen-week semester, fourth day of a seven-week semester, or third day of a six-week or shorter semester, students may Add a course through the web-registration process, by meeting with their advisor, or by submitting a Registration/Schedule Adjustment form to the Office of the Registrar.

Through the sixth day of classes for a ten- or fifteen-week semester, fourth day of a seven-week semester, third day of a six week or shorter semester, students may Drop any or all courses from their schedule and receive a refund of tuition and fees associated with the dropped courses.

Late Addition

In rare circumstances a student may have a legitimate and substantial need to register, add a class or change a class section after the deadline (i.e., Last Day to Add a Class). In these instances the student must complete the Registration/Schedule Adjustment form, with recommendations (approval/non-approval) from the instructor and the chair of the department that offers the course. The Office of the Registrar will process the request once approvals are obtained.

New international students who want to register after the deadline must obtain approval from the International Student Advisor, and in the case of graduate students, the Graduate Dean. Approvals for late registration for new international students will include the respective academic units.

Credit to Audit

A student is permitted to change a course from credit to audit through the fourth week of a fifteen-week semester, the third week of a seven- or ten-week semester, and the second week of a five-week or shorter semester. The instructor is not required to grade any written assignments that may be submitted by an auditing student. A student who elects to audit a course may not at any point after electing to audit, change to “for-credit”, i.e., graded status. Any student failing to follow established procedure for change to audit will continue to be enrolled in the class for credit and may receive a failing grade in that course.

Withdrawal

After the Drop/Add period a student may Withdraw from any course and receive a grade of W. The deadline for Withdrawal is the last day of class prior to final exams for all parts of term.

Withdrawal is accomplished by either 1) executing a withdrawal on the registration website or 2) by submitting a Registration/Schedule Adjustment form to the Office of the Registrar. No signatures or approvals are required for a Withdrawal, but students should consult with appropriate officials to determine the impact that withdrawing from a course may have on financial aid, athletics eligibility, visa status, etc.

Class non-attendance does not constitute withdrawal nor does notification to the instructor. Any student failing to follow the established procedure for withdrawal will continue to be enrolled in the class and may receive a failing grade in that course.

Retroactive Withdrawal

Undergraduate students may at times experience extraordinary problems during an academic term. Within two years of having completed such a semester, a student may petition the Dean of Students to withdraw retroactively from ALL classes taken during that term. A retroactive withdrawal is granted only under exceptional circumstances, such as extraordinary circumstances and is only granted prior to graduation. The petition must use the Retroactive Withdrawal form and include clear and documented evidence whenever possible. The Dean of Students verifies the documentation and considers the petition. If the request is granted, the grades for ALL courses taken during the semester in question will be changed to W's. Petitions for Retroactive Withdrawals are considered after final grades are posted. Students should be aware that retroactive withdrawals may have an impact on their ability to receive or retain financial aid and timely completion of their degree.

Recording of Withdrawals

If the withdrawal process is completed after the first six days of the semester, then the withdrawing student's name will be on the final roll of the class from which the student withdrew, and that course will be recorded on the student's permanent record with a final grade of W.

Counseling

Students need to be aware that many potential employers, as well as graduate and professional schools, view an excessive number of W's on a transcript as a flag that the student cannot be counted on to complete demanding projects. Advisors should be informed of this fact and students should be encouraged to discuss with their advisors any plans to withdraw from a course, especially after the first two weeks of the semester.

Grading System

The University of Alabama in Huntsville's grading system includes grades of A, B, C, D, F, I, X, W, S, U, P, AU, and N. Instructors have the option of augmenting the course grades of A, B, C, and D with symbols "+" and "-" signifying, respectively, high and low achievement within the assigned grade. These augmented letter grades become part of the student's permanent record and appear on transcripts, but augmentation of a letter grade does not affect its value for the purposes of the GPA computation.

A	Superior achievement. Four quality points given per semester hour.
AU	Audit. Course attendance as a listener. No credit given, no quality points assigned, no attendance requirement.
B	Above average achievement. Three quality points given per semester hour.
C	Average Achievement. Two quality points given per semester hour.
D	Passing work. One quality point given per semester hour.
F	Failing work. No credit given; no quality points assigned.
I	Incomplete. Assigned by the instructor when a student, due to circumstances beyond his or her control, has not satisfied some requirement of the course. The deadline for a student to remedy a grade of I is the last day of class of the next semester enrolled or one calendar year from the date of the grade whichever occurs first. If the grade of I is on a student's record at the time of graduation, it is treated as an F.
N	No grade. Assigned by the Office of the Registrar when the instructor does not report a grade.
P	Passing work. Assigned in some courses. See Pass-Fail Option.
S	Satisfactory work. Applicable to noncredit courses and to some specified credit courses, and will not be counted in the GPA.
U	Unsatisfactory work. Applicable to noncredit courses and to some specified credit courses.
W	Withdrawal. (See Withdrawal Policy.)
X	Excused absence from examination. Assigned by the instructor when a student completes all course requirements except the final examination. The final grade becomes an F unless the examination is completed by the time of the announced deferred examination date at the beginning of the semester of next regular enrollment of the student. (See Examinations and UAH calendar). Time schedule permits a student to take only one examination on this date. If a student receives more than one grade of X, he or she should make arrangements directly with other instructors for additional make-up examinations.

Course Numbering System

Range Year	Student Normally Takes Courses
001-099	Refresher (noncredit): Remedial courses or prerequisite courses needed to meet certain conditions of admission that do not apply toward any degree requirement.
100-199	Freshman: Introductory lower-division undergraduate courses, usually taken by first-year students that generally do not include prerequisites.
200-299	Sophomore: Lower-division undergraduate courses usually taken by second- or third-year students where content is built on materials from the first-year level that may include a minimal amount of prerequisite preparation.
300-399	Junior (upper-level): Upper-division undergraduate courses usually taken by third- or fourth-year students that are normally courses in the major and often include significant prerequisite preparation.
400-499	Senior (upper-level): Advanced upper-division undergraduate courses that require a high degree of disciplinary sophistication or specificity in content; these courses assume considerable prerequisite knowledge and experience and include courses that are cross-listed with graduate courses.
500-599	Graduate: Introductory graduate courses, many of which are cross-listed with 400-level courses; open to undergraduate students in an approved UAH accelerated degree program; open to undergraduate students by permission from the Graduate School; open to all graduate students.
600-699	Graduate: Intermediate-level graduate courses where content builds on introductory graduate classes; open to graduate students and to undergraduate students in an approved UAH accelerated degree program.

700-799	Graduate, Ph.D. level: Advanced graduate courses with significant graduate prerequisite information; open to graduate students.

Change of Grade

When it is believed that a grading error may have occurred, a student is permitted a maximum of one semester from the date a grade is assigned to request a change of course grade. Grades submitted to the Office of the Registrar can normally be changed only by submission by the instructor on a Change of Grade form containing a written explanation of the error. The Change of Grade form must be approved by the department chair and received in the Office of the Registrar no later than two semesters from the date the original grade was assigned.

Academic Appeals

An academic appeal may be filed by a student regarding an action taken by University personnel, including instructional personnel, administrators, or staff members at the University, that affects the student's academic standing. Examples of academic appeals include, but are not limited to, allegations of unfairness in grading, alleged violation of a written or oral agreement with a student (e.g., course requirements for graduation), and alleged inconsistent applications of existing policies. Appeals related to course grades must be filed within 30 days of the end of the semester/term in which the grade was earned. Students wishing to file an appeal must follow the Academic Appeals policy, found at https://www.uah.edu/images/administrative/policies/02.01.12-AA_Academic_Appeals_Policy.pdf

If the withdrawal process is completed after the first six days of the semester, then the withdrawing student's name will be on the final roll of the course from which the student withdrew, and that course will be recorded on the student's permanent record with a final grade of W. After the published deadline, registration requires approval from the Dean of the Graduate School. A student must submit a written petition with appropriate documentation to substantiate extenuating circumstances to the Graduate School. The petition must include signatures from the instructor and the Department Chair that offers the course. All financial obligations to the University must be cleared before a student may register for courses. Students should consult with their academic advisor prior to registration. Non-degree students have a lower registration priority for full classes.

Concurrent registration for multiple sections of a course is not allowed. A student who schedules courses during registration makes a financial commitment to the University. Schedule adjustments, drops, and withdrawals must be officially transacted either via UAH web registration or in writing on a Registration/Schedule Adjustment form and recorded by the Office of the Registrar by the published deadlines. Adjustments in fees, if any, will be made by the Office of the Bursar. The University assumes no responsibility for students who attend courses without proper registration.

Transcripts

There are two ways to request an official UAH transcript:

1. Complete a transcript request form (https://www.uah.edu/registrar/forms/transcript-request/) available on the Registrar's website.

2. Request electronic or paper official transcripts through the National Student Clearinghouse (https://tsorder.studentclearinghouse.org/school/ficecode/00105500/) (PDF transcripts must be requested through this link).

Please note: A 3 percent convenience fee will be added to all credit/debit card payments. However, if the National Student Clearinghouse (https://tsorder.studentclearinghouse.org/school/ficecode/00105500/) is used to request transcripts, no convenience fee will be charged.

Graduate Catalog

The Graduate Catalog provides basic information about the more than 80 master's, doctoral, and certificate programs available at The University of Alabama in Huntsville. The catalog is a valuable resource that includes information about course offerings, degree programs, academic deadlines, tuition, financial aid, funding opportunities, and student support services. Students should become familiar with the catalog material pertaining to their degree programs. In addition to becoming familiar with the information in the catalog, students should consult their academic advisors to ensure they take advantage of university support and resources in meeting their educational and career goals. Together with their academic advisors, students should make certain that their chosen programs of study comply with all Graduate School policies and procedures.

The Graduate School Handbook, which contains supplementary Graduate School policies and procedures, is currently under review. For questions regarding Graduate School policies and procedures or the content of this catalog, please contact the Graduate School at 256.824.6050, gradstudent@uah.edu (DeanGrad@uah.edu), or stop by our office in the Student Services Building (SSB), Room 218.

General Information

Mission of The University of Alabama in Huntsville

The University of Alabama in Huntsville is a research-intensive, internationally recognized technological university serving Alabama and beyond. Our mission is to explore, discover, create, and communicate knowledge, while educating individuals in leadership, innovation, critical thinking, and civic responsibility and inspiring a passion for learning.

History

The University of Alabama in Huntsville (UAH) is a part of the University of Alabama System. In June 1969, the University of Alabama Board of Trustees established the University of Alabama System with three independent, autonomous campuses at Huntsville, Birmingham, and Tuscaloosa. Each campus has a separate president who reports to the Board of Trustees through the chancellor of the system.

Academic programs were initiated in Huntsville in 1950; in 1963 degree opportunities at the master's level were provided and in 1964, at the baccalaureate level. The first master's degree based on work begun and completed in Huntsville was awarded in 1964 and the first undergraduate degrees in 1968. Doctoral programs were initiated in physics and engineering in 1971, and the School of Nursing was established the same year. In 1974, in a component of the Alabama School of Medicine, the first full-time medical students began their core clinical experience in Huntsville. (These programs were transferred to direct UAB management in 1995). In the two decades of the 1970s and 1980s, UAH implemented a broad range of undergraduate degree programs; established master's programs in the liberal arts, nursing, and business administration; initiated professional degree programs at both the graduate and undergraduate levels; and inaugurated selected Ph.D. programs in high-technology fields in the sciences and engineering.

UAH is focused to meet the specific needs of scientific and technological enterprises and the cultural and intellectual needs of a rapidly expanding region. It is UAH's intention to be innovative, even experimental, to explore what is new, to evaluate existing programs continually, to develop and establish curricula and pedagogical techniques calculated to help students live and perform well in a complicated environment.

Accreditation

The University of Alabama in Huntsville is accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) to award bachelor's, master's, specialist, and doctoral degrees. Questions about the accreditation of The University of Alabama in Huntsville may be directed in writing to the Southern Association of Colleges and Schools Commission on Colleges at 1866 Southern Lane, Decatur, GA 30033-4097, by calling (404) 679-4500, or by using information available on SACSCOC's website (www.sacscoc.org (http://www.sacscoc.org/)).

Several UAH programs are accredited by their respective accrediting agencies. Academic programs in chemistry are accredited by the American Chemical Society. Eight undergraduate engineering programs (aerospace engineering, chemical, civil, computer, electrical, industrial and systems, optical, and mechanical) are accredited by the Accreditation Board for Engineering and Technology, Inc. (ABET, Inc.) Both undergraduate and graduate programs in nursing are accredited by the Commission on Collegiate Nursing Education. Computer science holds accreditation from the Computing Accreditation Commission of ABET, Inc. All programs, both undergraduate and graduate, in the College of Business are accredited by the American Assembly of Collegiate Schools of Business (AACSB). In addition, the University of Alabama in Huntsville is an accredited institutional member of the National Association of Schools of Art and Design (NASAD) and the National Association of Schools of Music (NASM). All teacher certification programs are approved by the Alabama State Department of Education (ALSDE). All teacher certification programs are accredited by The *Council for the Accreditation of Educator Preparation* (CAEP).

Academic Calendars

Academic calendars are available on the registrar's website and can be found at the following webpage:

http://www.uah.edu/registrar/calendars (http://www.uah.edu/registrar/calendars/)

Student Facilities and Services

University Housing

The University of Alabama in Huntsville (UAH) offers a variety of housing facilities to meet the needs of its diverse student population. Please visit www.uah.edu/housing (https://www.uah.edu/housing/)for the most current information for housing options, requirements, policies, and residence hall amenities/services. All first-year freshmen students who apply for University housing will be assigned to either Central Campus Residence Hall, Frank Franz Hall, or North Campus residence Hall. All first year full-time undergraduate students with a permanent legal residence beyond a 30 mile radius from campus are required to live in the campus residence halls. Upper-class residents may apply to Bevill Center, Charger Village Addition, Charger Village Original, and Southeast Campus Housing. Upperclassmen assignments are based on availability of space off of a created waitlist by application date.

All residence halls are convenient to the Salmon Library, the University Fitness Center, Charger Union, and all classroom facilities. In each residence hall, suites are furnished with a sofa, accent tables, and lounge chairs. The suite will have a mini kitchen that includes a refrigerator and microwave. Every bedroom has a loftable extra-long twin bed, a wardrobe or closet, a chest of drawers, a desk, and chair. All Housing and Residence Life suites have digital cable (Xfinity On Campus), Wifi, and wired internet access. Finally, a laundry room, study lounges, and a kitchen can be found.

All housing facilities have a full-time, live-in Resident Director and Resident Assistants (RA) who live on each floor. RA's develop activities and programs, provide assistance to student residents, serve as liaisons to other University departments and help create a residential community that contributes to effective student learning, personal and social growth, and individual responsibility.

Any admitted student to UAH is eligible for an assignment in University Housing. Housing and Residence Life housing contracts can be found on their main page at http://www.uah.edu/housing (https://www.uah.edu/housing/). Room assignments are contingent upon confirmation of admission. Priority for assignment is based upon classification by the University (first-year student, transfer student, etc.), the date of receipt of the application, commitment fee, and availability of housing.

All single students sign an academic year room contract (Fall and Spring). Housing charges are due when tuition is due each academic semester. Summer housing for single students is available in a residence hall under a separate contract.

Current rates and additional information are all available from the:

Housing Office
601 John Wright Drive
256.824.6108

or online at http://www.uah.edu/housing (https://www.uah.edu/housing/). Individual and group tours of UAH Housing and Residence Life may be arranged by appointment through the Admissions Office.

University Food Service

Through the delivery of an exceptional food program, the UAH community is provided with options, quality, and convenience. Finding your favorite foods on campus is a snap. We are proud to offer a dining program, complete with signature brands and menu selections that entail just about every item you can imagine. Please visit www.uah.edu/dining (http://www.uah.edu/dining/) for available dining locations, menus, meal plan hours, and meal plan options.

The Charger Cafe is an "All You Care To Eat" dining area located in the Conference Training Center (CTC). The menu program is known as Ultimate Dining and features rotating formats of food presentation: Classics, Pizzarette, The Grille, International Station, Soup'n Salad, Made to Order Deli Station, Vegetarian Selections, Gluten Free Bar, Desserts and Beverages. A spacious dining room with an adjacent patio is available for all guests.

In addition to the Charger Cafe, the CTC also houses 'We Proudly Brew Starbucks Coffee'. Freshly brewed gourmet coffees, teas, fresh baked gourmet muffins and cookies, salads, and sandwiches provide a variety of choices for all to enjoy.

Charger Village (CGV) houses Chick-fil-A, Papa John's Pizza, Burrito Bowl, and a convenience store (The C-Store) featuring Boars Head Deli. A nice dining area and patio are available to meet with friends for a meal or to enjoy the view while studying.

Charger Union (CGU) is the home to Dunkin' Donuts, Mein Bowl, and The Den by Denny's. There are plenty of places in and around the building to enjoy a cup of coffee or meet friends to indulge in the best wings on campus.

Technology Hall is the home to Blue's Tech Hall mini convenience store featuring Simply-To-Go quick food options such as sandwiches, salads, fresh fruit, and more! The store also offers assorted candy bars, energy drinks, or bottled sodas or water.

UAH Dining Services also provides catering services campus-wide for any student or campus group. Visit www.uah.edu/bevill-center/catering (https://www.uah.edu/bevill-center/catering/) to view our menu options as well as limited-time offers for special events.

The Charger Union

The Charger Union (CGU) serves as the heart of the UAH community. It provides a comfortable, safe, and welcoming environment for student life and engagement. The Charger Union supports the personal and professional development of students, offering formal and informal spaces to attend programs and access to high-quality services that enhance the UAH educational mission.

The Charger Union offers meeting rooms, dining (Mein Bowl, Dunkin Donuts, and The Den by Denny's) and snack facilities, lounges, two game rooms (one traditional game room with pool tables and ping pong, and an e-gaming lounge), an information desk, student organization spaces, a theater, and the University Bookstore. Also located in the CGU are the offices of the Dean of Students, the Student Government Association, Association for Campus Entertainment, Student Life, and Charger Union Administrative offices.

M. Louis Salmon Library

333 Salmon Library
Telephone: 256.824.6540
Email: library@email.uah.edu
Director: David Moore

The M. Louis Salmon Library supports the information, instructional, and research needs of faculty, staff, students, and the surrounding community. It is housed in a 105,000 square feet facility which includes an InfoArcade, five general-purpose laboratories, and a 75-seat lecture hall. It also houses the Faculty Resource Center (FRC) for the University. Over 250 workstations are supported in the facility. There is also a coffee shop on the ground floor with a large area for collaborative study, complete with comfortable seating and whiteboards.

The Library supports the academic and research programs of the University. It has a collection of over 350,000 print volumes, a selective collection of over 500,000 United States government publications, and over 600,000 materials in microform, and manuscript collections. In addition to books and microform materials, the Library offers a broad selection of books, journals, newspapers, and other serials in electronic form. Approximately 67,000 online paid periodical titles, over 65,000 electronic books and over 350 databases can be accessed both on and off-campus via the Library website at http://lib.uah.edu (http://www.lib.uah.edu/). In addition, the University Archives/Special Collections offer a number of unique collections, including the papers of former Congressman Robert Jones, the personal Library of Willy Ley, the architectural research collection of Harvie P. Jones, and several space-related collections involving such projects as the Saturn V rocket, Skylab and Apollo-Soyuz.

For students in science and engineering and technology, research at UAH is supported by the Redstone Scientific Information Center (RSIC), located five miles from campus. RSIC was developed to support the wide-ranging research interests of NASA and the United States Army Missile Command and is one of the finest technical libraries in the Southeast. UAH subscribes to numerous full-text and bibliographical databases each of which supports specific colleges, including Arts, Humanities, and Social Sciences; Business; Education; Engineering; Nursing; Professional and Continuing Studies; and Science.

UAH subscribes to numerous full-text databases each of which supports specific colleges including: Arts, Humanities, and Social Sciences; Business; Education; Engineering; Nursing; Professional and Continuing Studies; and Science. The Library is privileged to provide access to many major online resources including the entire Elsevier collection through Science Direct and Scopus, Springer, CINAHL, the IEEE collection through IEEExplore, ABI/Inform, Bloomberg Terminals, Academic Search Complete, and JSTOR (Journal Storage). The Library is also a member of several consortia that provide access to research materials not owned by libraries in north Alabama. Its membership in the Online Computer Library Center (OCLC) and the Network of Alabama Academic Libraries (NAAL) facilitates rapid document delivery/interlibrary loan service to faculty and students without charge.

Reference services are provided by reference librarians who are able to assist students in finding information in-person, by email, phone, text message, chat, or Twitter. Group Library instruction sessions are provided to teach students how to locate, manage, and evaluate the information they need for class projects and papers. Other Library services include wireless access, federated searching across databases (EBSCO Discovery Service OneSearch), instant linking to the article level in most databases (LinkSource), Turnitin.com training (plagiarism), group study rooms, PC and Mac computers, a scanner workstation, a digital audio/video area, and special computer accommodations for users with disabilities. Printing is available in the InfoArcade and labs.

Loan Periods

Undergraduates may borrow materials for four weeks; graduate students for 90 days. Overdue fines accrue at the rate of twenty-five cents per day. All fines must be paid before registration for the following semester.

Contact Information

For additional information about the Library, inquire at the User Services Desk, 256.824.6530, the Reference Desk, 256.824.6529, Interlibrary Loan, 256.824.6124, Twitter @uahEref, SMS Text to 256.824.2368, Email at erefq@uah.edu. The Library home page is: http://www.lib.uah.edu (http://www.lib.uah.edu/).

Student Identification Cards

As your official student identification, the Charger Card gives you access to campus facilities and services and allows you to make purchases at participating locations.

Your Charger Card may be used for access to or purchases in:

- Food Service Venues
- Barnes and Noble's On-Campus Bookstore
- University Fitness Center
- Residence Halls
- Salmon Library
- Student Health Services
- Campus Entertainment and Athletic Events
- Computer Labs and Printers
- Copy and Laundry Machines

The Charger Card offers four (4) types of accounts:

- Meal plans
- Charger Bucks
- Dining Dollars
- Flex

Deposits by cash, check or credit card are accepted in UAH's Cashier's Office.

Meeting Spaces

Meeting Rooms

The Charger Union has meeting rooms designed for multipurpose functions. The rooms can accommodate meetings of a variety of sizes. The Center has a large number of tables, chairs, portable stages, and audiovisual equipment, and can assist in designing set-up to make any conference or meeting a success.

Lounges

Spacious lounges, designed as a place to relax and meet friends, are equipped with comfortable furniture, tables and chairs for small group meetings, and plenty of places to charge your favorite electronic devices.

Student Support Services

Dean of Students

Student Affairs at UAH creates opportunities for students to engage in a diverse community of learners characterized by a supportive campus environment that encourages individual growth and development. This mission is accomplished through comprehensive programs and services focused on student learning and success. Through the Dean of Students office, the interpretation and administration of the Code of Student Conduct takes place. The Code of Student Conduct protects students' rights and assists students in their awareness of their obligations and responsibilities in being part of the University community.

Counseling Center

The Counseling Center, under the direction of the Dean of Students, at UAH provides specialized professional services designed to assist students in their academic, personal, and social development. Many students encounter personal difficulties that affect the course of their collegiate experience. The Counseling Center provides short-term therapy to help students cope with stress and/or learn new skills. Counseling services are available to all students currently enrolled in 3 or more credits at UAH. The staff is committed to meeting the needs of individuals from diverse backgrounds. Services are confidential and in accordance with the ethical guidelines of the American Psychological Association. Information from counseling sessions does not go on a student's academic record and is not released to any other individuals (on campus or off) without the student's written permission—except in rare situations as mandated by law. Students come in for a variety of concerns such as relationships, self-esteem, time management, anxiety, family concerns, depression, stress management, and many other concerns. See our webpage at https://www.uah.edu/counseling-center (https://www.uah.edu/counseling-center/) for more information. To schedule an appointment, contact the Counseling Center at 256.824.6203.

Disability Support Services

Disability Support Services (DSS) is committed to ensuring access to educational opportunity for all qualified students with disabilities. Any student who has a documented condition that substantially limits his or her learning activities can request coordination of appropriate academic support services. DSS collaborates with students, faculty, and staff to ensure appropriate services are provided to students registered with our office.

Students must self-identify to be eligible for accommodations and other disability services on campus. However, the student can choose whether or not to register for services. Disability support services are provided in accordance with federal law. To be eligible for services, students must provide documentation of disability from an appropriate practitioner. See our webpage at https://www.uah.edu/dss (https://www.uah.edu/dss/) or contact DSS for more information. To schedule an appointment contact our office at 256.824.1997 or come by Wilson Hall 128.

Office of International Services

The Office of International Services (OIS) prepares students, faculty and staff for success in today's globally interconnected world through international study, research, teaching, service, and experience and through opportunities for intercultural engagement that foster strengthened awareness and understanding among people of different cultures. The purpose of OIS is to promote campus and community internationalization and to provide central administrative support for a wide-ranging network of international initiatives. Through the Office of International Student & Scholar Services, the Intensive Language & Culture Program, and the Office of International Programs, the OIS coordinates programs and services that extend the university to our local and global communities. The OIS is located in the Student Services Building, Room 218; phone 256.824.6055.

Student Health Services

The services of the Student Health Center are available to students enrolled for the current semester. Services available include treatment of illnesses and injuries, preventive health care, lab testing, immunizations and health counseling. There is a nominal fee for an office visit with additional minimum charges for laboratory testing, immunizations, and medications. The Student Health Center is located in Wilson Hall 325. The center is open Monday through Friday 8:15 a.m. – 5:00 p.m. For more information call 256.824.6775 or visit our website http://uah.edu/shc (http://www.uah.edu/shc/).

Tuberculosis Screening and Immunization Requirements

Immunization Requirements

The University of Alabama in Huntsville requires all students born after 1956 to have had 2 does of measles (rubeola) vaccine. One dose must have been a Measles, Mumps, Rubella (MMR) vaccine. Students ages 30 and older may submit evidence of one dose of MMR if the dose was received after 1980. A copy of a lab report showing proof of immunity to measles (rubeola), mumps, and rubella may be submitted in lieu of the vaccine.

A meningitis vaccination within the past 5 years is required for all first time freshman and all students living in on-campus residence halls.

Tuberculosis Screening

Domestic students are required to complete a Tuberculosis Screening form. Tuberculosis testing may be required for domestic students based upon the information provided on the screening form.

International students are required to have a Tuberculosis test. The test must be administered in the United States within 12 months of the student's most recent arrival to campus. TB screening tests are administered upon your arrival to campus at the Student Health Center.

Documentation Requirements

All new students admitted to The University of Alabama in Huntsville must provide a completed Tuberculosis Screening and Immunization Requirements form which is signed by a physician or authorized individual. The physician's license number or clinic stamp must also be recorded on the form for verification purposes. The form and instructions for completion can be found at the Student Health Center website at www.uah.edu/shc (http://www.uah.edu/shc/). Forms, along with any necessary attachments, should be uploaded to the Student Health Patient Portal (https://uahportal.pointnclick.com/) submitted to:

The University of Alabama in Huntsville
Student Health Center
Wilson Hall 325
301 Sparkman Drive
Huntsville, AL 35899
256.824.6775
256.824.6722 (Fax)
immunizations@uah.edu

Please note: The requirements noted above are for new students being admitted to The University of Alabama in Huntsville. Individual colleges, e.g. College of Nursing, may have additional immunization requirements.

Veterans Affairs

The Office of Military & Veterans Programs (MVP) serves military veterans and their dependents during their time as students at UAH. The MVP office assists students with applications for veterans' educational benefits to which they may be entitled as a result of their service or dependency status. While the MVP staff does not determine eligibility for assistance, it does ensure that proper paperwork is completed, certified, and filed with the US Department of Veterans Affairs. The Office of Military & Veterans Programs also offers resources for transitioning to the institution and encourages participation in programs to help students stay engaged at UAH.

For questions about tuition and fees for Veterans, please consult the UAH Tuition Fee Guidelines (http://catalog.uah.edu/undergrad/admissions/residency/) page.

For students receiving VA education benefits, any complaint against the university should be routed through the VA GI Bill® Feedback System by going to the following link: http://www.benefits.va.gov/GIBILL/Feedback.asp. The VA will then follow up through the appropriate channels to investigate the complaint and resolve it satisfactorily.

GI Bill® is a registered trademark of the U.S. Department of Veterans Affairs (VA). More information about education benefits offered by VA is available at the official U.S. government Web site at https://www.benefits.va.gov/gibill *(*https://benefits.va.gov/gibill/*)*. *(*https://benefits.va.gov/gibill/*)*

Class Schedule

The following link will take you to the current class schedule:

http://www.uah.edu/cgi-bin/schedule.pl

Additional student information can be found at https://www.uah.edu/students (https://www.uah.edu/students/).

Catalog Archives

The online catalog has been permanently archived since its first publication in 2013-2014.

- 2013-2014 (https://catalog.uah.edu/archive/2013-2014/) (Undergraduate (https://catalog.uah.edu/archive/2013-2014/undergrad/), Graduate (https://catalog.uah.edu/archive/2013-2014/grad/))
- 2014-2015 (https://catalog.uah.edu/archive/2014-2015/) (Undergraduate (https://catalog.uah.edu/archive/2014-2015/undergrad/), Graduate (https://catalog.uah.edu/archive/2014-2015/grad/))
- 2015-2016 (https://catalog.uah.edu/archive/2015-2016/) (Undergraduate (https://catalog.uah.edu/archive/2015-2016/undergrad/), Graduate (https://catalog.uah.edu/archive/2015-2016/grad/))
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- 2019-2020 (https://catalog.uah.edu/archive/2019-2020/) (Undergraduate (https://catalog.uah.edu/archive/2019-2020/undergrad/), Graduate (https://catalog.uah.edu/archive/2019-2020/grad/))
- 2020-2021 (https://catalog.uah.edu/archive/2020-2021/) (Undergraduate (https://catalog.uah.edu/archive/2020-2021/undergrad/), Graduate (https://catalog.uah.edu/archive/2020-2021/grad/))
- 2021-2022 (https://catalog.uah.edu/archive/2021-2022/) (Undergraduate (https://catalog.uah.edu/archive/2021-2022/undergrad/), Graduate (https://catalog.uah.edu/archive/2021-2022/undergrad/))
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