1985

1985-1987 Graduate Catalog

University of Alabama in Huntsville

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Graduate Catalog
1985-1987

The University of Alabama in Huntsville
Graduate Catalog
1985-87
The University of Alabama in Huntsville is committed to equal opportunity in employment and education. The University does not discriminate in any program or activity on the basis of race, color, religion, sex, age, or national origin, or against qualified handicapped persons, and it maintains an affirmative action program for protected minorities and women.

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The University of Alabama in Huntsville also reserves the right to modify its institutional policies from time to time. 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.
## Class Periods

### Monday, Wednesday, Friday

<table>
<thead>
<tr>
<th>Period</th>
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<tr>
<td>A</td>
<td>8:00 a.m.- 9:15 a.m.</td>
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<tr>
<td>B</td>
<td>9:25 a.m.-10:40 a.m.</td>
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<td>C</td>
<td>10:50 a.m.-12:05 p.m.</td>
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<td>D</td>
<td>12:15 p.m.-1:30 p.m.</td>
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<td>F</td>
<td>1:40 p.m.-2:55 p.m.</td>
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<td>G</td>
<td>3:05 p.m.-4:20 p.m.</td>
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<td>H</td>
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<td>R</td>
<td>3:50 p.m.-5:50 p.m. (MW only)</td>
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<td>S</td>
<td>6:00 p.m.-8:00 p.m. (MW only)</td>
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<td>T</td>
<td>8:10 p.m.-10:10 p.m. (MW only)</td>
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### Tuesday, Thursday

<table>
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<td>M</td>
<td>8:00 a.m.-10:00 a.m.</td>
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<td>P</td>
<td>10:10 a.m.-12:10 p.m.</td>
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<tr>
<td>Q</td>
<td>1:40 p.m.-3:40 p.m.</td>
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<td>R</td>
<td>3:50 p.m.-5:50 p.m.</td>
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<td>S</td>
<td>6:00 p.m.-8:00 p.m.</td>
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<td>T</td>
<td>6:00 p.m.-8:00 p.m.</td>
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</tbody>
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## The UAH Term System

UAH has four identical terms, each spanning twelve weeks. Credit for course work is granted in standard semester-hour units.

## General Information Center

The General Information Center located in the University Center is available to all students, prospective students, and the public to obtain information about the University of Alabama in Huntsville.
ACADEMIC CALENDAR 1985-86

Fall Term
Early Registration ............................................. July 11—24
Residual ACT ....................................................... June 27, July 11, August 8, August 22
Application Deadline ........................................... August 13
Holiday .............................................................. September 2
Registration ......................................................... September 3
Classes Begin—8:00 a.m. ......................................... September 5
Late Registration .................................................. September 5, 6
Deferred Exams (Summer term) ................................. September 7
Study Day ........................................................... November 14
Examinations ....................................................... November 15, 16, 18, 19
Last Day Fall Term ............................................... November 19
Commencement ..................................................... November 24

Winter Term
Early Registration ................................................ October 10—23
Residual ACT ......................................................... October 31
Application Deadline ............................................ November 11
Thanksgiving Holidays ............................................. November 28, 29
Registration ........................................................ December 2
Classes Begin—8:00 a.m. ......................................... December 4
Late Registration .................................................. December 4, 5
Deferred Exams (Fall Term) ..................................... December 7
Student Christmas Holidays ................................... December 21—January 1
Classes Resume—8:00 a.m. ....................................... January 2
Study Day ........................................................... February 25
Examinations ....................................................... February 26, 27, 28, March 1
Last Day Winter Term ............................................ March 1

Spring Term
Early Registration ................................................ January 16-29
Residual ACT ......................................................... February 13
Application Deadline ............................................ February 14
Registration ........................................................ March 7
Holiday .............................................................. March 10
Classes Begin—8:00 a.m. ......................................... March 11
Late Registration .................................................. March 11, 12
Deferred Exams ................................................... March 15
Examinations ....................................................... May 20, 21, 22, 23
Last Day Spring Term ............................................ May 23
Holiday .............................................................. May 26
Commencement ..................................................... May 31

Summer Term
Early Registration ................................................ April 17—30
Residual ACT ........................................................ May 8
Application Deadline ............................................ May 15
Registration ........................................................ June 5
Classes Begin—8:00 a.m. ......................................... June 7
Late Registration .................................................. June 9, 10
Deferred Exams (Spring Term) ................................. June 14
Holiday .............................................................. July 4
Study Day ........................................................... August 19
Examinations ....................................................... August 20, 21, 22, 23
Last Day Summer Term ........................................... August 23
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**Legend of Abbreviations**

- **ETS**—Educational Testing Service
- **GPA**—Grade Point Average
- **GMAT**—Graduate Management Aptitude Test
- **GRE**—Graduate Records Exam
- **IPG**—Irregular Postgraduate
- **MAT**—Miller Analogies Test
- **NEAS**—National Engineering Aptitude Search
- **NTE**—National Teacher Examination
- **TOEFL**—Test of English as a Foreign Language
Statement of Purpose

The University of Alabama in Huntsville is dedicated to the intellectual, aesthetic, social, technological, and economics advancement of the state and region it serves and is a competent member of the national and international academic communities. Such membership requires constant attention to teaching, research, and interaction with local, state, and regional communities. It demands a steady allegiance to academic values, an atmosphere conducive to the unhindered pursuit of knowledge, and the education of students as thinking individuals. Basic to the establishment and maintenance of its identity as a true university is a strong program in the liberal arts and sciences, which continues to form the core of education. This institution intends to expand its programs by pursuing the special advantages of its environment.

Its location in the midst of an important government and industrial research center gives it unusual opportunities for new and creative programs in engineering and natural sciences. Huntsville, a city which has peacefully managed drastic social and economic changes, also offers a rich field of discovery in social sciences. Because many citizens in this area have well developed cultural interests and talents, the university is encouraged to provide exceptional programs in the humanities.

In the development of these programs, and university is incorporating new academic disciplines, enriching traditional studies, and creating fresh academic approaches as faculty and students concentrate on the vastly complex problems of contemporary life.
The Setting

Surrounded by the hills, mountains, and rivers of the lower Tennessee Valley, Huntsville offers a cultural and intellectual diversity rare in any section of the country. To the outside world, Huntsville (pop. 150,000) is perhaps best known for its cluster of high technology industries and agencies — NASA's George C. Marshall Space Flight Center, the U.S. Army Redstone Arsenal, the Alabama Space and Rocket Center, and the 2000-acre Milton K. Cummings Research Park, home of some of America's most sophisticated and fastest-growing technical firms. However, Huntsville's image as a national research center built on advanced technology often obscures its uncommon blend of the traditional and the contemporary. First-time visitors are often equally struck by Twickenham, a showplace historical district in the center of town. Twickenham, a square-mile neighborhood of painstakingly restored nineteenth-century homes and gardens, captures better than most southern cities the opulence and charm of cotton-era architecture. Other visitors admire one of best restored and revitalized downtown areas in the nation, dominated by the Von Braun Civic Center with its art museum, concert hall, sports arena, exhibition halls and playhouse. Still others appreciate the opportunities for boating, camping, hiking, and other Southern Appalachian recreational activities in the nearby lakes, mountains, and state parks. Huntsville is one of the few cities of its size offering such a variety of clubs, professional organizations, community service groups, sports activities, and cultural groups, including a symphony orchestra and an opera company. It is certainly the only city in the South or West in which the leading local sport is ice hockey.

The University

With a quarter of a century of full-time operations behind it, programs at the University of Alabama in Huntsville are still developing and diversifying. Since UAH is new, it is unfettered by rigid patterns of established practice. It is our intention to be 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.

Efforts to start an undergraduate program in Huntsville began as early as 1947. Following negotiations between local officials and those at the University of Alabama in Tuscaloosa, the University Center opened as a branch of the Tuscaloosa campus on January 6, 1950, with 137 students in ten sections of basic freshman subjects. The University Center grew steadily during the 1950's, but like many things in Huntsville, it was given added impetus by the development of the space program in 1957. The first 83 acres of the present site were purchased and Morton Hall constructed in 1960. Degree-awarding programs at the Masters level were first offered in 1963 and at the baccalaureate level in the following year. The first Master's degree based on work begun and completed in Huntsville was awarded in 1965 and the first undergraduate degrees in 1968. In 1969 UAH was made a part of the newly-established University of Alabama System, three independent, autonomous campuses in Huntsville, Tuscaloosa, and Birmingham.

The University is accredited by the Southern Association of Colleges and Schools.
The School of Graduate Studies

The School of Graduate Studies provides a challenging and intellectually invigorating environment for advanced learning, discovery, and the pursuit of knowledge. The School seeks to assemble scholars among both students and faculty whose aims are to pursue advanced research both for the sake of pure knowledge and for serving mankind. Students seeking graduate studies are those who have already demonstrated strong intellectual abilities during their undergraduate years. The faculty which supervises graduate education formulates academic policies and maintains the quality of education. It is the main element in establishing the School’s level of excellence.

Faculty members of the School of Graduate Studies are selected from the University’s most active and productive scholars. Instruction within the School is therefore provided by those who have achieved national or international stature in their fields. A list of graduate faculty for each department appears at the head of each departmental entry. A complete list of graduate faculty appears at the end of this catalog.
Resources

School of Primary Medical Care

The school offers postbaccalaureate professional medical training on three levels. For junior and senior medical students in the University of Alabama School of Medicine, the school offers a complete clinical education program. Through the School of Primary Medical Care, UAH jointly offers with Huntsville Hospital a three-year residency in family practice for medical school graduates who want specialized training to qualify for certification by the American Board of Family Practice. The school also sponsors or cosponsors a variety of continuing medical education conferences and workshops to aid practicing physicians in maintaining licensure and certification requirements. All three programs are accredited through the University of Alabama School of Medicine (UASOM).

All UASOM freshman students are admitted to the parent school in Birmingham, where they complete their basic medical science training, which comprises the first two years of the undergraduate medical curriculum. Students then take their clinical clerkships and electives at the Birmingham, Huntsville, or Tuscaloosa campuses. Students who satisfactorily complete the medical curriculum at any of the three campuses are awarded diplomas from the University of Alabama School of Medicine.

Address correspondence about admissions to the tri-campus UASOM medical student program to: Director of Admissions, University of Alabama School of Medicine, University Station, Birmingham, Alabama 35294. Faculty and students of the School of Primary Medical Care are available for consultation with students interested in the UASOM/Huntsville medical student program. Interested students are referred to the Office of Medical Student Affairs, UAH Clinical Science Center.

Information on the UAH-Huntsville Hospital Family Practice Residency Program is available from: Director of the Family Practice Residency, Ambulatory Care Center, 201 Governors Drive, S.W., Huntsville, Alabama 35801. Telephone (205) 536-5511.

Project ACCESS

Project ACCESS (Advanced Comprehensive Computer Educational Service System) is a special university/private industry partnership between UAH and Sperry Corporation. Begun in 1984, ACCESS is a computerization and automation process that will make computers primary teaching, research, and management tools at UAH within three years. Its goal is to create model applications of computerized university instruction, research, administration, and public service. To reach this goal, the multi-million dollar project provides electronic classrooms and work areas for students, personal computers in faculty offices, office automation equipment for administration, networking, and a significant upgrading of the UAH host computer which will almost triple its current capability. Other objectives of the project are faculty development, encouragement of software authorship, gradual integration of the curriculum into a (micro) computer-intensive environment, and major enhancement of the university’s research capabilities. In addition, ACCESS will develop faculty and staff skills in computer applications so they can more effectively teach and work in a multi-level computer environment.
Computer Center

The primary source of mainframe computing at The University of Alabama in Huntsville is the Computer Center’s Sperry 1100/70 E2 Processor, with sufficient peripheral equipment to meet its instructional, research, and administrative needs. A Distributed Communications Processor (DCP/40) gives terminal access to the host computer. A combination of dial-up and hard-wired ports provide for a wide variety of terminal supports. General purpose graphics terminals are distributed throughout the campus for support of instructional and research efforts. A research-quality general purpose graphics laboratory is accessible to faculty and its graduate students for their special graphics applications. The Computer Center’s extensive software library may be used by the university community. In addition to the many language processors provided, numerous applications packages are available in such areas as Mathematics, Statistics, Graphics, and Simulation. A Computer Center User’s Guide, in machine-readable format, provides extensive documentation of the library. In an effort to “help users help themselves,” a Users Services staff is on hand for consultation with University personnel on questions about the use of the Center. Executive Control Language (ECL) Seminars are held quarterly and are open to all interested faculty, staff, and students. Weekly Sign-on Training Sessions introduce users to terminal sign-on procedures.

Continuing Education

The Division of Continuing Education responds to life-long educational needs for professional development, self-enrichment and personal growth. In cooperation with the University, community groups, professional associations, business and industry, and other agencies, the Division designs and sponsors credit, noncredit, professional development and certificate programs. In Continuing Education, the worlds of academia and business and industry intersect to support the educational needs of the community. Programs in professional fields are administered through three departments within the division: Technical Studies, Management Studies and Special Studies. Credit and noncredit programs in fields not allied with professional schools are administered through a fourth department, Health, Physical Education and Community Services. In 1986 the Division will occupy facilities in a new 93,000 sq. foot hotel and conference training center to be built on the UAH Campus.

Library

The UAH Library is being developed to give maximum support to the academic and research programs. Acquisition of library resources has high priority. Its monographs and journals reflect great care in selection; more than 210,000 supplementary items, such as microfiche, federal documents, maps, technical reports, and sound recordings, provide sources for special purposes. The Microform area contains three collections of special importance: the Library of American Civilization, the Evans Imprint collection, and the special slide and lecture collection of Afro-American Art. Special services available include rooms for classes or discussion groups, student and faculty carrels, duplicating machines, and a periodicals reading room. Courses in bibliography are offered by the professional library staff. In addition, access to Redstone Scientific Information Center (RSIC), with holdings in science and technology that make it possibly the finest technical library in the Southeast, adds substantial strength to UAH programs, particularly at the graduate level.
Library networks include: OCLC/Solinet databases, Faxon LINX serials system, DIALOG on-line search service. The Library is also a member of the Network of Alabama Academic Libraries (NAAL), a cooperative library resource-sharing network among Alabama universities supporting graduate study.

Special collections include: the Robert E. Jones Congressional Papers, which represent the accumulated official documents and other peripheral materials connected with the career of the Honorable Robert E. Jones of the 5th Congressional District of Alabama; the Willy Ley Collection, consisting of books and journals dealing with all phases of science; and the University Archives, which contain many important documents, memoranda, publicity releases, new articles, yearbooks, and other printed materials.

The UAH Library is a selective depository library for government documents. The majority of the documents are classified and shelved according to the Superintendent of Documents number.

A Library handbook containing complete information is available at the Reference Desk.

Additional Research Sources

UAH has several organizations to facilitate research, which of necessity must have a close relationship with graduate education.

Research Administration

The Research Administration office processes the grants, contracts, and proposals for research activities in which the University is engaged. For example, proposals for external support for graduate research fellowships are processed by the Research Administration office. The annual research report for UAH is assembled by this office under the supervision of the Director of Research.

The Director of Research has overall responsibility for promoting and facilitating research at UAH, requiring a close liaison with the deans and department chairs. The Director of Research organizes annual reviews of major research areas. The Research Administration office, the Johnson Environmental and Energy Center, the Alabama Solar Energy Center, the UAH Research Institute and the Security and Immigration office report to the office of the Director of Research.

Kenneth E. Johnson Environmental and Energy Center
and Alabama Solar Research Center

The Kenneth E. Johnson Environmental and Energy Center was established by the Alabama State Legislature in 1971. In 1977 the Center was designated by the Governor to operate the State of Alabama Solar Energy Center. In 1978 the State Climatologist Office was assigned to the Center. Major research areas of the Johnson Center are electric vehicle propulsion, transportation technology, building energy systems, atmospheric modeling, solar thermal, photovoltaics, and biomass energy conversion. The Center staff includes a core of full-time professionals supplemented by University faculty. A number of graduate research assistants are also supported by the Center. The Center has extensive research laboratories in the Johnson Center, the Research Institute Building, and the Science Building.
The UAH Research Institute

The Research Institute coordinates research in certain principal research themes or thrust areas, such as applied optics, materials, and solar terrestrial research. Each of these areas offers a number of opportunities for graduate research assistantships and other forms of participation. Possibilities for research support also exist in fields such as missile and space systems, numerical methods, robotics and industrial automation.
Admission and General Academic Information

Application Procedure
An applicant should submit a completed graduate application form (available in the Office of Admissions) and a nonrefundable application fee of $15. In addition, the student must request the following items be sent to the Office of Admissions:

1. Two official copies of the academic record from each collegiate institution attended;
2. Scores of the Graduate Record Examination (GRE) from Educational Testing Service (ETS), scores of the Graduate Management Admissions Test (GMAT) for Administrative Science applicants, or score of the Miller Analogies Test for Nursing.

All application materials should be submitted to the Office of Admissions no later than dates specified in the UAH calendar.

Applicants should initiate admission procedures at least six weeks before the registration date of the term for which admission is sought.

An applicant for a Ph.D. program who has been previously admitted to the School of Graduate Studies must submit a completed re-evaluation form to the Office of Admissions. A student who has been admitted to a Master’s degree program and who wishes to be considered for a Ph.D. program or an additional Master’s program must submit a re-evaluation form to the Office of Admissions.

Admission Requirements
For admission to the School of Graduate Studies, applicants must hold a Bachelor’s degree from an approved institution. The following minimum requirements are acceptable to the graduate faculty; individual departments may require higher averages or additional requirements.

Unconditional Admission
Applicants may be admitted unconditionally if they have a minimum of:

1. Average of B (GPA of 3.0) on the undergraduate record or on the last 60 semester hours, and
2. a. A score of 1000 on the aptitude test (verbal and quantitative) portion of the GRE; or
   b. A score of 450 on Graduate Management Admissions Test for Administrative Science (GMAT); or
   c. A score of 50 on Miller Analogies Test for Nursing.
**Conditional Admission**

An applicant whose scholastic record does not fully meet the requirements for unconditional admission may, upon recommendation of the department chairman and with approval of the graduate dean, be admitted on a conditional basis provided the applicant has taken the Graduate Record Examination, the Miller Analogies Test, or GMAT (for Administrative Science). The applicant must have a minimum of:
1. GPA of 2.5 overall, or QPA of 3.0 on the last 60 semester hours; or
2. Composite GRE score of 1000 on the verbal and quantitative portions; or
3. MAT score of 50, or GMAT of 450.

A student admitted on a conditional basis who has an overall grade average of B or better for all graduate work attempted up to and including the term in which 12 semester hours are completed assumes the status of an unconditionally admitted student.

Failure to remove conditional status by maintaining a minimum overall grade average of B or better on all graduate work attempted as described above results in dismissal from the School of Graduate Studies. In exceptional cases, a student may be re-admitted upon justified recommendation of the faculty in the major department and approval by the graduate dean.

**Residency**

A determination of residency status is made at the time the student is admitted to UAH. In order for a change in residency status to be effective for any given term, such change must be accomplished no later than the first day of classes for that term.

**International Student Admission**

An applicant who is a graduate of a foreign institution is subject to the same criteria for admission as a graduate of a U.S. institution. The applicant whose native language is not English is required to take the Test of English as a Foreign Language (TOEFL) and score at least 500. An I-20 form (Student Visa) will not be issued by UAH until acceptable results of the TOEFL are received and all admission requirements met.

In addition, all international students must request that:

1. Two official copies in English of secondary school and college or university transcripts be forwarded to UAH directly from the institution(s) attended. Do not send personal copies.
2. Graduate Record Examination (GRE) or Graduate Management Admission Test (GMAT) scores be sent directly to UAH from Educational Testing Service.
3. Scores from the Test of English as a Foreign Language Test (TOEFL) be sent directly to UAH from Educational Testing Service.
4. A certified financial statement be submitted as evidence of sufficient finances to cover university and personal expenses while attending UAH. In addition, a deposit of $1,500 is required before an applicant will be considered for admission. To make this deposit, have a bank cashier’s check drawn in U.S.
dollars for $1,500, made payable to the University of Alabama in Huntsville. Mail this check to the Office of Admissions, the University of Alabama in Huntsville, Huntsville, AL 35899. If an applicant is unable to attend UAH after making the deposit or if admission is denied, the deposit will be returned. The deposit must be maintained at $1,500 until the student completes studies at UAH. The amount held on deposit by the university will accrue interest.

5. Evidence be presented of university-approved health insurance coverage. Proof of continued coverage must be presented by the student during each term of enrollment.

Nondegree Graduate Students

Students interested in earning graduate credit but who are not applicants for a graduate degree at UAH may be admitted as nondegree graduate students and continue on a term-by-term basis. Admission in this category may be granted to students submitting evidence of at least a Bachelor’s degree from an accredited institution. Students must maintain the same GPA grade requirements expected of the conditionally admitted graduate students. Courses taken while in this category must have prior approval by the department offering the course and the graduate dean.

Credit earned under a nondegree graduate status may be applied toward a graduate degree program following admission to the graduate degree program and approval of courses by the major department. If the student’s previous record qualifies the student for admission to the graduate program, then the student by petition may apply up to 12 semester hours toward the degree. If the student is not admissible, the nondegree graduate credit may be considered in lieu of irregular postgraduate requirements.

Seniors Taking Graduate Courses

UAH seniors may take up to 9 hours of courses (500-level or above) for graduate credit while completing requirements for the baccalaureate if they meet the following qualifications:

1. An approved degree application on file;
2. An overall GPA or GPA for the last 40 hours of at least 3.5;
3. A total course load of no more than 12 hours a term;
4. Permission of the instructor for courses at the 600 level or above.

Students initiate the process by filling out the Request for Approval of Graduate Credit by UAH Senior (available at the Office of Admissions) that requires the approval of the department chairman and graduate dean.

Unclassified Admission

Persons who desire graduate credits without pursuing one of the degree programs offered at UAH may be admitted as unclassified graduate students if the qualifications for conditional admission are met.
Change in Major

A student previously admitted to the School of Graduate Studies to pursue a degree offered in one department may be admitted to a degree program in another department if the admission criteria of the latter department are met. Application re-evaluation of major (Form 1-B) is available at The Office of Admissions.

Irregular Postgraduate Status

A person whose application to the graduate school has not been approved may be admitted to UAH as an irregular postgraduate student. Those admitted in this category may register in courses at the 500 level or below at UAH, provided that all prerequisites for those courses have been met. In some instances students may, with the approval of the department chairman, take courses at the 600 level or above.

Upon completion of 12 or more semester hours of advanced-level courses with an average grade of B or better, a student may reapply for admission to the graduate school. An applicant may be admitted conditionally, if acceptance is recommended by the chairman of the appropriate academic department.

Once a student is admitted, graduate credit for courses taken during IPG status may be granted upon admission to the graduate school subject to the following conditions and limitations:

1. All grades received in 500 level courses or above during IPG status must have been B or higher.

2. Upon petition by the student, up to 6 credit hours may be granted for courses taken as an IPG and completed with grade of A, subject to approval by the major department and the Graduate Dean. These courses will not be used for calculating graduate quality point average.

General Academic Information

A student must be admitted to the School of Graduate Studies to receive graduate credit for courses taken. The maximum course load for a graduate student is 10 semester hours a term. A student employed full-time (40 or more clock hours a week) may schedule no more than 3 semester hours of graduate work a term without permission of the faculty advisor or the department chairman if the student does not have an advisor. A full-time teacher working toward certification is limited to one course a term and a maximum of three three-hour courses an academic year (nine months).

Students should schedule required undergraduate prerequisites or deficiencies early in the graduate program.

Students working on a thesis must register for thesis supervision. Thesis and dissertation supervision courses are graded on a pass/fail basis.
General Information Center

The General Information Center in room 124, University Center maintains current information on academic programs, procedures, and activities of interest to the public and the university community. Interested persons should call 895-6295. Information on admissions, application forms, brochures, testing, and other materials relating to the university are available at the Center.

Testing Service

The tests used for admissions, credit by examination, and placement administered through this office include: the Miller Analogies Test (MAT), the Graduate Record Examination (GRE), and the Medical College Admissions Test (MCAT).

Applications and information pertaining to the following testing programs are also available: the Graduate Management Admissions Test (GMAT), the National Teachers Examination (NTE), the Law School Admission Test (LSAT), and the Test of English as a Foreign Language (TOEFL), and the Alabama Initial Teacher Certification Test.

Student Course Load

A full-time graduate student is one enrolled in courses totaling 6 to 9 semester hours a term.

Registration

Dates of early, regular, and late registration are listed in the UAH calendar. Any continuing or returning student eligible to register may take part in early registration. All past financial obligations to the university must be clear before a student may register for courses.

All students in the Schools of Engineering, Nursing, and Administrative Science are required to have an advisor’s approval of registration requests.

A student who schedules courses during any registration period (early, regular, or late) will have made a financial commitment to the university. If courses are dropped or changed, these changes must be submitted in writing to the Office of Student Records. Adjustments in fees, if any, will be made by the Bursar’s Office.

Schedule Changes

After a student has completed registration, all schedule changes must be made on a change-of-course form and recorded in the Office of Student Records. (See section on registration for approval required.)

Credit to Audit

A student is permitted to change a course from credit to audit only during the first two weeks of classes.

Removal of Course from Schedule

1. In the case of a canceled class, submission of a change-of-course form by the student helps to correct the record.
2. In the case of a drop before class begins, a change-of-course form must be submitted before the first day of the term.
3. Except in the case of (1) or (2), removal of a course after the first scheduled meeting of a class is considered a withdrawal (see below).

Other Kinds of Changes
The following kinds of changes may be accomplished only during the designated hours of regular and final registration (see UAH calendar).
1. Change from one course to another.
2. Change from one section to another section of the same course.
3. Addition of course to schedule.
4. Change from audit to credit. Only students who are otherwise eligible to take the work for credit will be permitted to make this kind of change.

Withdrawal
A student who wishes to withdraw from one or more courses at UAH must obtain a Request for Withdrawal Form from the Office of Student Records. Regardless of a student’s reason for withdrawal, withdrawal procedures are as follows:
1. During the first two weeks of the term, the Request for Withdrawal Form must be signed by the student’s advisor before being submitted to Office of Student Records. A grade of W is recorded.
2. During the third, fourth, fifth, and sixth weeks of the term, Request for Withdrawal Form must be signed by the student’s advisor and department chairman (or dean) before being submitted to Office of Student Records. A grade of W or WF will be assigned by each instructor. Grades assigned will be based on student’s performance to date of withdrawal. (Note: a grade of WF is calculated in the grade point average.)
3. Beginning with the seventh week, a student may withdraw for exceptional circumstances only with the approval of the dean. If the dean approves, a grade of W or WF will be assigned by each instructor, with grades assigned based on student’s performance to date of withdrawal.
4. The Request for Withdrawal Form with all appropriate signatures must be returned to the Office of Student Records. Effective date of withdrawal is the date the form is received in the Office of Student Records. Notification to instructors will be provided by that office.

Repeating a Course
There is no limit on the number of times a student may repeat a course. Each time a course is taken, the hours attempted and the quality points earned will be counted in calculating the student’s grade point average. The credit for any course repeated may be counted only once toward graduation.

Class Attendance
Education at UAH depends upon the cooperation of students and faculty. Students are held responsible for the full 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 determined on the basis of identified course requirements; therefore, regular class attendance is important.
Examinations
During each term, one or more announced examinations of class period length may be held.
At the end of each term, a two and one-half hour 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 three examinations are scheduled 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 by the end of the ninth week of classes. 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 shall apply, except that the student shall now have the right to have both the second and third examinations rescheduled.

GRADES

<table>
<thead>
<tr>
<th>Grades</th>
<th>Quality Points per Semester Hour Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-Superior</td>
<td>.............................................4</td>
</tr>
<tr>
<td>B-Average</td>
<td>.............................................3</td>
</tr>
<tr>
<td>C-Average</td>
<td>.............................................2</td>
</tr>
<tr>
<td>D-Passing</td>
<td>.............................................1</td>
</tr>
<tr>
<td>F-Failure</td>
<td>.............................................0</td>
</tr>
<tr>
<td>I-Incomplete</td>
<td>Assigned by the instructor when a student, due to circumstances beyond control, has not satisfied some requirement of the course. This grade becomes an F unless the course requirements are completed during the first four weeks of the next term of enrollment. If the grade of I is on a student’s record at the time of graduation, it is treated as an F.</td>
</tr>
<tr>
<td>X-Excused absence from examination.</td>
<td>Assigned by the instructor when a student completes all course requirements except the final examination. This grade becomes an F unless the examination is completed by the time of the announced deferred examination date at the beginning of the term of next regular enrollment of the student. (See Examinations and UAH calendar.) Time schedule permits students to take only one examination on this date. If students receive more than one grade of X, they should make arrangements directly with other instructors for additional make-up examinations.</td>
</tr>
<tr>
<td>W-Withdrawal</td>
<td>Recorded by the Office of Student Records when a student withdraws from a course with passing work. (See Withdrawal.)</td>
</tr>
<tr>
<td>WF- Withdrawal failing</td>
<td>Recorded by the Office of Student Records when a student withdraws from a course with failing work. (See Withdrawal.)</td>
</tr>
</tbody>
</table>

Change of Grade
Grades submitted to the Office of Student Records can be changed only by the
instructor’s submission of a Change of Grade form containing a written explanation of the error. The Change of Grade form must be approved by the dean of the school concerned.

**Student Grade Report**

At the completion of each term, a report of final grades is mailed to the address furnished by the student.

A statement of a student’s satisfactory or unsatisfactory academic performance will be provided, upon request, to the individual or agency sponsoring the student’s tuition if the individual or agency submits a statement certifying grade release, unless written notification to the contrary is submitted by the student to the Office of Student Records before the final examination period.

**Grade-Point Average**

The grade-point average (GPA) is computed by dividing the total number of quality points earned by the total number of semester hours attempted. Courses in which a grade of W, P, or S is assigned are not included.

**Academic Appeal Process**

Academic appeals will originate with the student and will be processed through the student’s major department, the dean of the school, and the Office of Academic Affairs, in that order. Students classified as “special” will be routed through the most appropriate academic dean.

**Change of Major**

Students pursuing a program of study in one academic unit and desire to change to a program in another unit may petition to do so by making application at the Office of Admissions. Admission recommendation is made by the new unit. Application of previously earned credits toward the new program will be determined after the transfer has been approved.

**Transcripts**

Official transcripts are issued and sent by the Office of Student Records to recognized institutions and agencies which require such documents. Transcripts are issued only upon the written request of the student involved.

Official transcripts are not issued to individual students; however, they may request an unofficial transcript which does not bear the university seal. No charge is made for transcripts issued.

No transcript will be issued for a person who has a financial obligation to the university.

**Nondiscrimination Policy**

The University Alabama in Huntsville is committed to equal employment and educational opportunity. Its policy is one of nondiscrimination with regard to any person on the basis of race, color, national origin, religion, sex, or age, and with regard to any otherwise qualified handicapped individual solely on the basis of handicap. This equal opportunity policy extends to the recruitment and admission of students, the recruitment and employment of faculty and staff, and the operation of all programs and activities. Additionally, the university is an affirmative action employer of protected minorities and women.
The foregoing commitment is designated to meet the nondiscrimination affirmative action requirements of applicable federal laws, including the following statutes (with implementing regulations) and executive orders, as amended: Title VI and Title VII, Civil Rights Act of 1964; Executive Order 11246; the Age Discrimination in Employment Act of 1967 and the Age Discrimination Act of 1975; Title IX, Education Amendments of 1972; the Equal Pay Act of 1963; the Rehabilitation Act of 1972; and the Vietnam Era Veteran Readjustment Assistance Act of 1974.

Inquiries or complaints concerning the application to these federal requirements and this policy should be directed to one of the following persons:

Dr. Elmer E. Anderson  
Academic Affirmative Action Officer  
123 Madison Hall  
The University of Alabama in Huntsville  
Huntsville, AL 35899 (205-895-6337)

Mr. Kenneth W. Thompson  
Equal Employment Compliance Officer  
131 Madison Hall  
The University of Alabama in Huntsville  
Huntsville, AL 35899 (205-895-6350)

Confidentiality of Records

The Family Educational Rights and Privacy Act of 1974 is a federal law which protects the confidentiality of student educational records. To implement this law, UAH has formulated and adopted a written institutional policy governing the handling of these records. Copies of this policy document are available to students at the Office of Student Records, and it should be referred to for a more comprehensive treatment of this subject than is given in the summary statement here.

Under this law and university policy, students have a right of access to their educational records and may inspect and review the information contained in them. The term educational record generally refers to any record maintained by the institution directly pertaining to an individual as a student, other than that made by institutional, supervisory, or administrative personnel remaining in the sole possession of the maker; by campus security; or by a physician, psychiatrist, or any other such professional medical personnel. This right of access does not extend to financial information submitted by students' parents or to confidential letters and recommendations collected under established policies of confidentiality and placed in their files before January 1, 1975. Furthermore, students may at their discretion waive the right to any confidential letters of recommendation.

If a student believes the records contain inaccurate, misleading, or otherwise inappropriate data, the student may bring the matter to the attention of the records official concerned. If by informal discussion with this official the student does not obtain the corrective action desired, the student is entitled to a hearing at which the item found objectionable may be challenged. If the decision is adverse to the student, an explanatory statement relating to the contested item may be inserted in the educational record.

A student's privacy interest in personal records is further protected by the rule
against unauthorized disclosure. The university may not without the student’s consent release the student’s educational records or any personally identifiable information contained in them to other individuals or agencies. Disclosure to the following parties, however, is specifically excepted by the Privacy Act from this rule: (a) administrative and academic personnel within the institution who have legitimate educational interest; (b) officials of institutions in which the student seeks to enroll; (c) persons or organizations to whom the student is applying for financial aid; (d) accrediting agencies; (e) organizations conducting studies relating to tests, student aid programs, instruction; (f) certain federal and state government officials; (g) any person where the disclosure is required for compliance with a judicial order to proper subpoena; (h) appropriate persons where a health or safety emergency affecting the student exists; and (i) parents of a dependent student. As to some of these parties, additional conditions must be met for the disclosure to be allowable in the absence of a written consent from the student. Personally identifiable information will be transmitted by the university to a third party only on the condition that the recipient not permit any other party to have access to it without the student’s consent.

The university may release directory information to others without the necessity of obtaining permission from the student. Directory information is limited to the student’s name, address (local and permanent), telephone number, date and place of birth, major field of study, participation in officially recognized activities and sports, weight and height statistics if an athletic team member, date of attendance, degrees and awards received, and the previous educational institution most recently attended. If students do not wish this information to be released, they may so indicate on the form provided at the time of registration, and the university will withhold it during that particular term. This request for nondisclosure of directory information must be renewed each term.

The following officials have been designated as records officials for student records within their respective area:

- Director, Student Records
- Director, Academic Advisement and Information Center
- Coordinator of Undergraduate Advisement, Administrative Science
- Programs Coordinator, Administrative Science
- Assistant to Dean, Engineering, Lower Division
- Appropriate Engineering Department Chairman, Upper Division and Graduate
- Director, Nursing, Undergraduate Program
- Director, Nursing, Graduate Program
- Director, Continuing Education
- Vice-President, Student Affairs
- Director, Medical Student Affairs
- Director, Financial Aid

A student should make a request concerning educational records to the appropriate official listed above.

Any student who believes that rights under the Privacy Act have been violated by the university may notify and request assistance from the Vice-President for Academic Affairs and may file a complaint with the Family Educational Rights and Privacy Act Office, Department of Health, Education, and Welfare, Washington, D.C. 20201.
Marital, Parental, or Temporary Disability Status

The university does not discriminate against any student or exclude any student from its educational program or extracurricular activity on the basis of a student’s sex, marital, or parental status. Pregnancy or related conditions are treated the same as other temporary disabilities. The university may require written approval of a student’s physician regarding participation in an activity or educational program which might adversely affect the safety or health of a temporary disability.

Conduct

Students enrolling in the university assume an obligation to conduct themselves in a manner compatible with the university’s role as an educational institution. The administration reserves the right to establish rules for expulsion and penalties for failure to meet standards of scholarship, character, and health.

All members of the UAH community are subject to the provisions of federal and state statutes and local city ordinances with regard to alcoholic beverages, drugs and narcotics, weapons, gambling, fireworks, and the use of state property. Such laws are fully in force on the university campus and may be enforced by public authorities as well as by campus police. Each person associated with the university is responsible for being aware of and abiding by these laws.

The university has incorporated as its own regulations all existing federal, state, and local laws defining and proscribing criminal acts. In addition, the following policy applies to the UAH campus community:

1. University policy forbids the possession or consumption of alcoholic beverages by a student anywhere on University property, except in the student’s residence in University Housing. In addition, any possession or consumption of alcoholic beverages by a student under 19 years of age, the legal age for drinking established by state law, or any other violation of state or local law with respect to drinking is contrary to established University policy.

A student organization should be aware that it may be held responsible for actions of individuals, including non-members, connected with their consumption of alcoholic beverages made available by the organization at its functions. Careful consideration of this potential liability under the law and under University policy should therefore enter into plans to offer such beverages at an activity.

2. Narcotics and other controlled substances will not be permitted anywhere on university property except upon prescription by a practitioner (as that term is defined in the Alabama Uniform Control Substances Act) or except by practitioners or authorized agent under their supervision, incident to research, teaching, chemical analysis, or professional practice.

3. Firearms or other weapons (including explosives) are not to be brought onto or kept on UAH property by anyone, whether holding a firearm’s license or not, except police officers and other law enforcement officials in the exercise of their lawful duties.

Students who violate any of the foregoing laws, regulations, or policies are subject to university disciplinary action as provided in the UAH Student Judicial Code and/or arrest and prosecution by civil authorities, as appropriate. Similarly, faculty or staff personnel who violate these laws, regulations, or policies are subject to adverse employment action, including dismissal, and/or arrest and
prosecution, as appropriate. Suspected violations of the Student Judicial Code should be reported to the Office of the Vice President for Student Affairs.

Officers in the Office of Campus Security are by statute charged with all the duties and vested with all the power, such as that of arrest, of police officer. Violations of federal, state, or local laws should be promptly reported to the security office and full cooperation given in the discharge of its responsibilities.

Plagiarism

Plagiarism is the use of another's work as if it were one's own. A graduate student found guilty through university processes of plagiarism or falsification of data or results in any program is subject to dismissal from the university.
# Financial Information

## Graduate Tuition

<table>
<thead>
<tr>
<th>No.</th>
<th>Course Hours</th>
<th>Fee</th>
<th>Bldg. Fee</th>
<th>Union Fee</th>
<th>Activity Fee</th>
<th>Registration Fee</th>
<th>Total In-State</th>
<th>Total Out-State</th>
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<tr>
<td>1</td>
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<td>$ 5.00</td>
<td>$ 1238.00</td>
<td></td>
<td>$ 1238.00</td>
</tr>
</tbody>
</table>

THE ABOVE TOTAL DOES NOT INCLUDE LAB FEES, LATE-REGISTRATION OR CHANGE-OF-COURSE FEES.

An estimated average cost of books per term for full-time students is $85.00.

*These fees do not apply to any short-term, off-campus, or noncredit offering. For additional information on these courses, see section on Division of Continuing Education.

## BILLING AND PAYMENT PROCEDURE

Students participating in early registration will receive in the mail (see mailing date in calendar in the quarterly timetable of classes) a schedule of courses, a tuition bill, and an identification card. Tuition charges must be paid in full by the close of business on the due date indicated on the statement. Students whose payments have not been received by the deadline will have their registration canceled, and such students will be required to complete a new set of registration materials during final registration hours.

Tuition will be payable at the time of registration for all who register during periods of final registration.

Charges resulting from dropping, adding, or other changes will be due at the time the change is made.

Many students have all or part of their tuition and other costs paid by various sponsoring agencies (including tuition remission for faculty, staff and their dependents). It is the student’s responsibility to see that the Bursar’s Office receives the approved tuition assistance authorization from his sponsor. In many cases the sponsor does not pay the entire statement. These students should contact the Bursar’s Office to determine the unpaid amount and make full payment before the due date to avoid cancellation of their registration.
Fees for courses being audited are the same as those being taken for credit. Full-time students may include full-term, regular credit courses offered through the Division of Continuing Education under the maximum fee structure of UAH. Standard fees and fee conditions, however, do not apply for short-term, off-campus, or noncredit offerings.

**Other Charges**

<table>
<thead>
<tr>
<th>Description</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application (non-refundable)</td>
<td>$15.00</td>
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<tr>
<td>International student deposit</td>
<td>$1,500.00</td>
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<tr>
<td>Change of schedule (non-refundable)</td>
<td></td>
</tr>
<tr>
<td>Drop/add/change to audit/reinstatement</td>
<td>$15.00</td>
</tr>
<tr>
<td>Late registration (non-refundable)</td>
<td>$15.00</td>
</tr>
<tr>
<td>Examination (deferred or special)</td>
<td>$5.00</td>
</tr>
<tr>
<td>Credit by examination or validation, per semester hour</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

**Laboratory and studio instruction**

- Level 1: $5.00
- Level 2: $10.00
- Level 3: $20.00
- Level 4: $30.00
- Level 5: $40.00
- Level 6: $50.00
- Level 7: $60.00
- Level 8: $70.00
- Level 9: $80.00
- Level 10: $90.00
- Level 11: $427.00
- Level 12: $668.00
- Level 13: $608.00

**Replacement of I.D. card**

- $5.00

**Transcript**

- No Charge

**Graduation**

If qualifications for graduation are not met and if diploma has been ordered, $10.00 will be refunded

- $15.00

**Duplicate Diploma**

- $7.50

**Thesis binding (3 copies)**

- $17.50
  - Each additional copy: $6.00

**Vehicle registration**

Regulations concerning traffic and parking are available at the Campus Safety Office

- $7.00

**School of Nursing**

**Laboratory Fee (per term)**

- $60.00

**Liability Insurance (per year)**

- $25.00

**School of Nursing Pin (graduation)**

- Variable

**Annual health examinations**

- Variable
School of Primary Medical Care

General fee (per term) ............................................................................. $ 968.00
Out-of-state residents (per term) .............................................................. 3872.00
UAH student health service fee (per term) ............................................. 25.00
Student activity fee (per term) ............................................................... 16.00
General building fee (per term) .............................................................. 75.00
Medical building fee (per term) .............................................................. 34.00
Hospitalization insurance (per term) ...................................................... variable
Personal liability insurance (per term) ..................................................... 25.00

The complete student curriculum for the University of Alabama School of Medicine normally takes 12 quarters to complete.

Withdrawals and Refunds

After classes have begun, students may withdraw from one or more classes until the end of the sixth week of classes. A student desiring to withdraw from school or a class must complete a withdrawal request form at the Office of Student Records, Room 116, University Center. Date of withdrawal is the date the written request is received at the Office of Student Records. Date of withdrawal will determine the amount refunded. Only course fees, lab fees, building fees and Union fees are refundable.

Date of Withdrawal from School Fees Owed

Withdrawal after registration is completed but before classes begin .................................... Registration fee $ 5.00
During first two weeks ............................................................................. Withdrawal fee 15.00
After first two weeks of class ................................................................... 100% of basic fee

Dates of withdrawal from courses which are scheduled on other than a full-term basis will be prorated.

Refund checks will be issued as quickly as they can be processed after the second week of classes.

Students suspended for disciplinary reasons shall have no right to refund of any portion of any fees paid or due to be paid.

University Housing

For current rate information contact the Housing Office at: Housing Office, The University of Alabama in Huntsville, Huntsville, Alabama 35899, (205) 895-6108.

In addition to rental charges, residents are also responsible for their gas and electricity usage each month. Residents desiring a telephone assume responsibility for proper installation of telephone and payment of all bills.
Financial Aid

Financial Aid is available in the form of teaching and research assistantships, tuition scholarships, work-study programs and loans, and Co-op programs.

Interested students should consult their advisors and department chairmen for other types of aid.

Graduate Assistantships

Graduate assistantships are offered to encourage graduate work and the promote research. Graduate assistants have as their primary goal a graduate degree, and the assistantships are part of their graduate education. Such appointments are available through various departments of instruction and under the auspices of the School of Graduate Studies.

Eligibility

Any student qualified for admission to the School of Graduate Studies is eligible to apply for a graduate assistantship.

Assistantships

A student eligible for an assistantship may be appointed as a Graduate Teaching Assistant (TA) or Graduate Research Assistant (RA). Assistantships usually require half-time (twenty hours per week) service to the university but may be appointed more or less than half-time in exceptional cases. The graduate assistant may not hold other employment during any term in which this assistantship is in effect. The graduate assistant is registered for a minimum of six semester hours during any term in which an appointment is held. Two kinds of assistantships are available:

1. Graduate Teaching Assistantships

As the title implies, graduate teaching assistants (TA’s) share the faculty’s responsibility for teaching. The purpose of this assistantship is twofold: one is to support departmental teaching program, and another is to aid the student’s professional development. The teaching assistant is not intended to be a grader only; however, grading papers may be a part of the assigned duties of the assistant.

The TA’s fractional 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 staff members in the department.

2. Graduate Research Assistantships

A graduate research assistant (RA) does 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.
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 graduation of the assistant.

Tuition

Tuition and fees are paid for a graduate assistant who holds one-half time (20 hours per week) appointment and is registered for six to nine semester hours. An assistant who holds one-quarter time (10 hours per week) appointment is eligible for one-half tuition support only for a full course load.

Departments should submit to the graduate office the Tuition Support Request (Form 23) for the appointees before the close of the early registration period for entry into the Student Accounts System. Upon its receipt and approval, the form will be forwarded to the Office of Financial Aids.

Tuition Scholarships

Full tuition scholarships may be awarded to qualified students without assistantship appointments. Tuition grants are limited to a maximum of two per department at any given time.

1. Eligibility
   A department may award a full tuition grant to a qualified student. Recipient must:
   a. be a full-time student;
   b. be a U.S. citizen;
   c. have unconditional admission status.

2. Appointment Procedure
   a. The departmental faculty chooses the awardees from qualified applicants.
   b. An appointment letter (similar to the assistantship letter without duties) is written to each awardee and approved by the chairman. The letter is then forwarded to the graduate dean's office along with a copy of the Summary Information sheet (Form 1-A) for final approval.

3. Tuition Request
   Departments submit to the graduate office tuition requests for the awardees on the Tuition Support Request (Form 23), along with those of the graduate assistants, by the close of the early registration period.

Work-Study and Loans

The College Work-Study Program provides employment for students who need financial assistance. A student works part-time on campus while attending the university and during vacation periods. Preference will be given to students with the greatest financial need.
Loans

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 half of what is needed to meet expenses.

The National Direct Student Loan Program is available to all students enrolled at least half time and who have financial need indicated by the Family Financial Statement. Graduate or professional students may be eligible to borrow a maximum of $12,000, including their undergraduate loans. The program contains a provision that part of the loan plus interest may be canceled if the borrower performs military service in hostile areas. Forgiveness is also provided for teachers of handicapped or disadvantaged students and for those teaching in other special programs designated by the U.S. Office of Education.

The Guaranteed Loan Program provides state backing for loans made through private lending agencies such as banks, savings and loans, and credit unions.

A maximum of $2,500 per academic year may be applied for in most states if the educational costs warrant borrowing this much. The aggregate maximum may be extended to $25,000 for students who borrow for graduate study.

Graduate Record Examination Fee Waiver Program

UAH is a corporate institute for the Graduate Record Examination (GRE) Fee Waiver Program. These waivers are limited to senior students receiving financial assistance through the university whose parents' financial contribution is estimated to be zero for the applicant's senior year in college.

Information and fee waiver certificates may be obtained in the Office of Financial Aids.

Miscellaneous

Some businesses and industries provide tuition assistance to employees attending UAH. An employed student should consult the personnel office of his place of employment to determine its policy regarding tuition assistance.

Co-operative Education

The graduate Co-operative Education (Co-op) program offers qualified candidates the opportunity to combine classroom experience with closely-related practical work experience with a major employer. Students accepted for Co-op normally work six months, return to UAH as a full-time student for the following six months, and then return to work for the next six months. In addition, students are encouraged to take at least one degree-related course during each work term. While working, students are paid the same salary the firm pays a recent graduate with a bachelor's degree. At present, most graduate co-ops are in Computer Science and Engineering.
Requirements for admission into the Graduate Co-op Program are:

1. Unconditional admission to the School of Graduate Studies.
2. Formal application to the Co-op Program.
3. A 3.0 cumulative grade point average (on a 4.0 scale) on all graduate work. If the graduate major differs from the undergraduate, a student should complete nine hours of graduate work at UAH before starting a Co-op program.
Student Services and Activities

Career Planning and Placement

The Career Planning and Placement office offers the following services to all students and alumni: information about part-time employment opportunities in Huntsville and surrounding areas; full-time placement opportunities and on-campus interviews for graduating students and for UAH alumni; career planning assistance with professional staff; workshops in resume writing skills, workshops in resume writing skills, interview skills, and job search techniques, use of the DISCOVER computer-assisted guidance system to test interests, abilities, and values and relate them to 426 occupations, access to a computerized guidance information system with occupational and college information through Montgomery; Career Resource Center of occupational information, company literature, salary information and graduate school information; and a job fair and a career fair co-sponsored each Spring with the UAH Business Club.

A credentials file which includes a resume, transcript and college activities is established for each graduate student who registers with this office. Information in the file is available to employers upon request. Each registered student receives a monthly newsletter, Career Directions, which provides current employment trends, job-hunting hints, and the monthly on-campus recruitment schedule.

Students may register for any of the services at the Career Planning and Placement Office, 212 University Center. Appointments may be made with the Placement Coordinator by calling 895-6612 between 8:15 a.m. and 5 p.m., Monday through Friday.

Vocational Rehabilitation

Students with a physical disability may obtain grants-in-aid covering fees, books, and supplies through the Vocational Rehabilitation Service, which is supported by federal and state appropriations. For further information, write to: Alabama Vocational Rehabilitation Service, 407 Governors Drive, S.W., Huntsville, Alabama 35801 or the Director of Vocational Rehabilitation, Room 416, State Office Building, Montgomery, Alabama 36104.

Medical Services

UAH students who need a family physician may become patients of the UAH Family Practice Center by going to the UAH Ambulatory Care Center in the Huntsville Medical District and completing the intake forms. All UAH students registering as patients are required to have valid UAH identification cards.

UAH students planning to become patients of the UAH Family Practice Center are urged to register before they actually need medical care. UAH students who are not already registered patients of the Family Practice Center are eligible for emergency medical care only. Emergency care information for UAH students who do not have a doctor is available from 8 a.m. to 5 p.m. Monday through Friday by phoning 536-5511 (5 p.m. to 8 p.m.).

All patient care services provided by UAH School of Primary Medical Care are on a fee-for-service basis.
Veterans Affairs

UAH offers a full range of services to the student attending under the Veterans Administration Educational Assistance Program. These services include veterans advisement, educational loans, and the Veteran Tutorial Program.

Under the current Veterans Educational Assistance Programs, which affect most veterans, the veteran receives an allowance directly from the government. The veteran is responsible for paying fees directly to the university and meeting payment deadlines applicable for all students.

The Veterans Administration will make full payment only when the student carries a full academic load. To facilitate the prompt and accurate reporting of the veteran's status and course load, the veteran must complete a brief form every term enrolled. This form must be turned in to the veterans affairs clerk in the Office of Student Records.

It is the student's responsibility to remain in good standing with the Veterans Administration and to respond to notification of changes in regulations. For additional information, write to: Veterans Administration Regional Office, 474 South Court Street, Montgomery, Alabama 36104.

Many students who are children of veterans of World War I, World War II, or the Korean War may be eligible for benefits under the War Orphans Educational Assistance Act (PL 634). Write the nearest Veterans Administration Regional Office for additional information.

The Alabama G.I. and Dependents Education Benefits Act grants tuition assistance to eligible veterans, their children, widows, and wives. Tuition is paid directly to the school. For additional information, write to: Assistant to the Director, Department of Veteran's Affairs, P.O. Box 1509, Montgomery, Alabama 36102.

University Housing

University Housing is available to any student, married or single, who has been admitted to the university. Priority will be given to students register up for a full course load. A married couple is eligible if either husband wife is or will be a university student.

All townhouse and one-bedroom efficiency apartments will be primarily available for married couples and handicapped students. (Townhouses are for married couples with children and efficiencies are for handicapped students and married couples without children). If, after regular assignments are made, some of the apartments remain available, single students will be able to rent these units. The single students in this case will be responsible for the entire apartment, payment of all related housing charges, and finding an eligible roommate (if a roommate is desired). Single students interested in this accommodation should indicate so on the housing application.

Within University Housing there are two housing complexes: the north area (off-campus) and the south area (on-campus). The north area of housing consists of two and three-bedroom townhouse apartments (furnished and unfurnished) and are located a short distance from the UAH campus. All of these apartments have hook-ups for washers, but none for dryers.

In the south area there are three-bedroom suites which can accommodate up to six people. Each unit has a living room, a kitchen-dining area, three bedrooms, and a double bathroom. All suites are furnished with a couch, two end tables and two lounge chairs in the living room. A table and chairs are in the dining area, and
single captain’s beds (80 inches long), study desks and chairs, and night stands are in the bedrooms. Each suite is airconditioned, carpeted, and equipped with an electric range, refrigerator, and Levolor blinds.

The one-bedroom efficiencies are air-conditioned, carpeted, and equipped with an electric range, refrigerator, and Levolor blinds. Furnished apartments have a couch, two end tables, and lounge chair in the living room; dining table and chairs in the dining area; and double bed, night stand, study desk, and chair in the bedroom.

Items that students need to bring with them are: linens (in the south area, extra-long fitted sheets are needed for the 80 inch mattresses), dishes, pots, pans, TV’s, stereos, and other amenities.

Assignments are made on the basis of the application date: first come, first served. Students may choose roommates, or the Housing Office will assign them. Both apartment areas are located within walking or bicycling distance of the campus and are near supermarkets, drugstores, movie theatres, restaurants, and department stores. UAH housing is administered by the Housing Director in the Division of Student Affairs, and student staff members (resident assistants) live in the apartment areas to help students with any academic, maintenance, or personal problems. Since UAH housing is limited, students interested in University housing should apply at least one academic term before enrolling. A $50 deposit will reserve a place in either north or south area of University housing. Housing policies and regulations are contained in the housing brochure and in the rental agreement. Housing application forms and additional information may be obtained from: Housing Office, University of Alabama in Huntsville, Huntsville, Alabama 35899 (205) 895-6108. Tours are available.

Preschool Learning Center

An on-campus preschool is provided by the University Preschool Parents Association to accommodate the students, faculty, and staff, as well as the public. A stimulating environment is provided daily at the center, according to a fundamental philosophy that learning should be fun. In addition to cognitive development, the center focuses attention on the social, physical, and emotional development of the children enrolled. The center is staffed by professional teachers and well-qualified teacher aides, each of whom is attentive to the needs of individual students. The center has several attendance plans to accommodate the various schedules of student parents. Call (205) 837-9553 for information.

University Center

The Center houses student lounges, meeting rooms, a game room, offices for Student Affairs, Student Government Association, Exponent, the bookstore, and food service. The University Center has become the primary student programming facility on campus, and consequently numerous activities are continually occurring throughout the week.
School of Graduate Studies

Dean: N.F. Audeh, Professor of Electrical Engineering.

The graduate programs of the University of Alabama in Huntsville foster a creative learning experience while further strengthening intellectual capabilities through intensive studies. Graduate studies are characterized by a greater degree of independence in the student and concurrently by a closer association with one or more members of the graduate faculty. Only those students showing distinct promise of completing the requirements for a graduate degree are admitted to the School of Graduate Studies.

The graduate degree is based on a Program of Study designed to reach a specific intellectual or professional goal. This Program of Study should be planned by the student at the earliest appropriate time (see specific degree programs) with the counsel of a faculty advisor. The Program includes advanced studies in subject-matter areas and, in most cases, a research phase in which the student demonstrates independent scholarly work. It is the student's responsibility to be acquainted with all requirements related to a desired program and to fulfill these requirements.

History

Graduate courses have been offered in Huntsville since the earliest days of higher education in the area. With Redstone Arsenal, NASA's George C. Marshall Space Flight Center, and other scientific and technical organizations concentrated in Huntsville, a demand was felt as long ago as 1950 for postgraduate coursework emphasizing theoretical and practical studies. Graduate courses were first given in Huntsville in 1951 under the direction of the Graduate School of the University of Alabama in what was then called the Redstone Institute of Graduate Study. The graduate program was then completely separate from the new undergraduate program, except that both held classes at what was then Butler High School. In addition, separately funded graduate courses in Education were being held elsewhere in Huntsville, independent of both. After a two-year lapse because of the cancellation of government sponsorship, the graduate program re-opened in January of 1956 with classes in Physics, Engineering, Mathematics, and Management. Even more than the undergraduate program, graduate studies grew with the space program. At the encouragement of Redstone Arsenal, the Research Institute was created in 1960. Three years later it was announced that Masters degrees could be awarded locally in Mathematics, Physics, Chemistry, and Engineering. The first Masters degree, in Mathematics, was awarded in 1964, and the following year two Masters degrees were awarded for work begun and completed at Huntsville. In 1971 doctoral programs in Engineering and Physics were initiated. The School of Graduate Studies was organized in its present form in 1976.
## GRADUATE DEGREE PROGRAMS

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*In cooperation with The University of Alabama.
Degree Requirements

The following scholastic requirements are those of the School of Graduate Studies (individual departments may add additional requirements):

1. Overall grade average must be B or better on all graduate credit hours at UAH. In addition, the grade average must be B 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 50 percent of the hours required for a graduate degree must be completed in courses numbered 600 or above.

4. At least 50 percent of the courses on a student's Program of Study must be taught by UAH full-time faculty members.

5. At least 50 percent of the courses on a student's Program of Study must be taken on campus.

Probationary Status

1. Students admitted conditionally with an overall grade average of B or better for all graduate work attempted up to and including the term in which 12 semester hours are completed assume the status of an unconditionally admitted student. Any time a student's overall grade average on graduate courses drops below a B, the student will be placed on probation.

2. A student on probation is not a candidate for a degree.

3. Probationary status is removed by raising the overall grade average to B or better on all graduate work attempted in all terms up to and including the term in which 12 semester hours of graduate work are completed following the term the student is placed on probation.

4. Failure to remove probation in the manner described results in dismissal from the School of Graduate Studies. In exceptional cases students may be re-admitted upon recommendation of the faculty in the major department and approval by the graduate dean.

English Proficiency

Success in the graduate school is strongly dependent upon a well-developed ability to communicate in English. A faculty member has the right to refuse written material submitted by a student if that material, in the opinion of the member, does not meet standards in English proficiency. Students otherwise admissible to graduate studies but who have low verbal scores (less than the 25th percentile on a national standardized test such as: MAT 40, GRE Verbal 400, GMAT Verbal 20) must pass an English proficiency test, or pass a remedial English course within the first 12 hours of graduate study in order to continue in the graduate program.
The Master’s Degree

Students may follow one of two plans for the Master’s degree, except where modified by individual departments. To avoid delay, students are encouraged to plan a Program of Study with the help of a faculty advisor before the completion of 12 semester hours of coursework. Courses taken without an approved program of study may not apply toward a degree.

Plan I (Thesis)

Degree requirements under this plan include completion of 24 or more semester hours of graduate coursework and the writing of an acceptable 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 and approved by a faculty committee of the major field, by the chairman of the department, and by the graduate dean. All theses must be accessible to the general public.

A completed copy of the thesis must be submitted to the major department at least four weeks before the date on which the candidate expects to receive the degree. At least three weeks before graduation, three copies of the thesis approved by the thesis committee and the graduate dean must be deposited in the Office of the Associate Registrar along with a receipt for the binding fee. Theses must comply with the regulations set forth in the Guide for Preparation of Theses and Dissertations at The University of Alabama in Huntsville, available at the Office of School of Graduate Studies.

In exceptional cases, theses may be written in absentia. Before leaving the university, students must 1) select a thesis subject, 2) submit to the chairman of the major department a satisfactory outline of the thesis, and 3) submit satisfactory evidence that adequate facilities are available where work is to be done.

Plan II (Non-Thesis)

Degree requirements for the Master's degree under this plan include the completion of a minimum of 33 semester hours of graduate coursework. A thesis is not required.

A candidate working under Plan II may be required to participate successfully in a seminar or in problem courses for acquaintance with research methods and appreciation of the place and function of original investigation in the field.

Transfer Credit

With permission of the major department, students may transfer a maximum of 6 semester hours of acceptable graduate credit earned in an approved institution and may count it toward a Master's degree. Students may also petition the major department to recommend to the graduate dean that 6 additional hours of graduate credit be accepted. Such credit may not be more than six years old at the time of a student’s graduation from UAH. It is transferable only if the student was enrolled
in a graduate school at the time it was taken and has an overall average at the
institution of B or better. Students who have graduate credits from another campus
of the University of Alabama must complete a minimum of 12 semester hours of
acceptable graduate credit at UAH to receive a Master's degree from UAH.

Candidacy for the Master's Degree

A student admitted to a Master's degree program is a candidate for the
Master's degree only if the student has met all admission requirements, is not on
probation, has an approved Program of Study on file in the Office of Admissions
and Records, and has an average of B or better on all graduate work attempted at
UAH.

Examinations

In addition to the regular course examinations, a final comprehensive examina­
tion is required of all candidates for a Master's degree. This examination may be
written, oral, or both. If a thesis is submitted and a written examination given,
there will be an oral examination that may be limited to the thesis. The candidate
will be examined on the major subject or subjects and thesis in Plan I and on the
coursework in Plan II. The oral examination is conducted by a committee of at
least three members appointed by the graduate dean. The examination committee
is usually (but not always) the same as the thesis supervisory committee. The
members of the examining committee are selected by the advisor in consultation
with the student. Moreover, the examining committee is composed of faculty
members whose areas of expertise cover the areas listed on the student's program
of study insofar as possible. The majority of the committee must be composed of
full-time UAH faculty members. A written notice of the time and place of
examination is sent by the graduate dean to the candidate and each member of the
committee at least two weeks before the examination date. The examination must
be given at least one month before the date of graduation and the results reported
promptly to the graduate dean. A student may take the final oral or written
examination only twice.

Application for Degree

Each candidate for an advanced degree must apply for the degree through the
Office of Student Records at least three months before the degree is to be
conferred.

Time Limit

All requirements for the master's degree must be completed in not more than
six years. Credit for individual graduate courses completed at UAH more than six
years but less than ten before the completion of all requirements for the degree
may be validated by special examination. Such an examination, given by the
department in which the course is offered, can be taken only once and will be the
equivalent of a final examination in the course. When the student passes the
examination, the course is considered valid through the tenth year only.

Credit for courses transferred from other institutions cannot be validated at
UAH.
Second Master's Degree

A student is permitted to apply no more than 6 semester hours of credit earned for one graduate degree toward an additional master's degree at UAH. Such permission is granted at the discretion of the major department.

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 insure that a student's degree program is in order.

Form 3: Program of Study. This form must be filed as early as possible and definitely before the completion of 12 semester hours. If the program is developed by a supervisory committee, the student may be invited to the committee meeting.

Form 3-A: Petition for a change in Form 3, if any. A valid reason must be given for the change.

Form 5: Application for Advanced Degree. This is to be filed at least three months before graduation. It is available at the Office of Student Records.

Form 6: Notification of Final/Qualifying Examination. Notification of the examination date must be given at least two weeks in advance. The final examination must be taken at least one month before graduation, and not earlier than the term in which the student completed all required coursework.
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 program of study designed by the student and a faculty committee. The program includes mastery of certain research skills (languages, computer programming, statistics, and others approved by the Graduate Council) and 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 departments as shown in this catalog under the appropriate department.

Course Requirements

The School of Graduate Studies imposes no specific course or credit-hour requirements for the Ph.D. Course requirements are defined in the Program of Study 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.

The approval of the Program of Study should be accomplished as early as possible, but no later than the end of the first year of study. Once approved, the program may only be amended by the supervisory committee.

Transfer Credit

All credit toward the Ph.D. which has not been earned at UAH must be acceptable graduate credit, transferred from an approved institution. Such credit is transferred only with approval of the major department.

Foreign Language Requirement

The requirement for foreign language competency may be satisfied by one of four methods, the particular method being determined by the department of the major:

1. Reading proficiency in two languages as determined by performance on the standardized Graduate School Foreign Language Tests of the Educational Testing Service (ETS) and administered at UAH. The required level of performance is to be established by the major department.

2. Reading proficiency in one language as above and demonstrated competence in a research skill.
3. An in-depth knowledge of one language as demonstrated by performance on the ETS Graduate School Foreign Language Test at a level appropriately higher than that for No. 1 above; or completion of 12 semester hours in one language with a grade average of B or better.

4. Competency in two independent research skills. Criteria for acceptability of these skills are to be determined by the department of the major.

Residence Requirement

For the award of a Ph.D., residence at UAH as a graduate student is required for evaluation of the student’s investigative abilities, independent thought, and scholastic progress by faculty members other than the major advisor.

Full-time residence at UAH for at least one continuous academic year or its equivalent during the student’s graduate career is judged to be minimum. All research effort presented for residence credit toward the Ph.D. degree must be performed under the direction of a full-time 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 supervisory committee is composed of at least three members from the major department and one or more from another department appointed by the graduate dean. The supervisory committee will examine the student’s research proposal for the dissertation.

Qualifying Examination

The qualifying examination is given under the auspices of the supervisory committee. The examination is a demonstration of proficiency in the subject-matter phase of the Program of Study and shall be part written and part oral. The written portion shall become a part of the student’s permanent record. The examination may be taken twice if necessary. Further attempts will require the permission of the Graduate Council.

Admission to Candidacy

Upon successful completion of the qualifying examination and the foreign language requirement, the student may be admitted to candidacy for the degree. Admission to candidacy is based on the recommendation of the student’s supervisory committee and the appropriate department and is approved by the graduate dean. It is the responsibility of the student to secure the appropriate forms from the Associate Registrar’s Office and to initiate the procedure for admission to candidacy at least six months preceding the awarding of the degree.
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. 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 at least one month before graduation. At least two weeks before graduation, three copies of the dissertation, approved by the student's committee and the chairman of the major department and the graduate dean, are to be deposited in the Associate Registrar's Office with a receipt for the binding fee. A copy of the dissertation must be submitted for microfilming to University Microfilms International by the time of graduation. Dissertations must comply with the regulations set forth in the Guide for Preparation of Theses and Dissertations at The University of Alabama in Huntsville, available at the Office of the School of Graduate Studies.

Application for Degree

Each candidate for a Ph.D. degree must apply for the degree through the Office of Student Records as least three months before the degree is to be conferred.

Final Examination

The final examination is an oral presentation of the dissertation in the form of a seminar before the student's committee and is open to the members of the university community.

Time Limit

All requirements for the doctoral degree must be completed in no more than five years after the student has passed the qualifying examination.

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 insure that a student's degree program is in order.

Form 4: Graduate Student Supervisory Committee. This committee (see above) supervises the student's work throughout the doctoral program. It is selected by the student and the major advisor after the student has satisfactorily passed the preliminary examination.
Form 10: Program of Study for the Doctoral Degree. Subsequent to approval of Form 4, the committee should meet to develop a complete program for the student, who should be invited to the meeting.

Form 3-A: Petition for a change in Form 10, if any.

Form 6: Notification of Qualifying Examination. Students should consult with their advisors about specifics.

Form 11: Application for Admission to Candidacy for the Degree of Doctor of Philosophy. This form must be completed after passing the qualifying examination and the language requirement at least six months before graduation. (Available from the Office of Student Records.)

Form 5: Application for Advanced Degree. This should be filed three months before graduation. (Available from the Office of Student Records.)

Form 6: Notification of Final Examination. Notification of the final examination requires a minimum lead time of two weeks. This examination must be taken at least one month before graduation.

Cooperative Programs

Between UAH and the University of Alabama, Tuscaloosa

Close cooperation on Ph.D. programs exists between departments on the UAH campus and departments on the Tuscaloosa campus authorized for carrying on doctoral work. Applicants to programs in Mathematics, Chemistry, and Administrative Science who desire to make maximum use of services in Huntsville may submit application materials to the UAH School of Graduate Studies. Upon being admitted, the student will be advised of the procedures for program planning.

The minimum residence requirements on the Tuscaloosa campus include two consecutive semesters (or, if specifically approved by the faculty concerned, one full summer of two terms preceded by or followed by one regular semester) and 18 semester hours of credits (including research, seminars, dissertations, special problems, or other assignments for which a credit equivalency may be established).

Between Auburn University and the University of Alabama System

In some designated programs, a student enrolled in either Auburn University or any campus of the University of Alabama System 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 work. 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 at least one-half of the required coursework at the institution granting the degree.
For a course to be applicable for credit above the six hours presently transferrable toward a Master's degree or beyond the Master's, the course must be approved in advance by the student's major department or school 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.

**Between UAH and Alabama A&M University**

A visiting student policy has been established between Alabama A&M University and UAH. Under this arrangement, a graduate student at one institution may request permission to attend a course at the other. Conditions governing the granting of permission include the following:

1. The student must be in good graduate standing.
2. The course desired is unavailable to the student at the home institution.
3. A visiting student is limited to one graduate course a term at the host institution except where the second course is a laboratory required to accompany the first course.
4. A visiting student must have prerequisites for the course.
5. The number of courses taken under this plan cannot exceed those allowed in the policy on transferred credit.
6. The student's request requires the approval of the advisor, department chairman, and graduate dean.
7. Permission of the host institution is dependent upon availability of space for the visitor after its own students are accommodated.

Interested students should contact the Office of Admissions and Records for appropriate forms.
School of Administrative Science

Degrees: Master of Administrative Science
PhD in Business Administration in cooperation with the University of Alabama, Tuscaloosa

Dean: C. D. Billings, Professor

Professors:
Graves, B.B.; strategic planning, small business, international management.
Lindbeck, R.S.; taxation, not-for-profit accounting.

Associate Professors:
Banton, H.S., III; real estate.
McCollum, J.K.; labor relations, organizational thought.
Olsen, E.A.; organizational behavior/thought, human resource management.
Paul, C.W., II; managerial economics.
Stafford, E.F., Jr.; production/operations management.
Vozikis, O.S.; strategic management/policy, entrepreneurship.

Assistant Professors:
Busbin, J.W., II; advertising, consumer behavior.
Floyd, S. A.; decision support systems, management science.
Goss, E.P.; management information systems.
Schoening, N.C.; urban and regional economics.
Schroeder, E.A., IV; managerial economics, econometrics.
Scriven, M.C.; macro, micro, managerial economics.
Sherman, J.D.; organizational behavior, organizational theory.
Tseng, F.T.; management information systems.

Adjunct Associate Professor:
Davis, B.; project management.

The Master of Administrative Science (MAS) is a generic management degree, providing entry-level and mid-career managers with the practical and theoretical knowledge necessary to manage public and private organizations. The program builds capable, creative managers able to face successfully the challenges of rapid technological change, changing employee expectations, and overall increased complexity. The program recognizes the influence of computer technology on all management processes by thoroughly integrating micro and mainframe computer applications into coursework. It increases skills in information management through the use of computerized classrooms and laboratories and computer-assisted instruction. The cooperative PhD program with Tuscaloosa leads to careers in government, business, research, or academia.

Goals of the MAS program are met through an interdisciplinary curriculum which develops skills in applying advanced technology and behavioral concepts crucial to management. This curriculum supplies students with critical knowledge about a wide range of organizations through coursework in accounting, econom-
ics, finance, management, quantitative methods, marketing, management information systems, the worldwide dimension of management of organizations, and the legal-social-political-ethical environment of organizations. This Foundation Curriculum allows students without the prerequisite undergraduate preparation to acquire the common body of knowledge in administrative science. The Core Curriculum then builds on this foundation through advanced study in the quantitative and human aspects of organizational problem-solving, including the communication, interpersonal, and negotiation skills indispensable to effective management.

These management skills are enhanced further by a wide range of options for elective coursework. Advanced study can be in one of the following options:

- Computer Science
- Educational Administration
- Personnel and Human Resource Management
- Public Administration
- Economics
- Operations Research
- Product Management
- Systems Efficiency
- Analysis

Center for High Technology Management and Economic Research

The staff of the Center analyzes the business and economic environment of the Huntsville area, the state of Alabama, and the Southeast region of the United States. Special emphasis is on businesses in technological fields. The Center is an associate member of the Association for University Business and Economic Research, a member of the Southern Technology Applications Center, and a member of the NASA Technology Transfer Network.

The Center serves the business community, state and local governments, individuals, and the University through management and technical assistance, dissemination of economic and socioeconomic information, and support for faculty in seeking funding for research projects. The Center publishes the results of its research as monographs so that significant developments in business and economics can achieve wide exposure.

In addition, the Center staff does contract research on business and economic problems for governmental organizations and private industry. A major subsidiary program is the Alabama High Technology Assistance Center(AHTAC), which offers technical and management assistance to new and emerging high technology businesses throughout Alabama. Using technical experts from within the University and from such sources as the Federal Laboratory Consortium and the NASA Technology Transfer Network, AHTAC supplies idea and product evaluation and technical problem resolution. AHTAC regularly sponsors seminars and workshops on subjects of special interest to the “high tech” community.

Another subsidiary program is the Small Business Development Center(SBDC), which gives managerial and technical assistance to entrepreneurial ventures in North Alabama. The SBDC advises potential and established entrepreneurs, assists in the development of private-sector jobs, and advocates the free enterprise system.
Master of Administrative Science

Admission Requirements

Individuals with baccalaureate degrees in any field of study are eligible to apply to the MAS program. Admission to the program is competitive. It is based on an applicant’s undergraduate academic performance, scores on the GMAT, and information provided on the supplemental application form supplied by the School of Administrative Science. Scores on the TOEFL are also required for international applicants.

Once an applicant has submitted documents to satisfy all the above requirements, the applicant’s file will be reviewed by a faculty committee. Applicants may be allowed to begin graduate study in one of the following three categories:

1. Unconditional Admission

Applicants who meet the following criteria will be admitted unconditionally:

a. a minimum grade point average of 3.0 (4.0 scale);

b. a minimum score of 450 on the GMAT;

c. A minimum of the 50th percentile on each portion of the TOEFL (international applicants only).

2. Conditional Admission

Applicants not meeting the above criteria will be considered for conditional admission. Recommendation for conditional admission is based on the applicant’s prior academic performance, GMAT scores, relevant work experience, and any additional information the applicant may wish to submit. Students admitted conditionally must maintain a “B” average for the first twelve hours of graduate work and meet any other conditions established.

3. Graduate Non-Degree

Applicants who wish to begin graduate study before submission of all application material may do so provided they have:

a. an application to graduate school on file;

b. completed the supplementary application forms supplied by the School of Administrative Science;

c. have either
1. Transcripts of all undergraduate degree work on file with a minimum "B" undergraduate grade point average, or

2. provided proof of a Bachelor's degree and submitted a test score of at least 450 on the GMAT.

Advisement and Registration Procedures

Advisement of graduate students is handled by the School's Coordinator of Graduate Programs. Students must file a Program of Study outlining their degree program, including choice of electives, before they have completed 12 hours of graduate work beyond the Foundation courses. A member of the graduate faculty will be assigned as an advisor.

During each registration period, all registration cards must be approved by the Coordinator of Graduate Programs. All students, except students enrolling for the first time, are encouraged to pre-register for classes during the early registration period seven weeks prior to the term. (See the UAH Calendar.)

Course Load

The usual course load for a full-time graduate student in Administrative Science is 6-9 semester hours per term. The maximum load is 10 semester hours. Students who are employed full time must obtain permission of the advisor to enroll in more than three semester hours per term.

Transfer Credit

Courses taken at the graduate level which are transferred to meet the Foundation Curriculum are excluded from the UAH policy on the maximum number of hours permitted to be transferred. Please refer to the Graduate School requirements.

Degree Requirements

In addition to meeting all degree requirements established by the School of Graduate Studies, all candidates for a Master of Administrative Science degree must meet the following conditions to be eligible for graduation:

1. completion of the Foundation of Administrative Science Curriculum by undergraduate or graduate work;

2. completion of a minimum of 36 hours of graduate level coursework, including the Administrative Science Core Curriculum, 15 hours of electives (an option) and the Strategic Management requirement (AS 637, Organizational Policy).

3. successful completion of the comprehensive examination requirement;

4. a minimum "B" average for all degree credit coursework.
The Curriculum

The MAS allows students the opportunity to do advanced work in management regardless of undergraduate background. The MAS degree program consists of 57 semester hours, 21 of which may be waived on the basis of appropriate undergraduate course preparation. This policy ensures that all students entering the program have a common body of knowledge. Beyond the Foundation courses, the MAS program involves 36 semester hours, consisting of seven required courses and five elective courses.

The degree program has the following structure beyond the Foundation Curriculum:

| SEM HRS |
|------------------|------------------|
| Administrative Science Core Curriculum | 18 |
| Strategic Management Requirement | 3 |
| Option or Specialization | 15 |
| Total | 36 |

Foundation of Administrative Science Curriculum (21 semester hours)

The Foundation Curriculum gives students the necessary background to enter the Administrative Science Core curriculum, options, and Organizational Policy course. Students who have completed equivalent coursework (see Graduate Programs Coordinator) may be permitted to waive up to 21 semester hours of the Foundation coursework. The Foundation courses are:

| SEM HRS |
|------------------|------------------|
| AS 621 Introduction to Administrative Science | 3 |
| MIS 609 Introduction to Management Information Systems | 3 |
| MSC 608 Quantitative Methods I | 3 |
| AC/FIN 601 Introduction to Accounting & Finance | 3 |
| AS 615 The Social, Legal, and Ethical Environment of Organizations | 3 |
| EC 607 Survey of Economic Theory | 3 |
| MKT 606 Marketing Administration | 3 |
| Total | 21 |

Administrative Science Core Curriculum (18 semester hours)

The Administrative Science Core Curriculum provides students with a comprehensive understanding of effective management in public and private organizations. Emphasis is placed on the managerial aspects of economics, accounting, and quantitative methods as well as on understanding complex organizations and their human elements. The Administrative Science Core Curriculum consists of the following courses:

| SEM HRS |
|------------------|------------------|
| AS 621 Introduction to Administrative Science | 3 |
| MIS 609 Introduction to Management Information Systems | 3 |
| MSC 608 Quantitative Methods I | 3 |
| AC/FIN 601 Introduction to Accounting & Finance | 3 |
| AS 615 The Social, Legal, and Ethical Environment of Organizations | 3 |
| EC 607 Survey of Economic Theory | 3 |
| MKT 606 Marketing Administration | 3 |
| Total | 18 |
AS 622  Human Behavior in Organizations ................................. 3
AS 623  Organizational Theory ........................................... 3
AS 624  Organizational Problems ......................................... 3
EC 626  Managerial Economics ............................................ 3
AC 670  Managerial Accounting & Finance ............................... 3
MS 651  Quantitative Methods II ......................................... 3

(Production/Operations Management) .................................. 18

**Administrative Science Options** (15 semester hours)

Each student in the Administrative Science program must complete a minimum of 15 hours of electives, 3 hours of which must be at the 600 level or above. Individual career needs may be met by choosing one of the following options: Computer Science (Management Information Systems), Economics, Educational Administration, Operations Research, Personnel and Human Resource Management, Product Management, Systems Efficiency Analysis and Public Administration. Students who wish to tailor an option individually may do so by choosing from graduate-level courses in various departments. All tailored options must be approved by the Coordinator of Graduate Programs.

1. **Computer Science (Management Information Systems) Option:**

   This option is for students seeking additional technical expertise in computer science and information systems as well as in the application of computer technology to management systems. Students with no prior background in computer science will be required to complete up to 12 semester hours of undergraduate coursework as pre-requisites to CS 501.

   - **CS 501**  Systems Software ........................................ 3
   - **CS 517**  Data Structures ........................................ 3
   - **either**
     - **CS 624**  Programming Languages
     - **or**
     - **CS 690**  Operating Systems .................................. 3
   - Six hours from 500 and 600 level Computer Science and Management Information Systems courses ........................................ 6

   **Strategic Management Requirement** (3 semester hours)

   While the entire MAS program is concerned with the development of managers, the Strategic Management requirement emphasizes the top management perspective. AS 637, Organizational Policy, serves as the final integrating course for the MAS program. Students will examine administrative processes under conditions
of uncertainty, including such topics as integrating analysis and policy determination at the overall management level. AS 637 must be completed with a minimum grade of B. It includes analysis of changing environments, organizational strategy development, strategic goal setting, organizational policy formulation, and management problem analysis.

2. Economics Option:
This option is designed to develop an understanding of the principles and methods for organizing a business firm, combining resources to produce goods and services, taking account of costs, profits and the nature and extent of competition in markets.

EC 600 Theory of Income and Employment ........................................ 3
EC 610 Theory of Value and Distribution ........................................... 3
EC 620 Econometrics ................................................................. 3

Six hours from 500 or 600 level Economics courses ........................................... 6

15

3. Educational Administration Option
This program examines the planning, organizing, developing, staffing, coordinating, managing, researching, evaluating, financing, and controlling of educational organizations. This option leads to the Class A Professional Teaching Certificate. A prerequisite to the Class A certificate is eligibility for a Class B certificate. Students pursuing this option are required to complete the Core Curriculum (with the exception of EC 626) and an additional 18 semester hours in Education electives.

ED 601 Public School Organization and Administration ........................................ 3
ED 602 The Principal as Educational Leader ........................................ 3
ED 606 Principles of Curriculum Development ........................................ 3
ED 622 Modern Elementary School Programs
or
ED 630 Modern High School Programs (depending on whether the student is seeking Elementary or Secondary Certification) ........................................ 3

ED 647 Field Experience/Practicum ................................................. 1
ED 648 Field Experience/Practicum ................................................. 1
ED 649 Field Experience/Practicum ................................................. 1

18

Students who have not taken a survey course in special education at graduate or undergraduate level must make up that deficiency by taking ED 593, Survey of Exceptional Children.
4. Operations Research Option

This option analyzes management problems through probability theory, continuous distributions, mathematical programming, queuing theory, Markov processes, replacement maintenance and inventory models, other mathematical models, and simulation and game theory. Interested students should consult the chairman of the Industrial and Systems Engineering Department to ensure they meet the necessary pre-requisites.

ISE 626  Introduction to Operations Research ...........................................3
ISE 636  Systems Modeling .................................................................3

Nine hours from the following .........................................................9
ISE 527  Systems Simulation
ISE 621  Statistical Methods of Engineers
ISE 634  Value and Decision Theory
ISE 635  Linear Programming
ISE 737  Advanced Simulation Modeling ...........................................15

5. Personnel and Human Resource Management Option

This option furnishes advanced study in leadership and motivation, personnel activities, labor law, and communication patterns in organizations. It primarily emphasises managing human resources within an organization.

AS 631  Personnel Administration in Organizations ...............................3
CM 636  Effective Communications for Managers .................................3

Six hours from the following ..............................................................6
AS 625  Labor Relations and the External Environment
AS 629  Leadership and Motivation
AS 634  Seminar in Administrative Science
AS 635  Administrative Science Internship
AS 650  Selected Research Topics
SOC 630  Industrial Sociology

Three hours from 500 or 600 level School of Administrative Science courses 3

15
6. Product Management (Industrial and System Engineering)

This option emphasizes systematic regulation and control of the manufacturing, fabricating, extracting, and processing of goods. Interested students should contact the Chairman of the Industrial and Systems Engineering Department to ensure they meet the necessary prerequisites.

ISE 626 Introduction to Operations Research ......................... 3
ISE 627 Introduction to Systems Engineering .......................... 3
Nine hours from the following ............................................. 9
ISE 523 Statistical Quality Control
ISE 526 Design and Analysis of Experiments
ISE 621 Statistical Methods of Engineers
ISE 632 Stochastic Systems
ISE 633 Industrial Forecasting and Analysis I
ISE 634 Value and Decision Theory
Approved Administrative Science course offerings

7. Systems Efficiency Analysis (Project Management)

This option prepares individuals to examine organizational policies, structures, and administrative practices so they may recommend and install systems procedures and methods improvements. It includes advanced study in the design, implementation, testing, and maintenance of various systems procedures. The option stresses valid technical research to aid engineers, management personnel, and others in effectively installing efficient operations. Primary emphasis is on the development and management of matrix organizations and project management concepts.

MSC 640 Principles of Project Management ......................... 3
MSC 641 Applied Project Management .................................. 3
MSC 642 Quantitative Applications in Project Management ....... 3
MSC 643 Simulation of Project Management ......................... 3
Three hours from the following ........................................... 3
AS 629 Leadership and Motivation
CM 636 Effective Communication for Managers
SOC 630 Industrial Sociology

8. Public Administration Option

This option stresses the knowledge, skills, values, and behaviors involved in the formulation of public policies and the management of public services. Courses emphasize, for example, the development of public management as a field of study, the inter-relationships between national, state and local government, the development and evaluation of public policies, and the budgetary and regulatory processes of government.
The Doctor of Philosophy degree is a research-oriented degree awarded upon the demonstration of scholarly attainment. The program is designed principally for those who wish to prepare for college and university teaching and research or for careers in business and government. The degree requirements for the cooperative Ph.D. program in Business Administration have been jointly established by the graduate faculties of the University of Alabama, Tuscaloosa, School of Commerce and Business and UAH’s School of Administrative Science. Requirements of both graduate schools must be fulfilled. Consult UA’s graduate catalog for full degree requirements. The following considerations are made for UAH cooperative Ph.D. students:

1. Coursework to meet general field requirements, language/research tool requirements, and quantitative methods requirements may be completed at UAH.

2. Major and minor field coursework must be completed in residence at the University of Alabama in Tuscaloosa.

3. One or two UAH Administrative Science faculty members may serve on the student’s program and/or dissertation committee.

The transfer of credit to meet degree requirements for the cooperative Ph.D. program depends upon the program of each student. For detailed information contact the Dean of the School of Administrative Science at (205) 895-6735

### Accounting (AC)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>601</td>
<td><strong>Introduction to Accounting and Finance</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Fundamentals of financial accounting and corporate financial management. Preparation for higher-level administrative science courses for students who have not had courses in accounting and business finance. Prerequisites: graduate standing.</td>
<td></td>
</tr>
<tr>
<td>670</td>
<td><strong>Managerial Accounting and Finance</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>A study of accounting information as a management decision-making tool: financial analysis and interpretation of accounting data and internal reports. Prerequisites: graduate standing; AC 601 or equivalent.</td>
<td></td>
</tr>
</tbody>
</table>
## Administrative Science (AS)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>621</td>
<td>Introduction to Administrative Science</td>
<td>3 hrs.</td>
<td>Principles of organizational structure, planning and forecasting, directing, controlling, staffing, decision-making, communication, and their relation to one another. Preparation for higher-level administrative science courses.</td>
</tr>
<tr>
<td>622</td>
<td>Human Behavior in Organization</td>
<td>3 hrs.</td>
<td>Organization as a continuing social system. Problems of motivation and incentives, organizational communication, and their blockages. Selection, training, promotion, and severance of organizational members. Prerequisite: AS 621.</td>
</tr>
<tr>
<td>623</td>
<td>Organizational Theory</td>
<td>3 hrs.</td>
<td>Theories of organizations and their structures. Organizations from the perspectives of management, psychology, sociology, political science, and economics. Organizations as groups of people and as systems in multiple environments. Goals, resources, effectiveness, equilibrium, and change relating to organizations. Administration’s relationships with organization with emphasis on research and assessment. Prerequisite: AS 621.</td>
</tr>
<tr>
<td>624</td>
<td>Organizational Problems</td>
<td>3 hrs.</td>
<td>Organizational and group interface problems and processes and principles bearing on their solutions by simulations, case analysis, and structured interactions. Prerequisites: AS 622 and AS 623.</td>
</tr>
<tr>
<td>625</td>
<td>Labor Relations and the External Environment</td>
<td>3 hrs.</td>
<td>Relationships between management and organized labor and between organizations and the world outside their confines. Development of organized labor in the U.S. and major legislation-affective relations between management and labor. Collective bargaining process and administration of the resulting contract from the standpoint of labor's relations with the external environment. The public and news-media impact upon management actions.</td>
</tr>
<tr>
<td>629</td>
<td>Leadership and Motivation</td>
<td>3 hrs.</td>
<td>Authority and leadership styles and their effectiveness in different types and levels of organization. Theories of personnel motivation and their practicability and effectiveness. The critical role of effective communication in leadership and motivation. Prerequisite: AS 622.</td>
</tr>
<tr>
<td>631</td>
<td>Personnel Administration in Organizations</td>
<td>3 hrs.</td>
<td>Traditional and contemporary theories of purposes, functions, and processes of personnel administration needs of large complex organizations in both the private and public sector. Elements of a comprehensive personnel program in relation to the total management.</td>
</tr>
<tr>
<td>632</td>
<td>Civil Systems Planning</td>
<td>3 hrs.</td>
<td>Values and dangers inherent in current planning methods and predictive models. Application of specific techniques and planning situations for solving social problems through integration of purely technical information with that of economics, sociology, psychology, and political science. Classroom work and laboratory visits to community agencies.</td>
</tr>
<tr>
<td>633</td>
<td>Socio-Economic Consequences of Government Procurement</td>
<td>3 hrs.</td>
<td>The nature of federal government procurement, contracting. Government’s organization and procedures for managing the contractual system and its impact upon participating private industry. Implication of the contractual system on the political, economic, and social system-individual states, small business, minority groups, and labor employment areas.</td>
</tr>
<tr>
<td>634</td>
<td>Seminar in Administrative Science</td>
<td>3 hrs.</td>
<td>Social and behavioral concepts applicable to leadership, motivation, morale, decision-making, and communication. Student’s individual research projects based on their own investigation. Integration and application of acquired knowledge. Prerequisite: Administrative science majors with 27 credit hours toward the degree including 15 credit hours of core courses.</td>
</tr>
</tbody>
</table>
635 Administrative Science Internship 1-3 hrs.
Management internships will provide the opportunity to observe and participate in local industries and organizations. Students will be required to keep a log of activities and submit a final report. Prerequisite: minimum of 12 hours completed in AS Program.

637 Organizational Policy 3 hrs.
A study of administrative processes under conditions of uncertainty including integrating analysis and policy determination at the overall management level. Prerequisites: completion of all Administrative Science core courses.

650 Selected Research Topics 3 hrs.
Research in a particular topic relevant to administrative science 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. Prerequisite: completion of 15 hours of student's curriculum and approval of the Dean of the School of Administrative Science.

Business Legal Studies (BLS)

615 The Social, Legal and Ethical Environment of Organizations 3 hrs.
This course explores the external environment in which public and private organizations exist. Emphasis is given to the influence of legal and political forces on organizations in the operational and decision making processes. Prerequisites: graduate standing.

Economics (EC)

546 International Economics and Trade 3 hrs.
Theoretical principles underlying international trade with application of these principles to recent historical developments and to current national policies. Prerequisite: graduate standing and EC 345, or approval of AS Graduate Programs Coordinator.

564 Regional Economics 3 hrs.
Location theory and regional economics, factors affecting location of economics activity, consideration of differential growth rate among regions, and introduction to methods of regional analysis. Prerequisite: graduate standing and approval of AS Graduate Programs Coordinator.

585 Comparative Economic Systems 3 hrs.
Principle economic systems comparing resource allocation, consumption, pricing, production, investment, income distribution, and central planning. Prerequisite: graduate standing and approval of AS Graduate Programs Coordinator.

600 Theory of Income and Employment 3 hrs.
Continuation of EC 340. More advanced treatment of theory of national income determination and associated concepts. Prerequisite: EC 340 or equivalent. EC 607 and the approval of AS Graduate Programs Coordinator.

607 Survey of Economic Theory 3 hrs.
Rigorous treatment of basic principles underlying economic theory. Theory of national income determination, theory of market structures, principles of value and distribution theory. Prerequisite: approval of AS Graduate Programs Coordinator.

610 Theory of Value and Distribution 3 hrs.
Continuation of EC 345. Consideration of classical and neoclassical theory of value and distribution. Prerequisite: EC 345 or equivalent. EC 607 and approval of AS Graduate Programs Coordinator.

620 Econometrics 3 hrs.
Least-square estimation of single-equation linear models, properties of the estimators, significance tests and confidence intervals of estimation, and problems in estimation of single-equation models (autocorrelation, multi-collinearity, heteroscedasticity). Prerequisite: EC 430, EC 607, and approval of AS Graduate Programs Coordinator.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>626</td>
<td>Managerial Economics</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Analysis of economic problems or organizations and decision making techniques to solve these problems. Formal analysis of demand, supply functions, techniques used in demand analysis. Analysis of theory of cost, production, and cost estimation. Analysis of price, output and investment decisions including theory of optimal behavior, alternative price strategies, time value of money and project selection. Lab fee: Level 2. Prerequisites; EC 607 or equivalent.</td>
<td></td>
</tr>
<tr>
<td>630</td>
<td>Evolution of Economic Thought</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Methodology and social philosophy of outstanding economists and their part in shaping economic development. Selective treatment emphasizing systematic nature of theories involved. Prerequisite: EC 448, 600 610, or equivalent.</td>
<td></td>
</tr>
<tr>
<td>640</td>
<td>Seminar in Economics</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Intensive analysis of selected theoretical and applied aspects of economics. Prerequisite: EC 607 or equivalent.</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>Research in Economics</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Special topics in area of student interest. Prerequisite: EC 630.</td>
<td></td>
</tr>
</tbody>
</table>

**Finance (FIN)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>510</td>
<td>Principles of Real Estate</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>An introduction to principles and practices of Real Estate Business, including economics, finance, law, marketing, planning, development, valuation and brokerage. Prerequisites: FIN 301, AC/FIN 601, or approval of AS Graduate Programs Coordinator.</td>
<td></td>
</tr>
<tr>
<td>520</td>
<td>Principles of Risk and Insurance</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Introduction to basic principles of life, property, liability, and areas of insurance. Prerequisites: FIN 301, AC/FIN 601, or approval of AS Graduate Programs Coordinator.</td>
<td></td>
</tr>
<tr>
<td>530</td>
<td>Real Estate Finance</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>An introductory course in real estate finance—insti tutions, instruments, real estate financing, financial leverage, financial planning, investment strategies or decisions. Prerequisites: FIN 301, AC/FIN 601, or approval of AS Graduate Programs Coordinator.</td>
<td></td>
</tr>
<tr>
<td>554</td>
<td>International Finance</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>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. Prerequisite: FIN 352 (EC 352), graduate standing and approval of AS Graduate Programs Coordinator.</td>
<td></td>
</tr>
<tr>
<td>560</td>
<td>Monetary and Credit Policy</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Influence of governmental policies on money supply, price level, interest rates, and employment with emphasis on maintenance of economic stability and progress. Prerequisite: FIN 352 (EC 352); EC 340 optional but recommended, graduate standing and approval of AS Graduate Programs Coordinator.</td>
<td></td>
</tr>
<tr>
<td>570</td>
<td>Seminar in Finance</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Extensive readings and reports reflecting current developments and trends in financial theory and its applications to the decision-making process. Development of a logical approach to financial problems using accepted techniques of financial analysis. Prerequisite: FIN 431, and approval of AS Graduate Programs Coordinator.</td>
<td></td>
</tr>
<tr>
<td>601</td>
<td>Introduction to Accounting and Finance</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Fundamentals of financial accounting and corporate financial management. Preparation for higher-level administrative science courses for students who have not had courses in accounting and business finance. Prerequisites: graduate standing.</td>
<td></td>
</tr>
<tr>
<td>602</td>
<td>Investments</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Overall view of the investment-decision process, study of portfolio construction and management utilizing quantitative analysis. Prerequisite: AC 601 or equivalent.</td>
<td></td>
</tr>
</tbody>
</table>
603 Business Finance Problems and Policy 3 hrs.
Corporate financial policy and decision making. Working capital management, capital budgeting, risk-return analysis, valuation, and dividend policy; social aspects of mergers, acquisitions and reorganizations. Prerequisite: AC 601 or equivalent.

670 Managerial Accounting and Finance 3 hrs.
A study of accounting information as a management decision-making tool: financial analysis and interpretation of accounting data and internal reports. Prerequisites: graduate standing: AC 601 or equivalent.

Management (MGT)

550 International Management 3 hrs.
Management of the multinational business enterprise in interaction with its political, economic, social, cultural, and legal environments. Prerequisite: graduate standing and approval of AS Graduate Programs Coordinator.

570 Seminar in Management 3 hrs.
Selected Topics in management. Prerequisite: approval of AS Graduate Programs Coordinator.

Management Information Systems (MIS)

573 EDP Audit and Controls 3 hrs.
An introduction to Information Systems audit and controls. Prerequisites: MIS 340 or approval of AS Graduate Programs Coordinator.

574 Information System Planning 3 hrs.
An introduction to the financial, technical and strategic information systems planning processes. Prerequisites: MIS 411 or approval of AS Graduate Programs Coordinator.

575 Information Resource Management 3 hrs.
A seminar course providing a broad overview of the information systems management function. Prerequisites: MIS 411 or approval of AS Graduate Programs Coordinator.

609 Introduction to Management Information Systems 3 hrs.
Examines the role management information systems play in organizations including design, planning for, implementation and use of the management information systems. Applications and examples will be from administrative science areas. Open only to MAS students without background in computer usage and information systems. Prerequisite: graduate standing.

617 Modeling and Decision Systems 3 hrs.
The use of information systems in decision making and performance evaluation. Behavioral aspects of decision making in the decision support environment. Prerequisites: MIS 340, 400, or approval of AS Graduate Programs Coordinator.

Management Sciences (MSC)

570 Seminar in Production Management 3 hrs.
Seminar on current topics related to production management, such as materials requirements planning, flexible manufacturing systems, Japanese management systems, robotics. Lab Fee: Level 3. Prerequisites: CS 113, MSC 325, MSC 386, or approval of AS Graduate Programs Coordinator.

608 Quantitative Methods I 3 hrs.
Administrative applications of quantitative methods including sampling, linear regression and correlation time series analysis, queing, simulation, linear programming. Prerequisites: MSC 287 or equivalent and MIS 609 or equivalent, Lab fee: level 2.

640 Principles of Project Management 3 hrs.
The conceptual foundation and organization of project management. The project life cycle, planning, control, and financial management.
641 Applied Project Management 3 hrs.
Continuation of material developed in AS 640. Project management as a career field, project initiation, and the project plan. Insight into the intricacies of organizing for project management. Techniques for controlling the three major parameters of project performance and consideration of substantive aspects of interpersonal management.

642 Quantitative Applications in Project Management 3 hrs.
For technical and nontechnical students, many of the quantitative techniques used in contemporary project management. Systems, cost, and consequence analysis and schedule methodology, as well as the critical topic of system integration.

643 Simulation of Project Management 3 hrs.
Federal and industrial decision-making, student participation in a simulation exercise involving a critical review point in the project life cycle, and current issues in project management.

651 Quantitative Methods II 3 hrs.
Study of organizational production and operation problems and techniques applied in solving them. Capacity planning, location and distribution demand forecasting, inventory control, maintaining system reliability, process and job design. Prerequisite: MSC 608.

Marketing (MKT)

515 International Marketing 3 hrs.
Procedures and problems associated with establishing and carrying out marketing operations in or with foreign companies. Institutions, principles, and methods involved in solving these business problems. Effect of national differences in business practices and regulation. Prerequisite: approval of AS Graduate Programs Coordinator.

570 Seminar in Marketing 3 hrs.
Review of selected classics in the literature. Recent developments in marketing theory and application to marketing problem solving. Prerequisite: graduate standing and approval of AS Graduate Programs Coordinator.

580 Marketing Management 3 hrs.
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. Prerequisites: 15 hours in marketing or MKT 606, or approval of AS Graduate Programs Coordinator.

606 Marketing Administration 3 hrs.
Development of analytical concepts and principles to design efficient strategies for solving marketing problems; major policy areas of product, price, channels, and promotion integrated in development of the firm's total marketing effort; includes application of non-profit organizations. (Not open to students who have taken MKT 301.) Prerequisite: graduate standing.
School of Arts, Humanities, and Social Sciences

Dean: R.L. Meek, Professor of Political Science

Graduate study in the School of Arts, Humanities, and Social Sciences brings together faculty and advanced students to share the excitement of creative learning. All degree candidates plan a graduate program in consultation with faculty members who share the student's intellectual interests. Within the framework of the requirements established by the department and the School of Graduate Studies, students design, in consultation with a faculty advisor, a program of study fitted to their particular interests and needs.

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

Education and Developmental Learning

Degree: Master of Arts

Chair: T.M. Butts, Assistant Professor; school psychology, language development, learning theory.

Professors:
Engle, H.A. (Emeritus); administration and curriculum.
Rogers, J.G.; abnormal and clinical psychology, counseling
Wharry, R.E.; developmental learning and psychology, learning disorders and assessment.

Associate Professors:
Brindley, T.A.; education theory, social change, foundations, secondary education.
Gibson, J.E.; educational psychology, psychological evaluation, secondary education.
Kilgo, R.D.; marriage and family sociology, counseling and guidance, children's literature.

The Department of Education and Developmental Learning offers programs in Secondary Education (with Master’s degrees and Alabama Class A certification in English, History, Biology, Chemistry, Mathematics, and Physics); certification in the Elementary and Secondary principalship (through an interdisciplinary program with Administrative Science); and Master’s degrees in the Developmental Learning Program with majors in Learning Disabilities, Early Childhood Education for
the Handicapped, School Psychometry, Developmental Processes and Early Childhood Learning. Class A certification is available in Learning Disabilities, Early Childhood Education for the Handicapped and School Psychometry. Certain individual courses are also offered, on demand, for in-service training of school personnel. The programs in Secondary Education and Administrative Science are offered in conjunction with the other departments. A complete listing of courses will be found in the catalog sections describing graduate offerings from those departments.

The graduate education program requires a broad and liberal education base, in-depth study of one or more disciplines, and professional study of the teaching arts. The department's purpose is the preparation of qualified and competent elementary, middle, and high school faculty, the training of personnel in allied fields, and the continuous professional development of all educational personnel through graduate and academic field service programs. It provides educational systems and other institutions within the region with assistance in program, staff, and curriculum development. Likewise, it recognizes a research mission to expand the body of knowledge which has as its core the teaching-learning process. Another prime function of the department is to recommend to the State Department of Education certification in conjunction with the graduate degrees offered (where appropriate).

While it is not a requirement for UAH graduation, the State Department of Education requires that a student hold or be eligible to hold a Class B certificate as a prerequisite for issuance of the Class A certificate. Similarly, the State also requires proof of one year of teaching experience before the Class A certificate will be issued. Further, if the appropriate Alabama Initial Teacher Certification Test has not been passed, that, too, will be required.

Special Facilities

The Department maintains a Teacher Materials Center where current teaching materials are available and where laboratory classes are held. Testing facilities are also available for psychometric evaluation. Some in-field training is handled in cooperation with the local school systems.

Degree Programs:

(1) Secondary Education (Middle and High School options, traditional and strengthened subject matter available)

Middle School (traditional)

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED 604, ED 606, ED 626 (Required)</td>
<td>9</td>
</tr>
<tr>
<td>ED 510 or DL 625 (select one)</td>
<td>3</td>
</tr>
<tr>
<td>ED 601 or ED 603 (select one)</td>
<td>3</td>
</tr>
<tr>
<td>Teaching Field</td>
<td></td>
</tr>
<tr>
<td>Special Education Requirement*</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>(3)</td>
</tr>
</tbody>
</table>

73
High School (traditional)
ED 604, ED 606, ED 630 (Required) 9 sem. hrs.
ED 510 or DL 625 (select one) 3
ED 601 or ED 603 (select one) 3
Teaching Field 24
Special Education Requirement* (3)

Middle School (Strengthened Subject Matter)
ED 510, ED 604, ED 626 (required) 9 sem. hrs.
Teaching Field 24
Special Education Requirement* (3) sem. hrs.

High School (Strengthened Subject Matter)
ED 510, ED 604, ED 630 (required) 9 sem. hrs.
Teaching Field 24
Special Education Requirement* (3) sem. hrs.

*Special Education Requirement: A survey course in special education is required (ED/DL 593) if no such course has been taken at undergraduate or graduate levels prior to entering program.

(2) School Administration:
Options are available leading to the Master of Administrative Science degree and certification at the Class A level in the principalship. The student may choose Elementary or Secondary certification. The program description is in the Administrative Science section of this catalog.

(3) Developmental Learning:
Three options leading to Class A certification and two non-certification options are available. They are:

Early Childhood Education for the Handicapped:
Professional specialization: DL 601, DL 604,
DL 605, DL 606, DL 626, DL 650(01) 15
Elective* 3

Learning Disabilities:
Professional specialization: DL 602, DL 604,
DL 606, DL 627, DL 650(01) 15
Elective* 3

School Psychometry:
Professional Specialization: DL 604, DL 620,
DL 626, DL 627, DL 631, DL 650(03) 15 sem. hrs.
Elective*
Developmental Processes:
Core: DL 603, DL 610, DL 628, DL 630 12 sem. hrs.
Professional Specialization: DL 601, DL 606, DL 650(04), (DL 699) 9-12
Electives 9

Early Childhood Learning:
Core: DL 603, DL 610, DL 628, DL 630 12 sem. hrs.
Professional Specialization: DL 605, DL 606, DL 640, DL 650(05) 12
Electives 9

*Elective: A survey course in special education is required for the three certification options, if the student has not previously taken the course at either graduate or undergraduate levels.

ED 500 Special Problems in Education 3 hrs.
Independent study, special projects, and special in-service programs. Prerequisite: senior standing.

ED 502 Environmental Education 3 hrs.
The general nature of ecological life systems, relationships of humankind and environment, major conservation problems facing the world today, exploration of alternate solutions and the tasks for educators.

ED 510 Foundations of Education Evaluation 3 hrs.
Measurement process with emphasis on its relationship to problems of educational evaluation. Evaluation as an integral part of overall educational planning in addition to its use in measurement and evaluation of academic achievement.

ED 549 Audiovisual Instruction 3 hrs.
Audiovisual media in teaching and the selection, use, and maintenance of audiovisual materials in educational programs.

ED 593 Education of Exceptional Children and Youth 3 hrs.
Introduction to the field of exceptional children and youth, including observations. This course, or equivalent, is a prerequisite to certification. (Same as DL 593)

ED 600 Special Problems in Education 1-3 hrs.
Independent study, special projects, and in-service programs.

ED 601 Public School Organization and Administration 3 hrs.
Systematic treatment of problems of local, state and national administration. New developments modifying educational administration, state authorization and organization, board of education, superintendent of schools, personnel and management, financial support, and public relations.

ED 602 The Principal as Educational Leader 3 hrs.
Role of principal as supervisor, organizer, and administrator of schools, program of studies, teaching staff, pupil personnel, plant and equipment, and community relationships.

ED 603 Sources of American Educational Thought 3 hrs.
Foundations of education in their philosophical, historical, social, and comparative aspects. Major relationships of schools and educative processes with society at large pointing to development of particular crucial issues.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED 604</td>
<td>Contributions of Psychology to Education</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>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.</td>
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<tr>
<td>ED 606</td>
<td>Principles of Curriculum Development</td>
<td>3 hrs.</td>
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<td></td>
<td>Principles of curriculum construction that underlie the reorganization of the program of studies for elementary and secondary schools. Origin and background of the curriculum, methods of organization, curriculum planning and development, and pertinent applications.</td>
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<tr>
<td>ED 608</td>
<td>The Educational Leader as Evaluator</td>
<td>3 hrs.</td>
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<td></td>
<td>Procedures and techniques of empirical evaluation including a sampling of available instruments; and research approaches complementary to the course AS 627 (Quantitative Methods of Management). Evaluation of teacher and staff performance. Curricula, achievement and ability, media, and equipment, and plant and facilities. Preparation for maintenance of accountability.</td>
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</tr>
<tr>
<td>ED 609</td>
<td>Fundamentals of Reading for Middle and Secondary Schools</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Instruction in developing reading skills and methods and materials in reading. Motivations of children and adolescents, functional reading and the atypical learner. Diagnosis and remediation of related deficiencies. Other related topics for regular and special education teacher. (Same as DL 609).</td>
<td></td>
</tr>
<tr>
<td>ED 610</td>
<td>Legal Aspects of Public School Administration</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Legal status of schools in the United States. Alabama conditions, school laws, constitutional provisions, judicial decisions. Attorney General’s rulings and regulations of State Board of Education.</td>
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<tr>
<td>ED 611</td>
<td>Principles of Guidance</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Sociological, psychological, and educational foundations of guidance; history and growth of the guidance movement; functions, scope, organization, and administration of guidance.</td>
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<tr>
<td>ED 622</td>
<td>Modern Elementary School Programs</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Evaluating new patterns of organization and the developing curriculum in elementary school.</td>
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<tr>
<td>ED 626</td>
<td>Modern Middle School Programs</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Survey of important viewpoints and issues, reorganization trends, typical research findings by subject fields and analysis of current curriculum proposals at the national, state, and local, levels.</td>
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</tr>
<tr>
<td>ED 630</td>
<td>Modern Secondary School Programs</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Important viewpoints and issues, reorganization trends, typical research findings by subject fields. Analysis of current curriculum proposals at the national, state, and local levels.</td>
<td></td>
</tr>
<tr>
<td>ED 647, 648, 649</td>
<td>Field Experience Practicum</td>
<td>1 hr. each</td>
</tr>
<tr>
<td></td>
<td>Student demonstration of performance competencies in school administration through field practicum. Students with committee approval may register for 647-648-649 individually or jointly. Course approval based upon committee’s evaluation of student’s readiness for field practicum. Courses individually scheduled to fit concurrently with student’s regular employment assignment.</td>
<td></td>
</tr>
</tbody>
</table>

**Developmental Learning (DL)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL 593</td>
<td>Education of Exceptional Children and Youth</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Introduction to the field of exceptional children and youth, including observations. This course, or equivalent, is a prerequisite to certification. (Same as ED 593)</td>
<td></td>
</tr>
<tr>
<td>DL 600</td>
<td>Special Problems in Developmental Learning</td>
<td>1-3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Independent study, special projects, and in-service programs. Elective only</td>
<td></td>
</tr>
</tbody>
</table>
DL 601  Early Childhood Development  3 hrs.
Theories and issues regarding physical, psychological, and social growth and development and maturation in early childhood. Perceptual, cognitive, and psychomotor processes that directly affect learning and behavior. Normal development as a basis for analysis of the atypical. Observation required.

DL 602  Psychopathology of Children with Learning Problems  3 hrs.
Symptoms and learning theory as related to children with learning problems. Observation required.

DL 603  Sequential Development of the Human Organism  3 hrs.
Early learning processes in children from birth through maturation, from systematic motor exploration, through perceptual manipulation to cognitive operations. Observation and practicum.

DL 604  Adaptive Academics  3 hrs.
Sequential and veridical approach to making adaptations in academic areas so that programs can be developed to help individuals who can learn best through adaptive and concrete procedures. Practicum.

DL 605  Curriculum for Early Childhood Education  3 hrs.
Assessment findings and developmental objectives are linked so that individual programs can be developed. Curricula reflecting differing philosophies reviewed. In depth study of prominent curricula. Practicum.

DL 606  Language Development  3 hrs.
Theories and stages of language development. Practicum in developing language skills.

DL 609  Fundamentals of Reading for Middle and Secondary Schools  3 hrs.
Instruction in developing reading skills, methods, and materials in reading. Motivation of children and adolescents, functional reading in content areas, and reading and the atypical learner. Diagnosis and remediation of related deficiencies. Other related topics for regular and special education teacher. Prerequisite of LD students who have not completed a course in developmental reading. Observation (Same as ED 609).

DL 610  Interdisciplinary Aspects of Intervention  3 hrs.
Psychological, sociological, and familial aspects of learning. Multidisciplinary approach to learning and problems that require intervention. Involvement of professionals and parents from the community.

DL 620  Psychoeducational Counseling  3 hrs.
Application of microteaching, microcounseling and psychoeducational concepts for school psychologists and teachers of children with developmental disabilities.

DL 625  Diagnostic Procedures: Advanced Psychometrics  3 hrs.
Psychometric theory and psychological tests. Psychometric issues such as standardization, validity, reliability and theory of testing. Standardized tests in areas of intelligence, psychomotor assessment, and personality. This course, or equivalent, is a prerequisite to the School Psychometry program. Practicum.

DL 626  Diagnostic Procedures: Selected Tests for Preschoolers  3 hrs.
Practicum in administration, interpretation, and use of selected tests for pre-school children. A minimal level of competency will be required before the completion of the course. Prerequisite: DL 601 or DL 603, or DL 605.

DL 627  Diagnostic Procedures: Selected Tests for School-Age Children  3 hrs.
Advanced practicum in administration, interpretation and use of selected tests for school age children. Minimal level of competency will be required for all students before completion of the course. Prerequisite: DL 604.
Theories and approaches to human learning. Emphasis on psychological (motivation, perception, and personality), sociological (cultural and familial), and neurophysiological factors as they impinge upon the learning environment. Concrete application of learning principles to solving learning problems in children and adults.

DL 629 Behavior modification 3 hrs.
Psychological principles concerning control of human behavior and current theoretical experimental research in behavior modification.

DL 630 Research: methodology and Statistics 3 hrs.
Research methodology emphasizing design and inferential statistics. Includes writing research proposals and critically reading research articles. Prerequisite: AHS 300 or an elementary undergraduate statistics course approved by the instructor.

Practicum in administration, interpretation, and use of intelligence tests. Minimal level of competency will be required of all students before completion of course. Prerequisite: AHS 300 or DL 625, DL 626 or DL 627, and permission of instructor.

DL 640 The Family in an Changing Society 3 hrs.
The family as the major agent of childhood socialization, growth, and development. Influence of rapid social change on family structure and its function as well as interaction of the family with other societal institutions. Effects of handicapped and chronically ill children on intrafamilial relationships. Intervention programs for families and their handicapped and non-handicapped children.

DL 644 Advanced Studies in Socialization 3 hrs.
Survey and analysis of comparative theories of socialization. Ways in which theoretical constructs may be transformed into effective child training practices.

DL 649 Individual Readings 3 hrs.
Supervised readings in depth in an area needed by and/or of particular interest to the student. Prerequisite: approval of instructor prior to registration.

DL 650 Practicum 3 hrs.
Experiences working with children's learning patterns and deviations on an individual and group basis.
650(01) - Early Childhood Education for the Handicapped Practicum (200 clock hours minimum required)
650(02) - Learning Disabilities Practicum (200 clock hours minimum required)
650(03) - Psychometric Practicum (300 clock hours minimum required)
650(04) - Developmental Processes Practicum (200 clock hours minimum required)
650(05) - Early Childhood Learning Practicum (200 clock hours minimum required)

DL 699 Master's Thesis 3 hrs.
Required of each student who is working on and receiving direction for a thesis. Graduate School requirements for Plans One or Two, as appropriate, must be otherwise met. Prerequisite: departmental approval.
English and Communication Arts

Degree: Master of Arts

Chairman: Edward F. J. Tucker; Renaissance

Professors:
Francis, H.E.; Creative Writing, The Novel, Modern Literature
Martin, C. W.; American Literature
Wilson, J.L.; Linguistics

Associate Professors:
Goodall, H.L.; Communications
Moore, R.S.; American Literature
Munson, W.F.; Medieval Literature

Assistant Professors:
Davis, P.E.; Romantic Period
Dillard, N.F.; Milton, Seventeenth Century
Mebane, J.S.; Renaissance
Murray, C.D.; Eighteenth Century
Neff, D.S.; Romantic Period, Criticism
Richardson, M.; Medieval Literature
Schenker, D.; Modern British Literature

The Master of Arts with a major in English meets the needs of a variety of professional options. The M.A. sharpens the student's scholarship to the level of professional competence and leads to new levels of appreciation and pleasure in English studies. It qualifies secondary school teachers to earn Class A certification. It also enables graduates to become faculty members in private schools, junior colleges, community colleges, and certain four-year institutions. Additionally, it prepares students to move into programs leading to the Ph.D.

Graduate courses are offered both as seminars and as lecture courses. They are focused both on specific topics (individual authors or genres) and broader subjects, such as the historical periods of literature. Classes are usually small, so that all students are given the benefit of personal counseling.

Degree Requirements

The English graduate faculty offers courses in English and American literature and language. In addition to the Graduate School requirements, the requirements for the M.A. in English are:

1. Eighteen semester hours of graduate work in English, six hours of which may be transferred credit approved by the department Graduate Committee.
2. Six additional semester hours of elective graduate courses in English or a related subject approved by the Graduate Committee.

3. At least half of the hours offered for the degree (exclusive of thesis credit hours) in courses numbered 600 or above and at least 9 hours in English courses at UAH numbered 600 or above (exclusive of thesis credit hours).

4. Master's thesis with at least two terms (6 hours) of English 699. Upon petition to and approval by the Graduate Committee, a student may substitute 9 hours of graduate English courses for the thesis.

5. A minimum of 24 semester hours and a thesis (Plan I), or 33 semester hours (Plan II).

6. A maximum course load of 9 semester hours per term is permitted.

7. Oral comprehensive examination on courses taken and on the thesis. For students who choose plan II (non-thesis option), both oral and written examinations are required. The written examination must be passed before the oral examination is taken.

8. A reading knowledge of French, German, Spanish, or another language deemed by the department to be academically appropriate. Adequate reading knowledge must be demonstrated by one of the following options:

   a. Four semesters or their equivalent in one language with a minimum average grade of B at an accredited institution, completed not more than five years before the student's first graduate course in the UAH program.

   b. Intermediate-level performance on a UAH examination in the language, given each term at an announced test date.

   c. A score not lower than the 25th percentile on the Graduate School Foreign Language Test (GSFLT). Registration is necessary 21 days before the examination, and fee is required. A student who plans to pursue the doctoral degree is urged to take this test and pass with a score in the 50th percentile.

In lieu of the language requirement, additional coursework of 3 semester hours of English 507 (English Linguistics) or English 508 (History of the English Language) or a designated course of a similar nature. This option makes a total of 33 hours required for an M.A. in English and 36 hours required for an M.A. in English with Class A teacher certification or on the regular Plan II.

In addition to these requirements or in lieu of them (as indicated below), a student seeking Class A teacher certification must meet the following requirements:

1. Hold or earn before receiving the degree a Class B teacher certificate.

2. Take 9 hours of graduate courses in Education. These hours replace the thesis requirement; thus, of the 33 semester hours required, 24 are in English and 9 are in Education. Under provisions for strengthened subject matter programs, English courses may be taken instead of Education courses if certain requirements have been met at the undergraduate level.
**English (EH)**

The following are advanced undergraduate courses (500 level) open to graduate students, who must carry out special assignments over and above those required of undergraduates.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>500</td>
<td>Literary Criticism and Theory</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Major texts and approaches from Plato to the present.</td>
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<tr>
<td>507</td>
<td>English Linguistics</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>An advanced grammar course which includes traditional and contemporary analyses of major English syntactic patterns; dialect studies; analysis of style; selected socio- and psycho-linguistic topics.</td>
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<tr>
<td>508</td>
<td>History of the English Language</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Phonological, morphological, syntactic, and semantic changes in the English language from the pre-Anglo-Saxon period to the modern English period; historical events that have influenced and affected these changes.</td>
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</tr>
<tr>
<td>530</td>
<td>Special Studies in American Literature</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Topics announced in advance.</td>
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</tr>
<tr>
<td>532</td>
<td>Southern Renaissance</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Origin and development of Southern myth with emphasis on major writers of the Southern Renaissance.</td>
<td></td>
</tr>
<tr>
<td>533</td>
<td>William Faulkner</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Biography, background, and critical study of the major novels.</td>
<td></td>
</tr>
<tr>
<td>540</td>
<td>Special Studies in English Literature</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Topics announced in advance.</td>
<td></td>
</tr>
<tr>
<td>551</td>
<td>Middle English Literature</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>The literature of later medieval England, excluding Chaucer, chosen from the Gawain poet, Malory, romance and dream vision, the drama, and the short poem.</td>
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</tr>
<tr>
<td>571</td>
<td>Renaissance Drama</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Major plays of the sixteenth and early seventeenth centuries, including Marlowe, Jonson, and others. Excludes Shakespeare.</td>
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</tr>
<tr>
<td>572</td>
<td>Seventeenth-Century Poetry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>A study of seventeenth-century poetry, excluding Milton.</td>
<td></td>
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<tr>
<td></td>
<td>Major novelists: their depiction of reality in response to the post-Darwinian world.</td>
<td></td>
</tr>
<tr>
<td>601</td>
<td>The Idea of the Tragic</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Study of elements of the tragic in the theater and in the modern novel.</td>
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</tr>
<tr>
<td>630</td>
<td>Studies in American Literature to 1865</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Major movements from Colonial times to 1865; selected major figures or special problems.</td>
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</tr>
<tr>
<td>631</td>
<td>Studies in American Literature since 1865</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Major movements since 1865; selected major figures or special problems.</td>
<td></td>
</tr>
<tr>
<td>649</td>
<td>Special Studies</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Study of one or more writers, genres, groups, or movements; announced in advance.</td>
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</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
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<tr>
<td>650</td>
<td>Chaucer</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td><em>The Canterbury Tales, Troilus and Criseide</em>, and other works studied in relation to relevant literary and religious traditions.</td>
<td></td>
</tr>
<tr>
<td>660</td>
<td>Shakespeare</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Emphasis on the &quot;problem&quot; plays and less celebrated tragedies and histories, with special attention to the major criticism, problems of interpretation, and the Elizabethan background.</td>
<td></td>
</tr>
<tr>
<td>665</td>
<td>Renaissance Poetry and Prose</td>
<td>3 hrs.</td>
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<td></td>
<td>The period defined in terms of its principal movements, with attention to the major English authors, such as More, Wyatt, Sidney, Spenser, Marlowe, and Shakespeare, and selected continental predecessors.</td>
<td></td>
</tr>
<tr>
<td>670</td>
<td>Milton</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>A study of Milton's canon: the development of his thought and art through the early work and the prose culminating in a study of the three major works, especially <em>Paradise Lost</em>.</td>
<td></td>
</tr>
<tr>
<td>680</td>
<td>Eighteenth-Century Studies</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Extensive and intensive study of important themes in the poetry, drama, fiction, and non-fictional prose of major eighteenth-century writers.</td>
<td></td>
</tr>
<tr>
<td>690</td>
<td>Studies in English Romanticism</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Selected poetry and critical prose with attention to aesthetic theory and philosophical and psychological backgrounds.</td>
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</tr>
<tr>
<td>691</td>
<td>Studies in the Victorian Period</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Representative writing, both poetry and prose with emphasis on social and cultural changes that inform the literature.</td>
<td></td>
</tr>
<tr>
<td>699</td>
<td>Master's Thesis</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Required each term during which a student is working and receiving direction on his master's thesis. No more than 6 hours' credit may be applied toward the degree.</td>
<td></td>
</tr>
<tr>
<td>CM 636</td>
<td>Effective Communication for Managers</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Examination of techniques for effective interpersonal, group, and presentational communication applied to everyday situations faced by managers.</td>
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</tr>
</tbody>
</table>
History

Degree: Master of Arts

Chairman: J.C. White, Professor; France, Age of Reason, administrative history.

Professor:
Roberts, F.C. (Emerita); U.S. constitutional, U.S. South, Alabama.

Associate Professors:
Boucher, P.P.; early modern Europe, European expansion.
Hull, H.L.; Russia, modern Europe, Renaissance, Reformation, Church history.
Shields, J.N.; U.S. South, nineteenth-century U.S.
White, C.W.; Britain, modern Europe, historiography, U.S. constitutional.
Williams, L.E., II; twentieth-century U.S. Black, U.S. South, Mississippi West.

Assistant Professors:
Gerberding, R.A.; ancient, early middle ages, high middle ages.

The M. A. program in History, like the department’s undergraduate program, rests solidly upon the American and European fields of study, with more intensive focus in graduate studies upon historiography, research methods, and the writing of history. Course offerings are balanced between European and American history. Most thesis subjects are selected from topics in United States history or regional history, reflecting the strength of library holdings. The program serves teachers in the area’s secondary schools, adults seeking personal enrichment or career advancement, and students who will pursue doctoral-level studies elsewhere.

Admission Requirements

Applicants for graduate study in history must present a satisfactory undergraduate scholastic record and satisfactory GRE scores in both the aptitude and advanced portions of the examination. Reading ability in French, German, Russian, or Spanish is required. Admission may be granted without this requirement, but students must demonstrate reading proficiency in one of the above languages before a degree will be granted. Proficiency will be determined by the Department of History and Philosophy in cooperation with the Department of Foreign Languages and Literatures.

Each applicant must: (a) have a minimum overall undergraduate GPA of at least 3.0 (A = 4.0) or at least a 3.0 for the last 60 hours of work, (b) score at least 1000 on the aptitude portion of the GRE, and (c) have an undergraduate major in History or its equivalent as determined by the departmental Graduate Committee.
Degree Requirements

The history graduate faculty offers courses in European and American history. In addition to the Graduate School requirements, the departmental requirements for the Master of Arts in History are:

1. Eighteen semester hours of graduate work in history, 6 of which may be transfer credit approved by the Graduate Committee. Equal course distribution of U.S. and European history is expected. 5 is required.
2. Six additional hours of elective graduate courses in history or a related subject approved by the Graduate Committee.
3. At least 50 percent of the hours for a graduate degree (exclusive of thesis credit hours) in courses numbered 600 or above. At least 9 hours must be in history courses numbered 600 or above (exclusive of thesis credit hours at UAH).
4. Master’s thesis carrying a minimum of 6 hours. Upon petition to and approval by the department Graduate Committee, a student may substitute 9 hours of graduate history courses for the thesis.
5. Oral comprehensive examination on courses and thesis. Students must demonstrate competency in at least two fields of history. A student who does not write a thesis must take both oral and written examinations.

The requirements for the Master of Arts degree for those students seeking Class A certification are the same as above with the following exceptions:
1. Nine hours of graduate courses in education may be substituted for the elective graduate courses in history or a related subject.
2. Additional graduate hours in a related subject other than education may be allowed in lieu of thesis.
3. The student must hold Class B certification.
4. A student who does not write a thesis must take both oral and written comprehensive examinations.
5. The Department of Education will coordinate and direct any supplementary requirements.

Upper Level Undergraduate Courses In History (HY)

If an applicant has insufficient undergraduate hours in history for even probational admission to the graduate program, but demonstrates to the departmental graduate committee sufficient potential and determination to merit further consideration, 6 to 12 course hours at the 400 level (senior undergraduate) may be required. Courses listed below carry 3 hours semester credit, and are taught in alternate years. Senior undergraduate course credit can not be transferred or used for credit toward the Master of Arts in history.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>413</td>
<td>The Old South</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>414</td>
<td>The New South</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>424</td>
<td>The Atlantic World</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>426</td>
<td>Colonial America</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>427</td>
<td>The Age of the American Revolution</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>428</td>
<td>The Early American Republic</td>
<td>3 hrs.</td>
</tr>
</tbody>
</table>
437 The Transformation of the American Republic 3 hrs.
438 Modern America 3 hrs.
439 Recent American History 3 hrs.
473 The High Middle Ages 3 hrs.
474 The Renaissance and Reformation 3 hrs.
475 The Age of Absolutism 3 hrs.
476 The Ancient Régime and the Enlightenment 3 hrs.
477 The French Revolution and Napoleon 3 hrs.
478 Europe in the Nineteenth Century 3 hrs.
479 Europe in the Twentieth Century 3 hrs.

Graduate Courses In History (HY)

The courses listed below are offered at the senior/graduate level. Undergraduate students registering for 500 level courses must be history majors who have completed 24 hours in history and have senior standing.

513 The Old South 3 hrs.
A study of southern society, economics, politics and culture concentrating on the nineteenth-century South through Reconstruction.

514 The New South 3 hrs.
A study of the post-Reconstruction South emphasizing the economic, social, and political readjustments made during the twentieth century.

524 The Atlantic World 3 hrs.
A study of the Western European colonial empires in a comparative perspective from the 1450s to 1763.

526 Colonial America 3 hrs.
A study of the development of political, religious, and economic institutions in the United States, 1607-1763.

527 The Age of the American Revolution 3 hrs.
A study of political, economic, military, social, and cultural developments in the revolutionary period of American history, 1763-1789.

528 The Early American Republic 3 hrs.
A study of political, social, and economic changes in the United States and its sections from the adoption of the Constitution to the Compromise of 1850.

537 The Transformation of the American Republic 3 hrs.
A study of the nationalization and modernization of the United States from the period of the Civil War through the Populist movement.

538 Modern America 3 hrs.
A study of American society focusing on social and cultural change, reform, imperialism, and economic trends from the depression of the 1890s to the outbreak of World War II.

539 Recent American History 3 hrs.
A study of contemporary America from World War II to the present analyzing both domestic and foreign affairs.
573 The High Middle Ages 3 hrs.
A study of the political, economic, and cultural features of Europe when medieval civilization was at its height.

574 The Renaissance and Reformation 3 hrs.
A study of Europe during the Renaissance and Reformation with emphasis upon political, social, economic, and cultural developments.

575 The Age of Absolutism 3 hrs.
A study of Europe from the Edict of Nantes to the Peace of Utrecht with emphasis on political, cultural, and scientific change.

576 The Ancient Regime and the Enlightenment 3 hrs.
A study of European intellectual and social movements from the Peace of Utrecht to the outbreak of the French Revolution.

577 The French Revolution and Napoleon 3 hrs.
A study of European ideas, institutions, and events from the beginning of the French Revolution to the demise of the Napoleonic Empire.

578 Europe in the Nineteenth Century 3 hrs.
A study of major political, social, economic, and intellectual developments in Europe from the Congress of Vienna to World War I.

579 Europe in the Twentieth Century 3 hrs.
A study of major developments in Europe from 1914 to the present, including the two world wars and post-war reconstruction.

590 Research Seminar in History 3 hrs.
Historiography, research and writing, and recent interpretations in the field of history. Open only to seniors who are majoring or minoring in history or to graduate students.

Courses at the 600 level are open to graduate students or to senior history majors in accordance with specific Graduate School requirements.

605 Recent Interpretations of Modern History 3 hrs.
Development of the ability to appraise critical historical issues through study and discussion of recent interpretations of key historical problems in modern Western history. Prerequisite: Graduate standing or permission of instructor.

614 Studies in Southern History 3 hrs.
Research, writing, and critical examination of selected topics in nineteenth- and twentieth-century southern history.

618 Studies in Early American History 3 hrs.
Research, writing, and critical examination of selected topics in early American history from 1607 to 1800.

Research, writing, and critical examination of selected topics in nineteenth-century American history.

Research, writing, and critical examination of selected topics in twentieth-century American history.

650 Research Methods in History 3 hrs.
An exploration of contemporary research methods such as archival research, prosopography, paleography, quantitative methods, and state/local research techniques.

655 Studies in British History 3 hrs.
Research, writing, and critical examination of selected topics in British history.
656 Studies in French History 3 hrs.
Research, writing, and critical examination of selected topics in French history.

657 Studies in Russian and Soviet History 3 hrs.
Research, writing, and critical examination of selected topics on Imperial Russia and the Soviet Union.

670 Studies in Medieval History 3 hrs.
Research, writing, and critical examination of selected topics in medieval history.

680 Studies in Early Modern Europe 3 hrs.
Research, writing, and critical examination of selected topics in the field of early modern European history.

690 Studies in Modern Europe 3 hrs.
Research, writing, and critical examination of selected topics in the field of modern European history.

699 Master’s Thesis 1-3 hrs.
A course required each term 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.
Political Science and Criminal Justice

Chairman: T.J. Williams, Associate Professor
Assistant Professors: J.C. Brown, II, J.W. Randall

The Department of Political Science and Criminal Justice primarily offers graduate political science courses as part of the public administration option in the Master of Administrative Science Program: MAS students in the Public Administration Option are required to take fifteen hours of 600 level courses including PSC 650 and PSC 655.

- **598** Studies in Public Administration 1-3 hrs.
  - Special studies and projects in Public Administration.

- **620** Intergovernmental Relations 3 hrs.
  - Intergovernmental relations in the U.S. Specific government programs are discussed in terms of funding arrangements, policy decisions, and program administration.

- **650** Public Management Profession: Theory and Practice 3 hrs.
  - Introduction to public management as a field of study and practice. Review of basic literature. Emphasis on ethics in public service.

- **652** Public Personnel Administration 3 hrs.
  - Purposes, functions, and processes of personnel management at the national, state, and local levels.

- **655** Budgetary Process 3 hrs.
  - Governmental revenue and expenditure policies. Budget as a method of administrative and fiscal control.

- **660** Public Policy Determination 3 hrs.
  - Study of economic, political, social, and institutional factors which influence the policy making process and the impact of policy decisions made by the national, state, and local levels of government. Examination of the steps in policy-program analysis and evaluation.

- **678** Administrative Law and Regulations 3 hrs.
  - Judicial influences and controls on exercise of administrative authority with analysis of governmental regulatory policies.

- **680** Special Topics in Public Administration 1-3 hrs.
  - Study of selected current issues in Public Administration.

- **695** Internship in Government 1-6 hrs.
  - Graduate students may receive from one to 6 hours of academic credit for an internship with local, state, or federal governmental agencies. Students must attend internship seminars, keep a log of activities, and submit a report on their internship.
Psychology

Degree: Master of Arts (Developmental Psychology)

Chairman: W. R. Sullins, Associate Professor; behavioral analysis, experimen-
tal, motivation, emotion.

Professor:
Rogers, J.G.; theory of abnormal, human factors, counseling.

Associate Professors:
Coffield, K. E.; personality theory and research.
Hays, D. G.; social psychology, symbol processing.
James, R. E.; learning theory, nonverbal communication, experimental aesthetics.
Kirkpatrick, S W.; developmental theory and research, research methodology.

The Psychology faculty offers courses leading to the Master of Arts degree as
specified in Plan I of the School of Graduate Studies. This program is primarily
directed toward the student whose goal is the continuation of scholarly study,
research, and writing in developmental psychology. Courses offered in the program
are focussed on developmental theory and its empirical investigation, on relevant
experimental and statistical methods, and on related subjects such as human
learning and theory of abnormal psychology.

Admission Requirements

In addition to the general requirements for admission to the School of Graduate
Studies, this program requires a minimum combined score of 1100 on the verbal
and quantitative portions of the Graduate Record Examination, and an overall
gradepoint average of 3.25 or a minimum of 3.25 for the last 60 hours of work.
Fifteen hours of psychology, approved by the graduate committee of the depart-
ment, are required for admission. Applications for admission must include three
letters of recommendation from former professors, including at least one from a
psychology professor.

Degree Requirements

In addition to the Graduate School requirements, the requirements for the
Master of Arts in Developmental Psychology are:
1. At least 30 hours of graduate work, including 6 hours of thesis. A maximum
of 6 hours may be transfer courses approved by the graduate committee of the
department.
2. The following 4 courses are required of all students; Py 601, Py 603, Py 611
and Py 613. Three of these four must be completed before taking Py 641 or Py
643.
3. Each student must complete at least 6 hours of Directed Individual Study, Py
641 and Py 643, prior to beginning work on his/her required thesis.
4. The remaining courses will be selected, with faculty advice, from graduate level courses in Psychology, and may include up to 6 hours of graduate courses from related departments such as Biology, Developmental Learning or Administrative Science.

5. An oral comprehensive examination is required of all students. This examination covers both course work and the thesis.

Upper Level Undergraduate Courses in Psychology (PY)

Courses listed below are senior level undergraduate courses. Senior undergraduate course credit can not be transferred or used for credit toward a Master of Arts degree.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>401</td>
<td>Personality</td>
<td>3 hrs</td>
</tr>
<tr>
<td>410</td>
<td>Human Research: Developmental</td>
<td>4 hrs</td>
</tr>
<tr>
<td>411</td>
<td>Human Research: Motivation and Emotion</td>
<td>4 hrs</td>
</tr>
<tr>
<td>412</td>
<td>Human Research: Personality</td>
<td>4 hrs</td>
</tr>
<tr>
<td>413</td>
<td>Human Research: Applied Social Psychology</td>
<td>4 hrs</td>
</tr>
<tr>
<td>414</td>
<td>Human Research: Learning</td>
<td>4 hrs</td>
</tr>
<tr>
<td>420</td>
<td>Seminar in Psychology</td>
<td>3 hrs</td>
</tr>
<tr>
<td>422</td>
<td>Individual Research</td>
<td>3 hrs</td>
</tr>
<tr>
<td>426</td>
<td>History and Systems in Psychology</td>
<td>3 hrs</td>
</tr>
<tr>
<td>433</td>
<td>Abnormal and Health Psychology for the Human</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>Service Professions</td>
<td></td>
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<tr>
<td>436</td>
<td>Physiological Psychology</td>
<td>3 hrs</td>
</tr>
</tbody>
</table>

Graduate Courses in Psychology (PY)

The courses listed below are offered at the senior/graduate level. Undergraduate students registering for 500 level courses must be psychology majors who have completed 24 hours in Psychology and have senior standing.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>502</td>
<td>Industrial and Organizational Psychology</td>
<td>3 hrs</td>
</tr>
<tr>
<td></td>
<td>Application of basic principles of learning, motivation, and perception to typical industrial and organizational problems.</td>
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</tr>
<tr>
<td>503</td>
<td>Advanced General Psychology</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>Survey. Various major areas of psychology. Open only to senior psychology majors and graduate students. Prerequisite: 24 hours PY and senior standing.</td>
<td></td>
</tr>
<tr>
<td>513</td>
<td>Psychometrics</td>
<td>3 hrs</td>
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<td></td>
<td>History and development of psychological testing with special emphasis given to both theory and process of effective evaluation. Prerequisites: AHSS 300.</td>
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<tr>
<td>531</td>
<td>Individual Mental Testing: Stanford-Binet</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>Various assessment techniques; particular emphasis on Stanford-Binet. Use of theory and practice. Includes laboratory. Fee: Level 3. Prerequisite: approval of instructor.</td>
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<tr>
<td>532</td>
<td>Individual Mental Testing: Wechsler</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>Individual testing with Wechsler tests, along with practical experience. Includes laboratory. Fee: Level 3. Prerequisite: PY 531.</td>
<td></td>
</tr>
<tr>
<td>535</td>
<td>Theory of Abnormal Psychology</td>
<td>3 hrs</td>
</tr>
<tr>
<td></td>
<td>Major behavior exceptionalities of childhood and adulthood with emphasis on empirical findings. Prerequisite: PY 433 or approval of instructor.</td>
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</tbody>
</table>
Advanced Developmental Psychology: I 3 hrs.
An overview of major models of developmental theory and of theorists representing these models. Examination of issues, problems and research relevant to these theories. Prerequisites: PY 315 or equivalent as approved by instructor.

Advanced Developmental Psychology: II 3 hrs.
Continuation of PY 601. Prerequisite: PY 601.

Language Development 3 hrs.
Stages of language development and techniques for stimulating language development and communication skills in the young child. Includes practicum.

Experimental design and appropriate statistical techniques for psychological research. Includes laboratory for statistical applications. Fee: Level 6. Prerequisites: AHSS 300 and PY 302 or equivalents as approved by instructor.

Research Methods and Statistics II: Nonexperimental Designs 4 hrs.
Methods of psychological research in areas where direct manipulation of independent variables is infeasible. Observation, questionnaires, modeling, regression analysis, cluster and factor analysis and scaling processes. Laboratory included. Fee: Level 6. Prerequisites: AHSS 300 and PY 302 or equivalents approved by instructor.

Graduate Seminar 3 hrs.
Intensive analysis of selected theoretical or applied topics relating to psychological development. Prerequisite: graduate standing.

Human Learning Theory 3 hrs.
Critical examination of behavior changes commonly called "learning," as well as closely related behavioral phenomena such as transfer, retention, and stimulus generalization.

Behavior Modification 3 hrs.
Psychological principles concerning control of human behavior and current theoretical and experimental research in behavior modification.

Directed Individual Study and Research I 3 hrs.
Independent readings and/or experiments in an area within the student's field of specialization. Prerequisites: Completion of any 3 of the following: PY 601, 603, 611, 613; and permission of instructor.

Directed Individual Study and Research II 3 hrs.
Independent readings and/or experiments in the student's area of specialization. One of the requirements of this course is a major research paper, of publishable quality, which will be reviewed by the faculty of the department. Prerequisites: PY 341 and permission of advisor.

Symbolic Processes 3 hrs.
Psychology of processing symbolic material.

Master's Thesis 3 hrs.
A course required each term a student is working on, and receiving faculty direction on, the master's thesis. A minimum of two terms is expected, but no more than 6 hours is allowed, for the thesis. Credit awarded upon successful completion of the thesis. Prerequisites: PY 643.

Industrial Sociology 3 hrs.
Development of modern work relations in an historical and dialectical framework. Consequences of modern work relations on cultural values such as democracy and individuality. Alternative work relations with attention to industrial sociology.
School of Engineering

Dean: R. G. Griskey, Professor of Chemical Engineering

Engineering is the profession which translates scientific thought into reality. Through creative synthesis, analysis and design, the engineer produces systems, processes, and products for society’s benefit.

The School of Engineering is based in an established urban area, and also in the state’s high technology center. Close proximity to NASA’s Marshall Space Flight Center, Redstone Arsenal, and much of Alabama’s fastest-growing technological industry gives the School of Engineering a special character that leads to uncommon educational opportunities. This special setting, combined with high-quality faculty, affords maximum growth potential for those desiring an advanced engineering education.

Graduate Degrees and Programs

The School of Engineering offers programs leading to the degrees of Master of Science in Engineering, Master of Science in Operations Research, and Doctor of Philosophy. Specializations for the M.S.E. and Ph.D. are in the following areas:

- Communications and Information Theory
- Control Sciences
- Digital and Analog Computer Engineering
- Electromagnetic Fields
- Network Theory
- Optical Engineering
- Solid State Electronics
- Engineering Management
- Human Engineering
- Manufacturing Systems Engineering
- Materials Engineering
- Operations Research
- System Engineering
- Applied Mechanics
- Energy/Power
- Environmental Engineering
- Solar Terrestrial Environment System
- Thermodynamics, Heat & Mass Transfer

Admission Requirements

In addition to the admission requirements specified by the School of Graduate Studies, the following are further requirements for admission to graduate study in engineering.

1. For unconditional admission, a student is required (1) to have earned a minimum of a B average in all undergraduate work attempted and in all engineering courses, (2) to have scored at least 1000 on the aptitude (verbal and quantitative) portion of the GRE, and (3) to have received a Bachelor’s degree in an engineering curriculum accredited by the Accreditation Board for Engineering and Technology at the time the degree was conferred. Exceptions to (3) are permissible for students in the Master of Science in Operations Research degree program.
2. Conditional admission may be granted to other students who have baccalaureate degrees and, after evaluation of the quantity and quality of their work by the major department, are considered to be prepared and capable of successfully pursuing graduate work. To continue graduate study, students admitted conditionally are required to maintain at least a B average in their first 12 semester hours of graduate coursework and to remove any other conditions imposed at the time of initial enrollment.

3. Students admitted to the university as irregular post graduates but denied admission to Graduate School because of a deficiency in quality point average or GRE score may be reconsidered for graduate admission if they are otherwise eligible to pursue a particular engineering discipline. To be reconsidered, they must successfully complete 12 hours of courses numbered 500 or above (as recommended by the department into which admission is sought) in engineering, mathematics, or sciences with an average of B or better.

**Master of Science in Engineering**  
**Master of Science in Operations Research**

The following general requirements for the Master's degree are specified by the School of Engineering beyond those required by the School of Graduate Studies:

1. Average grade on the courses numbered 600 and above cannot be less than B.

2. Engineering courses numbered between 500 and 599 may be taken for graduate credit with prior approval of such courses on the student's plan of study. Graduate students will be required to do extra work of appropriate nature in 500-level courses. A minimum grade of B must be attained in each engineering course designated by a number less than 600 in the plan of study; otherwise a substitution of another approved course is necessary.

3. All courses are selected by students with the counsel of advisors and are subject to approval by the appropriate department chairman and the Dean of the School of Graduate Studies. Additional coursework may be required to correct deficiencies in undergraduate subjects.

4. Each department may require one or more seminar courses in addition to other requirements.

Upon admission to graduate study by the Dean of the Graduate Studies, students will be referred to the appropriate department chairman. A supervisory committee, which usually is but does not have to be the same as the final examining committee, should be appointed after students have completed 12 semester hours.
Special Requirements For The M.S.E. Degree: Basic Program Of Study

The basic program of study, common to both Plan I and Plan II, contains a minimum of 24 semester hours of graduate-level coursework that must include (a) 12 hours of graduate courses in an engineering major, including supporting engineering courses; (b) first minor of 6 hours in an approved engineering area of specialization, (c) second minor of 6 hours in an engineering area other than those in (a) and (b) above or in any approved graduate area from the School of Science.

With prior approval, up to 12 hours of courses numbered 500–599 may be taken in fulfillment of these requirements.

Plan I (Thesis). Students selecting this plan must (a) successfully complete an approved basic program of study, (b) complete an acceptable thesis, (see statement with each 699 course), and (c) pass a comprehensive final examination.

Plan II (No Thesis). Students planning to complete degree requirements under Plan II must (a) be admitted to the Plan II program, (b) successfully complete an approved basic program of study, (c) successfully complete an approved extended program of study consisting of a minimum of 9 semester hours of courses numbered 500 or above, and submit an acceptable paper on independent work, and (d) pass a comprehensive final examination.

Doctor of Philosophy

Programs leading to the degree of Doctor of Philosophy are offered in the School of Engineering and are granted on the basis of general scholarly proficiency, distinctive achievement in a special field, and demonstrated ability to do independent, original investigation. These attributes are tested in 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.

Admission

Ph.D. candidates must be admitted to the School of Graduate Studies before being admitted to the Ph.D. program. Admission is limited to those whose backgrounds show distinct promise of success in the program.

Examinations

Students must pass three examinations before being awarded the degree. They are:

1. The preliminary examination (or entrance examination) is a written test of the student's capability to pursue success fully the Ph.D. and aids in developing a program of study appropriate for the student. The examination may be taken at any time after the accumulation of at least 24 semester hours of graduate work beyond the baccalaureate degree and is administered by the student's department. Upon the recommendation of the department, a student who fails this examination
may repeat it after a lapse of three months. The examination may not be taken more than twice.

2. The qualifying examination (or comprehensive examination) is a written or oral test of the student’s knowledge in the major and minor fields of study and is administered by the applying student’s advisory committee. An applicant must pass this examination to be admitted to candidacy for the Ph.D. degree. The following must be completed before taking the examination: (1) foreign language requirement, (2) basic program of study, (3) at least 18 hours of coursework in residence at UAH subsequent to passing the preliminary examination, and (4) advisory committee’s assurance of adequate preparation in the major and minor fields.

3. The final examination (or dissertation examination) primarily concerns research work in the candidate’s dissertation and will be taken after the dissertation has been approved by the advisory committee.

Advisory Committees

A faculty advisor appointed by the chairman of the department directs a student’s work until the preliminary examination is successfully completed. Thereafter the student immediately chooses an advisory committee, subject to acceptance by the faculty members chosen and approval by the Dean of Graduate Studies. This committee consists of at least five members of the graduate faculty—three representing the major field of study and one from each of the minor fields. The committee chairman must be a permanent faculty member.

Program of Study

Students should prepare an outline of the program of study as early as possible after the successful completion of the preliminary examination.

Major and Minor Subjects

A defined major subject or field of specialization is required of all candidates for the Ph.D. degree. The candidate must also have at least two minor subjects chosen with approval of the candidate’s advisory committee.

All students must complete at least 60 semester hours of graduate coursework. At least 33 semester hours must be in work within related departments, including credits for the major. Of these 33 semester hours, at least 18 must be within a defined major. Of the remaining 27 semester hours, a minimum of 15 semester hours of work is required for the first minor and a minimum of 12 semester hours for the second.
Transfer of Credits

Credits from other recognized institutions may be applied to the student’s program of study if so approved by the student’s advisory committee and by the Dean of Graduate Studies. These credits will generally not be evaluated until the student has been in residence study at UAH for at least one term and has passed the preliminary examination.

Admission to Candidacy for the Degree

A student should apply for admission to candidacy for the Ph.D. degree after passing the qualifying examination and obtaining approval of the dissertation subject from his advisory committee. The student must be admitted to candidacy at least six months before the degree is awarded.

Residence Requirements

The minimum period in which the doctoral degree can be earned is three full academic years in graduate study or their equivalent. The student must complete a minimum of 24 semester hours of graduate work in three consecutive terms during the second or third year, or both, of graduate study in the School of Graduate Studies at UAH. Half-time graduate assistants are required to complete a minimum of 18 hours of graduate work in three consecutive terms.

Language Requirements

The student must satisfy the language requirement before applying for permission to take the qualifying examination in one of the ways specified by the School of Graduate Studies.

Dissertation Registration

Students must register for a minimum of 18 semester hours of dissertation supervision during the time they are actively conducting research and consulting their dissertation advisor.
Electrical and Computer Engineering

Degrees: Master of Science in Engineering
Doctor of Philosophy

Chairman: R.J. Polge, Professor; communications, radar, computer engineering, digital and optical systems.

Professors:
Audeh, N.F.; microwaves, antennas and optics.
Halijak, C.A.; analog and digital computers, network synthesis and controls.
Kheir, N.A.; controls and networks; modeling, credibility of models.

Associate Professors:
Bugnolo, D.S.; electromagnetics, optics, wave propagation, numerical methods.
Ho, F.D.; solid state and electronics, VLSI design and modeling, digital hardware.
Thurstone, R.L.; networks.
Stern, H., (Adjunct); communications and controls.

Assistant Professors:
Greene, M.E.; medical instrumentation and controls.
Gupta, A. (Visiting); communications and signal processing.
Marr, J.; digital hardware, computer applications, radar and speech processing.

Electrical engineering today is concerned with the broad problem of generating, transmitting, receiving, and processing information and energy. Emphasis in the department is on "information" related areas: Antennas and Microwaves, Communications and Signal Processing, Computer Engineering, Control and System Theory, Electronics, Network Theory, and Solid State Devices. New thrust areas under development include optical engineering and robotics.

The faculty is active in publications and funded research (about one-half million dollars annually). Support is available at attractive levels in the form of graduate teaching or research assistantships, and graduate Co-op’s with local industrial firms or government agencies.

Admission Requirements

For unconditional admission to the ECE graduate programs, an Electrical Engineering Bachelor’s degree from an ABET accredited program is required, with a grade point average of at least 3.00 and a GRE score of 1000 (verbal plus quantitative). Outstanding non-EE graduates with Bachelor’s degrees in another
engineering field, mathematics, computer or natural sciences may be admitted to the ECE graduate programs if they take additional courses to satisfy certain minimal proficiency requirements in basic electrical engineering subject matter.

**Degree Requirements**

Like the general graduate school requirements, the MSE has two options: plan I which requires twenty-four of coursework hours plus thesis, or plan II of thirty-three hours plus a technical paper. Under certain conditions students may satisfy the degree requirements by satisfactorily completing thirty-six hours. A comprehensive oral exam required for all options.

To be admitted to the Ph.D. program, students must pass a written preliminary examination. At the end of the coursework, Ph.D. students must pass a qualifying examination, which includes a written examination of the major and two minors, and a comprehensive oral. Finally, a student must write an acceptable dissertation which must be defended in front of the supervisory committees.

**Undergraduate ECE Courses (ECE)**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>Electrical Circuits I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>307</td>
<td>Electricity and Magnetism</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>311</td>
<td>Electronic Instrumentation</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>313</td>
<td>Electrical Circuits II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>315</td>
<td>Electronics I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>381</td>
<td>Operational Methods in Engineering</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>402</td>
<td>Design of Digital Computer</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>407</td>
<td>Electromagnetic Waves</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>411</td>
<td>Electric Power Systems</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>414</td>
<td>Passive Electrical Networks</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>416</td>
<td>Electronics II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>487</td>
<td>Analysis and Control of Dynamical Processes</td>
<td>2 hrs.</td>
</tr>
</tbody>
</table>

**Graduate ECE Courses (ECE)**

Courses at the 500 level are taken by seniors and first year graduate students. Up to 12 hours of 500 level courses may count towards a graduate degree with prior approval by the program committee. Courses at the 600 and 700 level are open only to graduate students.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>Electric Machines</td>
<td>3 hrs.</td>
</tr>
</tbody>
</table>

Direct and alternating current machines equivalent circuits and models, efficiency, input requirements and output characteristics, applications; graphical and mathematical aspects of electrical machines. Prerequisite: ECE 313.
502 Advanced Logic Circuits
3 hrs.
Boolean algebra; the n-cube, star array, Karnaugh arrays; one-to-one transformations, partial transformations, DON'T-CARES: symmetric switching function synthesis and reduction with applications to multiple input adders; generator theory of flip-flops and stability condition; serial arithmetic and the binary comparator. Prerequisite: ECE 202.

503 Analog and Hybrid Simulation
3 hrs.
Principles of analog, digital, and hybrid computation. Analog components for addition, multiplication, integration, and function generation. Analog computer simulation of systems represented by linear and nonlinear differential equation. Analog-digital (Hybrid) simulation techniques. Laboratory sessions. Lab fee: Level 3. Prerequisites: ECE 311 and 381 or MA 352.

504 Instrumentation
3 hrs.
Measurement techniques and conventional and electronic instruments. Construction, theory of operation, and proper use of bridge circuits, oscilloscopes transducers, and digital instruments. Prerequisite: ECE 315.

505 Automatic Control Theory
3 hrs.
Theory common to all feedback control systems. Transfer functions, stability criteria, and frequency response. Prerequisite: ECE 381.

506 Communication Theory
3 hrs.
Transmission of information including effects of networks, modulation systems, noise, and use of statistics in analysis of information transmission. Prerequisite: ECE 381.

509 Microcomputers
3 hrs.
The microcomputer as a component in digital design. Laboratory experience in interfacing and design projects. Lab fee: Level 3. Prerequisites: ECE 202 and 315; ECE 516 recommended.

510 Selected Topics in Electrical and Computer Engineering
Credit to be arranged

516 Digital Electronics
3 hrs.

519 Digital Electronics Laboratory
1 hr.
Experiments and reports related to logic circuit realization of digital hardware. RTL, DI, TT, ECI families for combinational and sequential switching circuits. Lab fee: Level 4. Must parallel ECE 516.

595 Microcomputer Development Systems
3 hrs.
A course on the development of general purpose stand-alone microprocessor systems using a microprocessor development system. Prerequisites: ECE 509, 402. Lab fee. Level 4.

600 Bit-Slice Design
3 hrs.
Theoretical and practical aspects of computer hardware design using AMD 2900 family bit-slice components. Lab fee: Level 3. Prerequisite: ECE 509.

601 Linear Systems
3 hrs.
Formulation and solution by transform methods of differential equations of linear electrical and electromechanical systems, state equations, signal-flow graphs, and discrete-time systems. Prerequisite: graduate standing.

602 Digital Computer Design
3 hrs.
603 Computer Methods in Power Systems 3 hrs.
System modeling and matrix analysis of three-phase power networks. Application of
numerical methods and computers to solution of problems related to planning, design, and
operation of electric-power systems. Prerequisites: ECE 411 and 501.

604 Digital Image Processing 3 hrs.
Derivative matrices and u-notch, r-notch filters. Periodic images, their transformation and
scanning, their two-dimensional Fourier transforms. Rational vectors and image filtering.
Prerequisite: ECE 506 or 708.

605 Control System Design 3 hrs.
Control system synthesis by means of feedback, feedforward, minor loop, and cascade
techniques. System designs by analog simulation. Laboratory sessions. Lab fee: Level 3.
Prerequisite: ECE 505.

606 Statistical Communications Theory 3 hrs.
Generalized harmonic analysis. Correlation, convolution, power density spectra. Probability
and statistics. Correlation detection. Optimum linear filtering and prediction. Prerequisite:
ECE 506.

608 Electromagnetic Field Theory I 3 hrs.
Mathematical approach to electromagnetic phenomena. Basic field concepts. Radiation and
propagation. Waveguides and simple radiating and scattering systems. Peturbational and
variational techniques. Prerequisite: ECE 407.

609 Electromagnetic Field Theory II 3 hrs.
Continuation of ECE 608. Prerequisite: ECE 608.

610 Selected Topics in Electrical and Computer Engineering Credit to be arranged.

612 Graduate Design Project 3 hrs.
Graduate design project in support of an MSE program. Prerequisite: approval by MSE
committee. Lab fee: Level 3.

613 Laser Electronics 3 hrs.
Resonant optical cavities. Atomic radiation. Laser oscillation and amplification. General

614 Linear Graphs and Electrical Networks 3 hrs.
Linear-graph theory with applications to electrical network theory. Classical network
equilibrium equations, formulation of state equations, topological formulas for network
functions, signal-flow graph method of circuit, and system analysis. Prerequisite: ECE 414.

615 Active Networks Synthesis 3 hrs.
Properties and synthesis of RC and LC networks, active network elements, RC active filter
design, network sensitivity analysis, realization methods, approximation theory, and filter
design. Prerequisite: ECE 414.

616 Microelectronic Devices and Integrated Circuits 3 hrs.
Solid-state theory applied to the analysis and design of devices for integrated circuits.
Properties of semiconductors important to solid-state 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:
ECE 516.
Very Large Scale Integration Devices 3 hrs.
Discussion of MOSFET characteristics. Second-order considerations for a MOSFET. Computer modeling, VLSI device fundamentals, and scaling laws. Micron-length and submicron-length semiconductor devices. Gallium arsenide (GaAs) digital integrated circuits for ultra-high speed VLSI. Basic technology and applications of VLSI. Impact of VLSI on computer architectures. VLSI computer aided design. Prerequisite: ECE 616 or equivalent.

Introduction to Radar Systems 3 hrs.
Topics include radar equation, CW radar, MTI and pulse doppler radar, tracking radar, major systems components, detection in the presence of noise and clutter, ambiguity, and resolution. Prerequisite: ECE 606 or equivalent.

Master's Thesis 3 or 6 hrs.
Required each term student is working and receiving direction on his master's thesis. Minimum of two terms 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.

Sampled Data Control Systems 3 hrs.
Classical and modern methods for analysis and design of sampled data-control systems; Z-transforms, transport lags, z and w plane analysis, state variables, and the transition matrix. Prerequisite: ECE 701.

Advanced Linear Control Theory 3 hrs.
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: ECE 605 or permission of instructor.

Theory of Automata 3 hrs.
Linear automata, efficient and inefficient coders analyzed with Z-transforms and cyclotomic polynomials. State description of autonomous automata. Multilinear automata and various machines. Prerequisite: ECE 602.

Nonlinear Control Systems 3 hrs.
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: ECE 701.

Theory of Optimal Control 3 hrs.
General theory of optimal control of dynamic processes. Calculus of variations. Hamilton-Jacobi theory. Pontryagin's maximum principle, dynamic programming. Prerequisite: ECE 701 or approval of instructor.

Information Theory 3 hrs.
Self-information, entropy, mutual information, and channel capacity, encoding, error detecting and correcting codes. Sampling theorem. Discrete and continuous channels. Prerequisite: ECE 506.

Digital Signal Processing 3 hrs.
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. Prerequisite: ECE 606 or 614 or 605 or 602.

Selected Topics in Electrical and Computer Engineering Credit to be arranged.

Antenna Theory 3 hrs.
Antennas and antenna arrays. Radiation patterns and impedance characteristics. Spheres, cylinders, horns, slots, microwave lenses, traveling-wave, and frequency independent antennas. Prerequisite: ECE 608.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>715</td>
<td>Digital Filters with Switched Capacitors</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Finite Time Laplace Transforms describe the reverse-switched and switched capacitors as current-voltage elements. Discretizations or resistors in RC passive and active networks. Realization of inductors and supercapacitors with operational amplifiers enables discretizations of RLC filters. Prerequisite: ECE 615.</td>
<td></td>
</tr>
<tr>
<td>716</td>
<td>Device Modeling for Integrated Circuit Design</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>718</td>
<td>Microwave Techniques</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>719</td>
<td>Advanced Electromagnetic Field Theory</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Classical theory of electricity and magnetism. Potential theory, time-varying fields, boundary-value problems, stresses, theory of relativity. Prerequisite: ECE 609.</td>
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</tr>
<tr>
<td>726</td>
<td>Decision and Estimation Theory</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>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. Prerequisite; ECE 606 or equivalent.</td>
<td></td>
</tr>
<tr>
<td>799</td>
<td>Doctoral Dissertation</td>
<td>3-6 hrs.</td>
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</tbody>
</table>
Industrial and Systems Engineering

Degrees: Master of Science in Engineering
Master of Science in Operations Research
Doctor of Philosophy

Chairman: R.A. Brown, Professor; systems engineering, microcomputer applications, applied statistics.

Professors:

Wyskida, R.M.; operations research, engineering management, and economy.

Associate Professors:

Lovett, J.N.; operations research, work design, manufacturing processes.
Walker, J.R.; engineering management, engineering economy, applied statistics.

The Department of Industrial and Systems Engineering encourages students to tailor their graduate programs with a blend of theory and applications. Major and minor subject areas within the department are Applied Statistics, Engineering (Technical) Management, Manufacturing Systems, Operations Research, and Systems Engineering. The Master of Science in Operations Research (M.S.O.R.) degree is specifically intended for students with undergraduate degrees in science or mathematics who do not desire to take the additional undergraduate engineering courses needed to qualify for the MSE degree.

The Engineering Management Option meets the needs of practicing engineers who find themselves performing engineering management functions without the benefit of formal management education. The program builds upon the mathematical and analytical expertise gained from both a formal engineering education and professional experience.

The Systems Engineering Option is for persons with a Bachelor’s degree in a traditional engineering area who desire to broaden their background into systems-oriented aspects of engineering. Methods of needs identification, cost-benefit analysis, the system life cycle concept, quality control, logistics planning and control, forecasting, etc., will provide students with the analysis and design tools to supplement those learned in their baccalaureate engineering degree program.

Admission and degree requirements are those outlined by the School of Graduate Studies and the School of Engineering.

The M.S.O.R. Degree

The Master of Science in Operations Research (M.S.O.R.) is primarily for graduate students with an interest in operations research, that is, the solution of real-world problems through diverse methods, techniques, tools, and algorithms. The M.S.O.R. program is concerned with optimization, stochastic systems analysis, and operations research applications. Areas of application include large-scale
systems analysis, analysis of urban and socioeconomic systems, and management sciences. This program is open to students not holding an Engineering undergraduate degree.

**Admission Requirements**

The requirements for admission to the O.R. program conform to policies of the School of Graduate Studies. In addition, the following are required: (1) a minimum score of 500 on the quantitative portion of the GRE, (2) mathematics through calculus (MA 251), and (3) 6 hours of either applied or mathematical statistics.

**Degree Requirements**

The program of study in the O.R. contains a minimum of 24 semester hours of graduate-level coursework that includes: (a) 12 semester hours of graduate-credit courses in operations research, including ISE 626, 636, 629, or 527; (b) 6 hours of courses in approved minor area; (c) 6 hours in another minor, i.e., statistics, mathematics, etc.; and (d) an acceptable thesis. A plan II is also available. Detailed instruction governing the M.S.O.R. program should be obtained from the chairman of the Industrial and Systems Engineering Department.

**Undergraduate ISE Courses (ISE)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISE 321</td>
<td>Engineering Economy</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>ISE 326</td>
<td>Production and Operation Systems I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>ISE 327</td>
<td>Production and Operation Systems II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>ISE 390</td>
<td>Probability and Engineering Statistics I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>ISE 490</td>
<td>Probability and Engineering Statistics II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>ISE 427</td>
<td>Management Systems Analysis</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>ISE 428</td>
<td>Systems Analysis and Design I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>ISE 429</td>
<td>Systems Analysis and Design II</td>
<td>3 hrs.</td>
</tr>
</tbody>
</table>

**Advanced Undergraduate and Graduate Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>522</td>
<td>Logistics Planning and Control</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Basic nature of logistics systems. Quantitative analysis of two networks and their interaction, the logical network for project-planning and control, and the physical distribution network. Charting, milestone method, lines of balance PERT-CPM, resource allocation and leveling, and maximum flow and minimum cost algorithms. Lab fee: Level 2. Prerequisite: ISE 390.</td>
<td></td>
</tr>
<tr>
<td>523</td>
<td>Statistical Quality Control</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>Statistical theory and techniques to control quality of manufactured products. Prerequisite: ISE 390.</td>
<td></td>
</tr>
</tbody>
</table>
524 Introduction to Ergonomics: Work Development 3 hrs.
Philosophy, methodology, and techniques related to providing optimal match between job requirements and worker skills. Intensive use of actual industrial requirements and experience in practical applications. Lab fee: Level 3. Prerequisites: ISE 390; ISE 327 or graduate standing.

526 Design and analysis of Experiments 3 hrs.
Advanced topics in statistical experiments with emphasis on design aspect. Confounding, fractional replication, factorial and nested design. Prerequisite: ISE 490.

530 Modern Manufacturing/Production systems 3 hrs.
Overview of modern manufacturing and production systems, including principles, theory and practical applications of integrated manufacturing systems with and without robotics and automated materials handling. Includes review of classical systems, Japanese production systems, and group technology. Lab fee: Level 2. Prerequisite: Senior standing.

539 Selected Topics in Industrial Engineering Credit to be arranged

547 Introduction to Digital Simulation 3 hrs.
Philosophy and elements of digital simulation. Review of queuing models and stochastic process models. Discrete-event simulation with emphasis on analysis of systems and models. Prerequisite: ECE 197, ISE 390 or equivalent.

571 System Simulation Laboratory I CPSS 2 hrs.
Modeling and Digital Simulation of Systems Using GPSS. Prerequisite: ECE 197.

572 System Simulation Laboratory II - SIMAN 2 hrs.
Modeling and Digital Simulation of Systems Using SIMAN. Prerequisite: ECE 197.

573 Systems Simulation Laboratory III 2 hrs.
Modeling and Simulation of Dynamic Feedback Systems. Prerequisite: ECE 197.

620 Engineering Management I 3 hrs.
Principles of executive process in technical organizations. Basic management functions, scientific management, planning, directing, controlling, and decision making as they relate to management of technical organizations and design and implementation of management systems. Prerequisite: graduate standing.

622 Research unique to the management of organizations engaged in R&D activities. Management control systems for R&D projects, motivation of technical personnel, problems of managing the creative person, means of increasing creativity, and management of change. Prerequisite: ISE 620.

623 Engineering Economic Analysis 3 hrs.
Mathematical models for expenditure analysis under uncertainty. Relationship between investment decision criteria and microeconomic theory. Capital planning and budgeting. Decisions involving expansion, acquisitions, replacement, and disinvestment. Prerequisite: ISE 490 or ISE 690.

624 Advanced Ergonomics: Man-Machine Interfaces 3 hrs.
Psychological, physiological, and anthropometric requirements of human beings and their relationship to design specifications for machine in man-machine interfaces. Lab fee: Level 2. Prerequisite: ISE 524.

626 Introduction to Operations Research 3 hrs.
Philosophy and methodology of operations research. Lab fee: Level 3. Prerequisite: ECE 197 or CS 113, ISE 390 or 690, MA 251.

627 Introduction to Systems Engineering 3 hrs.
Overview of engineering analytic methods applied to design of operational, procedural, and hardware systems. Concepts of the system life cycle, and the cost-benefit and tradeoff analyses. Use of engineering models of components, logic, signals, and organization in systems analysis. Prerequisite: ISE 390 or ECE 505 or ECE 506 or ISE 690.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>628</td>
<td>Engineering Management II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Organization and human relations of technical management. Formal and informal organizations, job satisfaction, motivation of employees, manager-employee relations, social behavior in work situation, and executive management functions as they influence design and implementation of management systems. Prerequisite: ISE 620.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Classical optimization theory with introduction to search techniques. Jacobian and Lagrangian methods. Kuhn-Tucker conditions, quadratic programming, geometric and dynamic programming, and several search procedures. Lab fee: Level 5. Prerequisites: ISE 626, 390 or 690.</td>
<td></td>
</tr>
<tr>
<td>630</td>
<td>Automation: Numeric Control to Computer-Aided Manufacturing</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Numerical Control, CNC, DNC, FMS, unmanned cellular manufacturing systems, robotics, autonomy and other aspects of programmable automation systems found in CAM. Includes introduction to adaptive control, NC and robot programming. Lab fee: Level 5. Prerequisite: ISE 530.</td>
<td></td>
</tr>
<tr>
<td>631</td>
<td>Management Information Systems</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Design of integrated information systems necessary for effective management. Methods of systems design, basic concepts of computer processing systems, design of management information procedures and reports, and their application to mechanized and electronic data-processing equipment. Prerequisite: ECE 197 or CS 113.</td>
<td></td>
</tr>
<tr>
<td>632</td>
<td>Stochastic Systems</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Processes whose outputs are governed by probabilistic laws. Gaussian processes, processes with correlated and uncorrelated variables, and Markov processes. Lab fee: Level 2. Prerequisite: ISE 490 or 690.</td>
<td></td>
</tr>
<tr>
<td>633</td>
<td>Industrial Forecasting and Analysis I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Industrial forecasting methods. Simple forecasting models, multivariate regression, correlation, and spectral analysis, exponential smoothing, and Box-Jenkins forecasting. Lab fee: Level 3. Prerequisite: ISE 490 or ISE 690.</td>
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</tr>
<tr>
<td>634</td>
<td>Value and Decision Theory</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Mathematical development of decision-making process. Statistical decision theory and game theory applied to decision making under risk and uncertainty. Consideration of utility, benefit functions, opportunity loss and value of additional information. Prerequisite: ISE 390 or 690.</td>
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</tr>
<tr>
<td>635</td>
<td>Linear Programming</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Application of linear programming to complex allocation problems. Methods for determining maximum or minimum of objective functions whose variables are subject to constraints. Simplex methods, degeneracy, modified simplex, transportation problems, network flows, goal programming, and sensitivity analysis. Lab fee: Level 4. Prerequisite: ISE 626.</td>
<td></td>
</tr>
<tr>
<td>636</td>
<td>Systems Modeling</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Philosophy and methodology for modeling probabilistic systems. Team project required. Lab fee: Level 4. Prerequisites: ISE 390 or 690, ISE 626 or 627.</td>
<td></td>
</tr>
<tr>
<td>638</td>
<td>Engineering Reliability</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Methodology of reliability prediction including application of discrete and continuous distribution models. Reliability estimation, reliability logic diagrams, life testing, and reliability demonstrations. Prerequisite: ISE 490 or 690.</td>
<td></td>
</tr>
<tr>
<td>639</td>
<td>Selected Topics in Industrial and Systems Engineering</td>
<td>Credit to be arranged</td>
</tr>
<tr>
<td>647</td>
<td>System Simulation</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Methods and procedures for simulation of large and complex systems. Discrete increment, continuous time and combined models. Comparison of discrete-event simulation languages. Model verification and validation. Statistical inference. Input data collection and analysis. Prerequisites: ISE 547.</td>
<td></td>
</tr>
</tbody>
</table>
690 Statistical Methods - Engineers 3 hrs.
Application of probability and statistics useful in research work. Descriptive statistics, theoretical distribution functions, point and interval estimations, test of hypotheses, linear regression, and analysis of variance. Prerequisites: MA 251 and graduate standing.

699 Master’s Thesis 3 or 6 hrs.
Required each term student is working and receiving direction on his master’s thesis. Minimum of two terms 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.

729 Advanced Nonlinear Programming 3 hrs.
Continuation of ISE 629 with emphasis on development and application of nonlinear programming algorithms. SUMI algorithm, Zoutendyk’s method of feasible directions, Rosen’s gradient method, and selected algorithms from current literature. Lab fee: Level 5. Prerequisite: ISE 629.

730 Multi-criteria Decision Analysis 3 hrs.
Methods for analysis of management-decision problems involving multiple goals and constraints. Linear and nonlinear goal programming; risk programming and decision making in fuzzy environments. Prerequisite: ISE 635.

733 Industrial Forecasting and Analysis II 3 hrs.
Industrial forecasting methods. Box-Jenkins model diagnostic checking, seasonal models, and transfer function modeling. Lab fee: Level 3. Prerequisite: ISE 633.

735 Discrete Optimization 3 hrs.
Integer programming and network analysis. Zero-one problem formulation and Balas method, cutting plane techniques, branch and bound, out-of-kilter-algorithm, and special applications of integer programming. Lab fee: Level 4. Prerequisite: ISE 635.

739 Selected Topics in Industrial and Systems Engineering Credit to be arranged

747 Advanced Simulation Design and Analysis 3 hrs.
Advanced aspects of simulation modeling of large scale, real-world, industrial and service systems. Optimal model selection. Specialized problems of dealing with large-scale systems. Survey of state-of-the-art, applications, and research needed. Prerequisites: ISE 647.

790 Advanced Statistical Applications 3 hrs.
Continuation of 621 with extension to nonparametric methods, multivariate analysis and clustering techniques. Lab fee: Level 3. Prerequisite: ISE 690.

799 Doctoral Dissertation 3-6 hrs.
Mechanical Engineering

Degrees: Master of Science in Engineering
Doctor of Philosophy

Chairman: A.C. Cogley, Professor; radiative transfer, fluid mechanics, and heat transfer.

Professors:
Chung, T.J.; finite element applications and combustion instabilities.
Griskey, R.G.; polymer engineering; thermoics.
Hung, R.J.; ionospheric and atmospheric research, remote satellite sensing, and robotics.
Karr, G.R.; fluid mechanics; heat transfer, and cryogenic systems.
Liu, F.C.; missile dynamics and control, orbital mechanics, and vibrations.
Shih, C.C.; high energy lasers and fluid-thermal aspects of chemical lasers.
Wu, S.T.; magnetohydrodynamics, gasdynamics, and solar phenomena.

Associate Professors:
Brainerd, J.J.; computational fluid mechanics and hypersonic aerodynamics.
Curry, J.E.; ceramic and composite materials.
Thompson, K.O.; numerical methods and fluid mechanics.
Wallace, D.B.; solar energy, photovoltaic cells, CAEDM, and robotics.

Assistant Professors:
Bower, M.; nonmetallic materials, fluid mechanics, and CAEDM.
Kane, W.F.; geotech engineering, rock mechanics, and structures.
Lewis, J.G.; materials science, engineering, and corrosion.
Rutzler, W.; chemical processes, process control, and process synthesis.
Smith, J.E., Jr.; catalysis and modeling of chemical reactors.

The range of faculty research interests in the Department of Mechanical Engineering, which includes programs in Civil and Chemical Engineering, is broad. It affords graduate students opportunities for advanced work in fluid and solid mechanics, heat transfer, aerodynamics, thermodynamics, transport phenomena, and chemical processes and systems. The Master and Ph.D. degrees granted by the Department in these areas are equivalent to those available in traditional Mechanical, Chemical, Civil, and Aerospace Engineering programs. Support is available at attractive levels for all qualified students, including assistantships, tuition grants and graduate Co-op's with many local research and industrial organizations. UAH has the intellectual and social environment to provide a well-rounded, technologically-oriented degree.
Admission Requirements

The Department of Mechanical Engineering rarely accepts students who have below a 3.00 GPA (undergraduate) from an ABET accredited school. Outstanding (3.5 GPA) students from other technical fields may gain admittance to M.E. by completing certain undergraduate courses. Please contact the M.E. Department for further details.

M.S.E. In Mechanical Engineering

All M.S.E. students in the Mechanering Department are guided through one of two areas of concentration; each area has a core of three required courses. The mechanical engineering area requires ME 649, 653, and 671 (or 554). The engineering mechanics area requires ME 561, 571, and 671. The remainder of the program and elective courses are chosen with the approval of the student’s advisor. M.S.E. students must enroll in the departmental seminar, ME 683, for one term.

Ph.D. In Mechanical Engineering

The Department of Mechanical Engineering offers a program leading to the degree of Doctor of Philosophy. The program is based on scholarly, independent and original investigation coherently reported as a dissertation. Such work is supervised by an experienced researcher and recognized authority in the field. Coursework, written and oral exams, and the dissertation are all essential components of the Ph.D. Because the Department also offers advanced work in certain areas in civil and chemical engineering, the Ph.D. studies are rather broad and include areas not associated with the traditional mechanical engineering advanced degree.

Ph.D. students in Mechanical Engineering must meet the minimum requirements set by the School of Graduate Studies. ME doctoral students must also meet some additional requirements set by the Department.

Undergraduate Course Listing (Upper Level)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 471</td>
<td>Structural Analysis II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CE 472</td>
<td>Hydraulic Engineering</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CE 473</td>
<td>Transportation Engineering &amp; Design</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CE 475</td>
<td>Hydrology</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CE 476</td>
<td>Sanitary Engineering</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CHE 440</td>
<td>Unit Operations Laboratory</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CHE 441</td>
<td>Chemical Kinetics &amp; Reactor Design</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CHE 443</td>
<td>Mass Transfer Operations</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>ME 442</td>
<td>Intro. to Heat &amp; Mass Transfer</td>
<td>4 hrs.</td>
</tr>
</tbody>
</table>
ME 444 Anal. & Design of HVAC Systems 3 hrs.
ME 446 Design of Thermal Systems 3 hrs.
ME 449 Intro. to Environmental Eng. 3 hrs.
ME 450 Environmental Control 3 hrs.
ME 455 Fluid Mechanics II 3 hrs.
ME 459 Selected Topics in Engineering TBA
ME 461 Vibrations of Elastic Systems 3 hrs.
ME 465 Engineering Design 3 hrs.
ME 474 Applied Mechanics of Solids 3 hrs.
ME 478 Matrix Methods in Structural Mech. 3 hrs.
ME 486 Numerical Engineering Analysis 3 hrs.
ME 488 Analysis of Engineering Systems 3 hrs.

Graduate Mechanical Engineering Courses (ME)

540 Physical Properties of Fluids 3 hrs.
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. Prerequisite: ME 342. Offered upon demand.

541 Chemical Kinetics and Reactor Design 3 hrs.
Fundamental principles of chemical kinetics and chemical reactor engineering along with the design of both thermal and catalytic reactors. Prerequisites: CHE 344, 443.

542 Internal Combustion Engines 3 hrs.
Application of principles of thermodynamics, heat transfer, and fluid mechanics to combustion engines and turbines. Basic engine types, engine components, idealized cycles, combustion, fuels, engine variables, testing, exhaust gas analysis, and air pollution as related to spark-ignition, compression-ignition, and turbine engines. Prerequisites: ME342, 442, 454.

544 Analysis and Design of HVAC System 3 hrs.
Analysis and design of heating, ventilation, and air-conditioning (HVAC) systems. Design requirements for human comfort, exterior weather conditions, and energy conservation. Calculation of heating and cooling loads for residential and commercial buildings, air and liquid distribution systems, selection and specification of system components, energy recovery and system efficiency, and commercially available systems. Prerequisites: ME 342, 442.

545 Heat Distribution System Design 3 hrs.
Design of hydronic and air distribution systems used in heating and air condition. Piping design, pump selection, heat coils, room air distribution, ducting design, fan selection, controls, and complete systems. Prerequisites: ME 454, 544; ME 446 recommended.
Solar Energy Systems  3 hrs.
Components for solar-energy systems (collectors, heat exchangers, thermal storage). Numerical simulation of solar energy systems, and solar energy system design. Residential and commercial space heating, process heating, and hybrid system applications. Prerequisites: ME 446, 544, ME 454 recommended.

Energy Conversion and Power Generation I  3 hrs.
Application of principles of thermodynamics and fluid mechanics and economics to analysis and design of conventional hydro and steam power plants. Energy sources and end uses, fossil fuels, combustion equipment, steam generators, and pollution control devices. Hydro, steam and wind turbines. Prerequisites: ME 352, 442, 454, ME 446 recommended.

Energy Conversion and Power Generation II  3 hrs.
Application of principles of thermodynamics, heat transfer, and fluid mechanics to combustion engines and turbines. Basic engine types, engine components, idealized cycles, combustion, fuels, engine variables, testing, exhaust gas analysis, and air pollution as related to spark-ignition, compression-ignition, and turbine engines. Prerequisites: ME 342, 442, 454.

Introduction to Environmental Engineering  3 hrs.
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. Prerequisite: ME 442.

Environmental Control  3 hrs.
Engineering design and synthesis of environmental control systems. Control of multiphase systems with application to air and water pollution control. Prerequisite: ME 442.

Advanced Fluid Mechanics  3 hrs.
Derivation of equations of motion, stress and rate of strain tensors; survey of application in one, two, or three dimensions; the complex potential and singularities, airfoils, and aerodynamic shapes; exact solutions of Navier-Stokes equations, approximations for flow at low and high Reynolds numbers; turbulence. Prerequisite: ME 454.

Dimensional Analysis and Similitude  3 hrs.
Nature and use of dimensions, principles of dimensional analysis, systematic calculation of dimensionless products, algebraic theory of dimensional analysis, similarity and model testing. Applications to problems of stress and strain, dynamics, fluid mechanics. Theory of heat and electrical phenomena, differential equations and similarity. Prerequisite: ME 353. Offered upon demand only.

Selected Topics in Mechanical Engineering  Credit to be arranged

Vibrations of Elastic Systems  3 hrs.
Formulation of the equations of motion of discrete and continuous systems, analytical and numerical methods of solution, eigenvalue problems, and dynamic response. Prerequisite: ME 488.

Intermediate Dynamics  3 hrs.
Kinematics and dynamics of particles, system of particles, and rigid-body. Variational principles and Lagrangian mechanics. Prerequisite: ME 362.

Mechanical Behavior of Engineering Materials  3 hrs.
Structure, properties, and behavior of materials. Structural defects and their influence on mechanical properties, point defects, dislocation and lattice imperfection in crystals, plastic deformation of single crystal and polycrystalline alloys, strengthening mechanisms and fracture. Strain rate, time to failure, and cyclic life from a microscope viewpoint. Prerequisites: ME 294, 370.

Applied Mechanics of Solids  3 hrs.
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. Prerequisite: ME 370.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
<th>Description</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>578</td>
<td>Matrix Methods in Structural Mechanics</td>
<td>3</td>
<td>Matrix application to formulation and solution of linear problems in structural mechanics. Stresses, vibrations, and stability of engineering structures. Prerequisite: CE 471</td>
<td></td>
</tr>
<tr>
<td>586</td>
<td>Numerical Engineering Analysis</td>
<td>3</td>
<td>Finite elements and finite differences in solving various engineering problems. Numerical applications to fluid mechanics, heat transfer, structural mechanics, and machine design. Prerequisite: ME 396.</td>
<td></td>
</tr>
</tbody>
</table>

The following courses are open to graduate students only.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
<th>Description</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>641</td>
<td>Advanced Thermodynamics</td>
<td>3</td>
<td>Application of classical thermodynamics. Treatment of problems involving nonideal gases and liquids, phase equilibrium, and chemical equilibrium. Prerequisite: EG 342.</td>
<td></td>
</tr>
<tr>
<td>645</td>
<td>Propulsion</td>
<td>3</td>
<td>Aerothermodynamics of rocket propulsion systems; rocket propellants and combustion; heat transfer and cooling problems. Application to ramjets and hybrid systems. Prerequisite: ME 545.</td>
<td></td>
</tr>
<tr>
<td>649</td>
<td>Transport Phenomena</td>
<td>3</td>
<td>Mass, energy, and momentum transport in steady and transient motions in real and rheological substances. Prerequisite: ME 442.</td>
<td></td>
</tr>
<tr>
<td>652</td>
<td>Introduction to Air Pollution</td>
<td>3</td>
<td>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. Prerequisite: graduate standing. Offered upon demand.</td>
<td></td>
</tr>
<tr>
<td>653</td>
<td>Gasdynamics</td>
<td>3</td>
<td>Fluid mechanics and thermodynamics of ideal and real gases. Shock waves, Prandtl-Mayer fans, acoustic waves, isentropic, isothermal, and general diabatic flows. Laval nozzels, exact solutions for flow over wedges and cones, and approximate methods. Prerequisite: ME 545.</td>
<td></td>
</tr>
<tr>
<td>654</td>
<td>High Speed Flow Theory</td>
<td>3</td>
<td>Transonic, supersonic, and hypersonic flows. Compressible potential flows, perturbation methods, similarity rules, characteristics, chemically reacting flows, and blunt-body problem. Prerequisite: ME 554.</td>
<td></td>
</tr>
<tr>
<td>655</td>
<td>Hydrodynamics</td>
<td>3</td>
<td>Potential flow in two and three dimensions, potential and stream functions, vorticity; Laplace’s equation, singularities and distributions of singularities, complex potential, conformal mapping. Prerequisites: ME 554 and a course in vector calculus.</td>
<td></td>
</tr>
<tr>
<td>656</td>
<td>Viscous Flow and Convective Heat Transfer I</td>
<td>3</td>
<td>Navier-Stokes equations, including several exact solutions and several approximate solutions for both large and small Reynolds’s number in incompressible flow. Free and forced convective heating. Application to laminar and turbulent flows. Prerequisite: ME 554.</td>
<td></td>
</tr>
<tr>
<td>657</td>
<td>Advance Process Control</td>
<td>3</td>
<td>Application of modern control theory to chemical processes; multivariable control; estimation and adaptive control, optimal control. Prerequisite: ECE 505.</td>
<td></td>
</tr>
</tbody>
</table>
Catalysis and Reactor Design  
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. Prerequisites: CHE 541.

Selected Topics in Mechanical Engineering  
Credit to be arranged

Theory of Vibrations  
Matrix treatment of systems with many degrees of freedom. Vibrations of elastic bodies. Nonlinear vibration of systems with single degree of freedom. Prerequisite: CE 561 or 563.

Advanced Dynamics  
Variational methods, optimization, and dynamic stability. Lagrangian and Hamiltonian formulation for dynamical systems and Hamilton-Jacobi theory. Prerequisite: ME 563.

Astrodynamics  
Astronomical coordinates and time systems; the many-body problems and disturbing functions. General perturbation theories, special perturbation methods, and application of classical mechanics and Hamilton-Jacobi methods to orbital mechanics. Prerequisite: ME 563.

Continuum Mechanics  
Kinematics and kinetics, various coordinate systems, constitutive equations for continuous media; applications to boundary value and initial value problems. Prerequisites: ME 352, 370.

Theory of Elasticity  
Review of fundamentals. Formulation of boundary-value problems of classical elasticity. Application to plane problems, prismatic members, and axisymmetric problems. Prerequisite: CE 671

Finite Element Analysis I  
Finite element theory, variational methods, weighted residuals; applications to linear partial differential equations in continuous media; solution of boundary-value and initial-value problems. Prerequisite: ME 671.

Inelastic Behavior of Materials and Structures  
Theory of constitutive equations with applications in classical viscoelasticity, thermoelasticity, and plasticity. Linear viscoelasticity, creep and relaxation phenomena; linear coupled thermoelasticity. Classical theories of plasticity, kinematic hardening law, concept of stress space, limit analysis. Applications to selected boundary-value and initial-value problems. Prerequisite: ME 671.

Experimental Stress Analysis  
Experimental methods to determine stress distribution in machine and structural elements subjected to static and dynamic loadings. Theory and laboratory application of mechanical and electrical resistance strain gauges, brittle coatings, and analogies. Prerequisite: CE 571.

Mechanics of Composite Materials  
Introduction to composite materials, micro- and macromechanical behavior of laminae; bending, buckling and vibration of laminated plates. Prerequisites: ME 671, 672.

Graduate Seminar in Mechanical Engineering  
No Credit
Minimum one-term requirement of M.S.E. students in mechanical engineering and minimum three-term requirement of Ph.D. students in mechanical engineering.

Graduate engineering Analysis I  
Linear algebra, matrices, and its applications to system of differential equations, vector analysis, integral theorems, and introduction to tensor analysis. Prerequisite: MA 352.
693 Graduate Engineering Analysis II 3 hrs.
Fourier series, Fourier integrals, Laplace transformations, partial differential equations, boundary-value problems, and special functions. Prerequisite: MA 352.

699 Master’s Thesis 3 or 6 hrs.
Required each term student is working and receiving direction on his master’s thesis. Minimum of two terms 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.

741 Statistical Thermodynamics 3 hrs.

743 Direct Conversion of Energy 3 hrs.
Systems for direct conversion of heat to electricity including thermionic, magneto-hydrodynamic, fuel cells, and semiconductor devices. Prerequisite: ME 641.

747 Advanced Heat Transfer 3 hrs.

752 Mechanics of Rarefied Gases 3 hrs.
Application of kinetic theory to rarefied gas-flow problems. Boltzmann statistical distribution; gas-surface interaction, transport properties, free molecule flow; heat-free molecule flow; procedures for non-equilibrium flows. Prerequisite: ME 554. Offered upon demand.

753 Magneto-Gas Dynamics 3 hrs.
Equations of motion for ionized gases with critical analysis of transport properties in steady and varying electric and magnetic fields. MHD shock waves and radiation effects. Prerequisite: ME 653.

756 Viscous Flow and Convective Heat Transfer II 3 hrs.
Boundary layers in compressible flow; adiabatic, heated, and cooled walls; aerodynamic heating; shock-wave boundary layer interactions. Prerequisites: ME 653, 656.

757 Turbulence 3 hrs.
Turbulence in gases and liquids; boundary layers, atmospheric phenomena. Prerequisite: ME 656.

759 Selected Topics in Mechanical Engineering Credit to be arranged

760 Analytical methods in Nonlinear Dynamics 3 hrs.
Theory and applications of nonlinear vibration phenomena, transient and steady-state response of nonlinear systems. Prerequisite: ME 661.

762 Wave Motion of Continuous Elastic Bodies 3 hrs.
Dynamics of continuous elastic bodies. Properties of wave motion considered while studying motion of elastic string. Propagation of elastic waves infinite and semi-infinite bodies, cylinders, rods, and beams. Prerequisite: ME 660.

768 Dynamics of Aerospace Vehicles 3 hrs.
Advanced problems in aerospace vehicles, rigid-body dynamics, and stability. Trajectory optimization for space navigation and related topics. Prerequisite: ME 660.

772 Theory of Structural Stability 3 hrs.
773 Theory of shells 3 hrs.
The first-approximation theory of thin shells, higher approximations, and transvers-shear deformations, geometrical nonlinearities and shell instability. Illustration of theories by selected problems. Prerequisite: ME 671.

774 Finite Element Analysis II 3 hrs.
Advanced topics in finite element analysis; application to nonlinear partial differential equations in continuum mechanics; theoretical studies of convergence and stability of solutions. Prerequisite: ME 674.

778 Fracture Mechanics 3 hrs.
Theory of crack propagation, stress intensity factors, mapping techniques, series expansion, asymptotic approximations, alternating method, field singularities, integral transforms, numerical solutions. Prerequisites: ME 671, 672.

799 Doctoral Dissertation 3-6 hrs.
School of Nursing

Degree: Master of Science in Nursing

Dean: J.K. Shoemaker, Professor

Director:
Burge, J.M., Professor; medical-surgical nursing, foundations of education.

Professors:
Hincker, E.A.; public health nursing, administration in higher education.
Shoemaker, J.K.; medical-surgical nursing, curriculum and instruction.

Associate Professors:
Baur, M.K.; medical surgical nursing, administration and supervision.
Henze, R.L.; medical-surgical nursing, teaching.
Perrin, M.N.; psychiatric nursing, management of human services organization.
Williamson, J.W.; adult health nursing, teaching.

Assistant Professors:
Cash, J.T.; adult health nursing, teaching.
Grissett, G.; cardiovascular nursing, teaching.
Hartig, M.T.; family nurse practitioner.
Benedict, S.; family nursing, adult health nursing.

The Master of Science in Nursing degree augments the professional base provided in baccalaureate-level study. It provides a theoretical and clinical base which enables the graduate to engage in advanced professional practice. The program is designed for five terms of full-time study.

Clinical experiences focus on the family. They provide opportunities for students to individualize the program while developing advanced skills as Acute Care Clinical Specialists or as Family Nurse Practitioners. The Acute Care track has the functional options of teaching or supervision; the Family Nurse Practitioner track has the functional option of Advanced Practice. Upon completion of the Family Nurse Practitioner requirements, the graduate is eligible to apply for state and national certification as a Family Nurse Practitioner.

Special Facilities

Madison County has three general hospitals with a licensed capacity of 1,013 beds, one army hospital licensed for 42 beds, a county health department, and five skilled nursing homes with approximately 685 beds. The Ambulatory Care Center is the major clinical service facility for the UAH School of Primary Medical Care and serves also as a facility for the School of Nursing.

Huntsville Hospital (578 beds), the largest general hospital in the northern part of the state, is the regional medical care center for north Alabama and southcentral Tennessee. The hospital offers comprehensive emergency treatment facilities and
the only newborn intensive care unit in north Alabama. Crestwood Hospital (120 beds) is a private general hospital fully equipped to handle most diagnostic and surgical procedures. Humana Huntsville Hospital (315 beds), the largest private hospital in the area, is a general, acute care hospital with a complete range of surgical, medical, and obstetrical services. Fox Army Community Hospital provides complete outpatient care and general medical and surgical short-term acute care.

Four rural health clinics in Jackson County are used extensively for student experiences. Various other hospitals, clinics, and physicians’ offices are used on a selected basis.

Admission Requirements

In addition to meeting the requirements for admission to the School of Graduate Studies, requirements for admission to the graduate program in nursing are:

1. Graduation from a National League for Nursing accredited baccalaureate program with a major in nursing.

2. Grade point of 3.0 on a 4.0 scale in all undergraduate nursing courses.

3. Evidence of a current license to practice as a registered nurse in Alabama.

4. Three letters of recommendation: one each from a previous nursing employer or supervisor, a previous faculty member or dean, and a personal reference.

5. One undergraduate (AHS 300 or MSC 287) course in basic statistics.

6. A minimum of one year of professional nursing practice as evidenced by letters of recommendation.

7. Personal interview (may be required).

Once a student has been admitted to the graduate program, and prior to registration in a clinical course, the following must be on file with the Director of the Graduate Program:

1. A health and dental examination by a medical physician and dentist with results of the examination submitted on forms provided by the School of Nursing.

2. Documentation of personal health insurance that covers cost of ambulatory or out-patient treatment.

3. Documentation of professional liability insurance.
Degree Requirements

Students may follow one of two plans for their program of study: (1) Plan I: Thesis, or (2) Plan II: Professional Paper. Requirements for completion of the program in Plan I are a minimum of 45 semester hours of graduate coursework for students enrolled in the Adult Acute Care track, and a minimum of 51 semester hours for those enrolled in the Family Nurse Practitioner track. Requirements for completion of the program in Plan II are a minimum of 51 semester hours of graduate coursework for students enrolled in the Adult Acute Care track and a minimum of 49 semester hours for those enrolled in the Family Nurse Practitioner track. Both plans also require that all students successfully complete a written comprehensive examination before progressing to the oral exam.

Financial Aid

Financial aid for graduate students in the School of Nursing come primarily from two sources:

1. Alabama State 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 or $950 per term for one year. Students must make application to the Alabama State Board of Nursing by June 1 of each year.


   The School of Nursing applies annually for a limited number of traineeships for graduate students. These funds are granted to students enrolled for full-time study in the program. Application forms may be obtained through the Office of Financial Aid or the Office of the Director of the Nursing graduate program.

Nursing Tracks

Core Requirements:  
Semester Hours
Development of Nursing Theory (NUR 601) .......................................... 3
Seminar in Research (NUR 602) ................................................................. 3
Advanced Health Assessment (NUR 606) ................................................ 3
Pathophysiology (NUR 612) ................................................................. 4
Use fo Computers in Nursing (NUR 604) ..................................................  
Professional Practice Issues (NUR 641) .................................................. 2
Family Nursing (NUR 627) .......................................................................... 4

   22
Adult Acute Care Track

In addition to the above 22 semester hours of required core courses, student selects one of the following options:

Option I: Acute Care with Teaching Functional Area

Acute Care Nursing (NUR 631, 632) .................................................. 8
Teaching Support Courses (NUR 634, 635) ...................................... 6
Teaching Practicum (NUR 636) .......................................................... 3

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OR

Option II: Acute Care with Supervision Functional Area

Acute Care Nursing (NUR 631, 632) .................................................. 8
Supervision Support Courses (AS 621, 624) ................................. 6
Supervision Practicum (NUR 636) ..................................................... 3

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The remaining 6-10 hours required are selected on the basis of a thesis (Plan I) for 6 semester hours or a professional paper (Plan II) for 4 semester hours plus 6 hours of electives. A minimum of 45 semester hours is required for the program in acute care nursing.

Family Nurse Practitioner Track

In addition to the above 22 semester hours of required core courses, student completes the following 27-29 semester hours of course work if enrolled in the family nurse practitioner track:

Role Resocialization (NUR 640) ....................................................... 2
Community Nursing (NUR 628, 629, 630) .................................... 15
Pharmacology in Advanced Practice (NUR 614) .............................. 3
Family Counseling (NUR 616) ......................................................... 3
Professional Paper (NUR 603) ......................................................... 4

OR

Thesis (NUR 699) ........................................................................... 6

  27-29

A minimum of 49 semester hours is required in the program preparing family nurse practitioners.

Graduate Nursing Courses (NUR)

500 Special Topics 2-4 hrs.
Advanced study of underlying sciences and personal experiences in application of skills in selected area of interest in nursing. Elective. Prerequisite: approval of instructor.

503 Advanced Coronary Nursing Care 3 hrs.
A course designed primarily for graduate nurses to provide in-depth knowledge of the care of the cardiovascular patient. Emphasis will be placed on normal and pathological physiology as well as the exploration of behavioral aberrations and coping mechanisms. Prerequisite: Registered Nurse or new graduate.

601 Development of Nursing Theory 3 hrs.
Seminar. Theory and theory building as explored and practiced in clinical setting. Theory building for nursing practice and its application to research in nursing.
602 Seminar in Research 3 hrs.
Identification, exploration, and critique of current nursing theory and research to encourage
student to think critically. Use of theory and scientific methodology to formulate a proposal
for investigation or research.

603 Professional Paper 4 hrs.
Application of research or investigative process with faculty guidance. Research or investiga-
tion of a nursing problem and preparation of appropriate written report. Prerequisites:
NUR 601, 606, 612, and 627.

604 Use of Computers in Nursing
Course prepares students to become users of computers in contemporary nursing practice,
education and research.

606 Advanced Health Assessment 3 hrs.
Theory and laboratory practice to develop skills for comprehensive health assessment of
individuals and families. Lab fee: Level 7.

612 Pathophysiology 4 hrs.
Expansion upon previous knowledge of anatomy, physiology, adaptation, and disease
process. Anticipated and existing physiological alterations as they affect the individual and
the family.

614 Pharmacology in Advanced Practice 3 hrs.
Advanced content in clinical pharmacology based on body systems and the physiological-
biochemical relations with and between those systems.

616 Family Counseling 3 hrs.
Prepares graduate nurses to assist the family unit in dealing with crises of daily living
through the analysis of the family as a system and the application of therapeutic intervention.

627 Family Nursing 4 hrs.
Advanced nursing concepts and clinical practice of health management of adults in primary
and secondary health settings. Lab fee: Level 7. Prerequisites: NUR 601, 612, and 606.
Corequisite with NUR 602 and NUR 614.

628 Family Nursing in Community I 4 hrs.
Advanced nursing concepts and clinical practice of health management of mothers and
infants in context of the family. Required for students selecting family nurse practitioner

629 Family Nursing in Community II 4 hrs.
Advanced nursing concepts and clinical practice of health management of children in
context of the family. Lab fee: Level 7. Prerequisites: NUR 628 and NUR 640.

630 Family Nursing in Community III 7 hrs.
Seminar and clinical practicum in innovative nursing management of families with complex
problems. Lab fee: Level 7. Prerequisite: NUR 629.

631 Family Nursing in Acute Care I 4 hrs.
Advanced nursing concepts and clinical practice focusing on management of adults in
Prerequisite: NUR 627.

632 Family Nursing in Acute Care II 4 hrs.
Continuation of concepts and theories taught in NUR 631 with additional application to
practice in acute-care settings. Lab fee: Level 7. Prerequisite: NUR 631.

634 Curriculum Development in Nursing 3 hrs.
Current trends and research related to curriculum development in schools of nursing.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>636</td>
<td>Practicum in Teaching or Supervision</td>
<td>3 hrs.</td>
<td>Practicum in planning and teaching nursing to selected student groups at the baccalaureate level. Practicum in directing and evaluating activities of nursing personnel in selected health service settings. Lab fee: Level 7. Prerequisites: NUR 632, 634, 635, or NUR 632 and AS 622, AS 624.</td>
</tr>
<tr>
<td>640</td>
<td>Concepts of Role Resocialization</td>
<td>2 hrs.</td>
<td>Seminar in leadership skills and role resocialization to enhance effectiveness of master’s prepared family nurse practitioner students. Corequisite with NUR 628.</td>
</tr>
<tr>
<td>641</td>
<td>Issues in Professional Practice</td>
<td>2 hrs.</td>
<td>Exploration of professional nursing’s development and related social, political, and technological forces. Strategies for management and change are identified and evaluated. Corequisite with NUR 630 or 636.</td>
</tr>
<tr>
<td>650</td>
<td>Independent Study</td>
<td>2-4 hrs.</td>
<td>The planning, implementation, and evaluation of related phenomena of special interest observed in nursing practice.</td>
</tr>
<tr>
<td>699</td>
<td>Thesis</td>
<td>6 hrs.</td>
<td>Independent research investigation related to practice of nursing under faculty guidance. Prerequisite: NUR 627, and 602.</td>
</tr>
</tbody>
</table>
School of Science

Dean: Harold J. Wilson, Professor of Biological Sciences

The School of Science includes the departments of Biological Sciences, Chemistry, Computer Science, Mathematics and Statistics, and Physics. In addition, significant graduate course offerings are available in atmospheric and environmental sciences, biochemistry, materials science, and optical sciences.

The School offers programs leading to the Ph.D. degree in Computer Science and in Physics. All departments in the School offer programs leading to the M.S. degree. A Ph.D. degree is also offered in chemistry and in mathematics through cooperative programs with other campuses in the University of Alabama system. A program for the M.A. degree is offered in The Department of Mathematics and Statistics.

While the School of Science does not directly prepare students for professional degrees, provisions are available for public school teachers who wish to concentrate in the sciences while pursuing graduate professional degrees in education.

The School takes advantage of its strategic location in the midst of the heavy concentration of high technology-oriented private and government industries of the Tennessee Valley. In this regard, it offers unique opportunities for original investigations at the forefront of science and technology, including problems which are of direct interest to industry as well as to basic academic research. Dissertation and thesis work may be undertaken in areas where numerous opportunities exist for testing theoretical models under experimental conditions. In several graduate program areas there is a close working relationship with the School of Engineering.
Biological Sciences

Degree: Master of Science

Chairman: R.B. Young, Associate Professor; gene expression in skeletal muscle, recombinant DNA.

Professors:
Adams, C.H. (Emeritus); environmental health and safety, toxic waste management.
Dimopoulos, G.T.; pertussis vaccine development, giardiosis detection and diagnosis.
Leonard, R.C.; taxonomic characteristics of oomycota.
Wilson, H.J.; subcellular movement in plant and animal cells.

Associate Professors:
Campbell, P.S.; reproductive physiology, sex steroid hormone action.
Eley, M.H.; chemical and biological conversions of biomass.
Modlin, R.F.; limnology of temporary and permanent wetland ponds and estuaries.

Assistant Professors:
Garstka, W.R.; reproduction and chemical communication in vertebrates.
Lawton, R.O.; structure and composition of forest communities.
Meehan, E.J. (Adjunct); biomolecule structure, x-ray crystallography.
Moriarity, D.M.; Regulation of eucaryotic gene expression.
Zahorchak, R.J.; mechanisms of bacterial pathogenesis, especially Yersinia

The Department of Biological Sciences provides instruction, learning, and creative scholarly activities in the biological sciences. Scholarly investigations are undertaken by scientists and those who as graduate students (and sometimes advanced undergraduate students) undertake to become future scholars. The department does not offer courses in all areas of biological science; rather, it has chosen to emphasize instruction at the undergraduate and graduate levels in three general areas:

1. cellular and developmental biology
2. microbiology
3. environmental biology

The graduate program is exceptional in at least two ways. First, the relatively small number of graduate students fosters an academic atmosphere stressing individuality and close interaction with the graduate faculty. Second, the graduate program is a cooperative venture with Alabama A&M University, with a combined faculty at both UAH and A&M of approximately 20. This arrangement provides a faculty resource and diversity of expertise available in large universities without sacrificing the close, personal supervision only small programs can accommodate.

Special Facilities

Facilities available for postgraduate research include well equipped laboratories in biochemistry, physiology, cell biology, microbiology, immunology, environmental biology and limnology. Graduate students also have access to the following support units: A Univac 1100/70 computer with terminals in the Science Building;
Sperry microcomputers; the Johnson Environmental and Energy Center's biomass conversion demonstration plant and research laboratories with extensive instrumentation; and the Marine Research Complex at the Dauphin Island Sea Lab, located on the northern shore of the Gulf of Mexico, with three ocean-going research vessels and a library with holdings pertinent to marine biology research. In addition, the UAH library houses over 6750 monographs and 450 journals in the biological and medical sciences. Specific accommodations and equipment for graduate research include an electron microscopy suite with a Phillips 201 transmission electron microscope, a variety of light microscopes, a laboratory animal care facility, radiotracer technology with both liquid and gamma scintillation counters, preparative centrifuges, ultracentrifuges, tissue culture facilities, recombinant DNA laboratory, electrophoresis equipment, numerous UV-visible recording spectrophotometers, physiograph, limnological research boat, arboretum, and greenhouse facilities. Biological research equipment at Alabama A&M University is also available.

Admission Requirements

In addition to fulfilling admission requirements set by the School of Graduate Studies, applicants must also:

1) show competence in an area of life science related to the proposed area of study;

2) complete one year of undergraduate chemistry, including at least one term of organic chemistry and biochemistry;

3) have a minimum GPA of 3.0 (A = 4.0) in the major area of concentration.

A course in statistics is also recommended.

Degree Requirements

The graduate faculty, in cooperation with the Biology graduate faculty of Alabama A & M, offers an M.S. in Biological Sciences with emphasis in cell and developmental biology, ecology, genetics and molecular biology, microbiology, physiology, and systematics. A minimum of 25 percent of biological sciences course requirements must be met at the cooperating institution. A minimum of 50 percent of the graduate program must be taken at the 600 level.

Students may elect one of the following three plans:

Plan I—Master of Science with thesis

a. Graduate course work of 24 semester hours of an approved program;

b. Comprehensive coursework examination;

c. Acceptable thesis describing original research;

d. Final oral examination.
Plan II—Master of Science without thesis

a. Approved program of 33 semester hours;

b. Acceptable master’s report (Library search, survey, and/or experimentation);

c. Comprehensive final examination.

Plan III—Master of Science with Education option (Class A Certification)

a. Approved program of 24 semester hours in biological science and 9 semester hours in education;

b. Acceptable master’s report;

c. Comprehensive final examination.

Undergraduate Biological Sciences Courses (BYS)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>301</td>
<td>Elementary Biochemistry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>312</td>
<td>Principles of Ecology</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>313</td>
<td>Anatomy and Physiology I</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>314</td>
<td>Anatomy and Physiology II</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>315</td>
<td>Ichthyology</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>317</td>
<td>Vertebrate Zoology</td>
<td>5 hrs.</td>
</tr>
<tr>
<td>318</td>
<td>Vertebrate Reproduction</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>319</td>
<td>General Genetics</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>320</td>
<td>Genetics Laboratory</td>
<td>1 hrs.</td>
</tr>
<tr>
<td>340</td>
<td>Introduction to Cellular and Developmental Biology</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>361</td>
<td>General Biochemistry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>362</td>
<td>General Biochemistry Laboratory</td>
<td>1 hrs.</td>
</tr>
<tr>
<td>364</td>
<td>Biogeography</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>368</td>
<td>Dendrology</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>371</td>
<td>Nonvascular Cryptogramic Botany</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>372</td>
<td>Biology of Vascular Plants</td>
<td>5 hrs.</td>
</tr>
<tr>
<td>378</td>
<td>Invertebrate Zoology</td>
<td>5 hrs.</td>
</tr>
<tr>
<td>421</td>
<td>Introduction to Medical Microbiology</td>
<td>5 hrs.</td>
</tr>
<tr>
<td>429</td>
<td>Animal Histology</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>430</td>
<td>Immunology</td>
<td>4 hrs.</td>
</tr>
</tbody>
</table>

128
435  Bacterial Physiology and Metabolism  4 hrs.
436  Physiological Psychology  3 hrs.
455  General Entomology  4 hrs.
464  Speciation and Evolution  3 hrs.
490  Special Topics in Biological Sciences  1-4 hrs.
492  Undergraduate Research  2-4 hrs.
496  497, 498, 499 Seminar  1 hr. each

Graduate Biological Sciences Courses (BYS)

BYS 519  Gene Structure and Function  3 hrs.
Molecular basis for inheritance and gene expression. Includes replication, transcription, translation, gene cloning and recombinant DNA technology. Prerequisites: BYS 319 and BYS/CH 361.

521  Medical Mycology (UAH)  4 hrs.
Comprehensive study of fungi pathogenic to man; their properties, pathogenesis, and laboratory diagnosis. Two 2-hour labs a week. Lab fee: Level 4. Prerequisite: BYS 421; BYS 430 is recommended.

524  Mycology (UAH and A&MU)  4 hrs.
Lines of phycomycetes using representative species; various series of actinomycetes; representative pathogenic (crop and vegetative pathogens) and nonpathogenic heterobasidiomycetidae organisms; orders and families of homobasidiomycetidae. Ontogenetics, cellular, and structural study applied to all divisions, classes, series, orders and families. Lab fee: Level 4.

525  Medical Parasitology (UAH)  5 hrs.
Protozoa and helminths parasitic for man and their laboratory identification. Anthropods in relation to their roles as vectors. Two 2-hour labs a week. Lab fee: Level 3. Prerequisite: BYS 221 or equivalent.

521  Plant Physiology (UAH)  4 hrs.
A general introductory study of life processes of plants, including water relations, mineral utilization, metabolism, photosynthesis, digestion, respiration, assimilation, and growth as affected by growth hormones. One 3-hour lab a week. Lab fee: Level 3. Prerequisites: BYS 113, 371, or 372, CH 113 or 331.

532  Animal Physiology (UAH)  4 hrs.
Basic course in organismal function. Membrane physiology with respect to transport phenomena, muscle, nerve, synapse, and sensory receptor physiology. Physiology of respiration, heart, circulation, kidney, and gastrointestinal tract as individual systems with emphasis on regulation. One laboratory session a week illustrating physiological principles discussed in lecture. Lab fee: Level 4. Prerequisite: senior classification with a major or cluster in biological science; 16 hours completed in AOC and CH 113 or 331 or graduate standing.

543  Cellular and Developmental Biology (UAH)  3 hrs.
Cellular structure and function coupled with relevant aspects of developmental mechanisms. Lectures on mitosis, gametogenesis, nuclear-cytoplasmic interactions, role of genes in development, mechanisms of hormone action on cellular function and development and cell movements and affinities. Prerequisites: BYS 113, 114, 319, CH 101, 105, and 113 or CH 123, 126 and 331 (may be taken concomitantly).

544  Cellular and Developmental Biology (UAH)  3 hrs.
Continuation of BYS 543 and selected morphogenesis of germ-layer derivatives. Prerequisite: BYS 543.
545 Cellular and Developmental Biology Laboratory (UAH)  2 hrs.
Take course after BYS 543 and concurrently with BYS 544. Lab fee: Level 5.

547 Biochemistry I (UAH)  3 hrs.
Structural chemistry and function of biomolecules, mechanism of biochemical reactions, enzyme kinetics, and energy transfer. Prerequisite: CH 333 or CH or BYS 361. (Same as CH 561).

548 Biochemistry II (UAH)  3 hrs.
Metabolism, biosynthesis of macromolecular precursors, storage, transmission, expression of genetic information, and molecular physiology. Prerequisite: CH 561 or BYS 547. (Same as CH 562).

561 Physiological Ecology (UAH)  4 hrs.
Physiological and behavioral responses of organisms to natural changes in their chemical and physical environment. One 3-hour lab a week. Lab fee: Level 3. Prerequisite: BYS 312 or approval of instructor. BYS 361 or 532 recommended.

562 Community Ecology (UAH)  4 hrs.
Detailed consideration of ecological principles and concepts, as well as biotic and abiotic factors relative to development of plant communities and ecosystems. One 4-hour lab a week. Lab fee: Level 3. Field trips required. Prerequisites: BYS 312 and taxonomy.

563 Population Ecology (UAH)  4 hrs.
Distribution, population dynamics and behavior of animal population in relation to environmental factors. One 4-hour lab a week. Lab fee: Level 3. Field trips required. Prerequisites: BYS 312 and organic chemistry.

564 Limnology (UAH)  4 hrs.
Fresh-water environments and organisms exemplified by lakes, ponds, and streams in North Alabama. Laboratory and required field trips. One 4-hour lab a week. Occasional Saturday field trips required instead of week's laboratory session. Lab fee: Level 4. Prerequisites: BYS 312, 315, 371, or 378, or approval of instructor.

571 Plant Anatomy (UAH and A&MU)  4 hrs.
Ontogeny, differentiation, and maturation of tissues and organs of angiosperms. Problems in growth and development of an angiosperm, using histological techniques. Two 3-hour labs a week. Lab Fee: Level 4. Prerequisite: BYS 372 or approval of instructor.

578 Aquatic Arthropod Biology  4 hrs.
Systematics, Physiology, Ecology and Importance of the Crustacea, Insecta and Arachnida that inhabit freshwater and estuarine ecosystems. Particular attention will be given to those arthropods common to the aquatic systems in and around Alabama. Since all field trips are required, prospective students should consult with the instructor prior to registration. Lab fee: Level 4. Prerequisite: BYS 378.

621 Pathogenic Bacteriology (UAH)  4 hrs.
Detailed study of bacteria that cause infections in man. Mechanisms of pathogenicity and host-parasite relationships. Two 1-hour labs a week. Lab fee: Level 4. Prerequisites: BYS 361, 421, 430, or equivalents, or approval of instructor.

624 Immunology (UAH)  4 hrs.
Theoretical and practical aspects of immunology. Current areas of immunology that are controversial. One 4-hour lab a week. Lab fee: Level 4. Prerequisites: BYS 361 and BYS 430 or approval of instructor.

633 Endocrinology (UAH)  3 hrs.
Anatomy, physiology, and biochemistry of endocrine glands. Systemic effects of hormones, their regulation, integration, and mechanisms of action. Prerequisites: BYS 361, 532 or equivalent, or approval of instructor.
641 Advanced Cell Biology (UAH and A&MU) 4 hrs.
Integrated approach to fine structure and function of various cellular processes. Particular aspects of cellular processes each term, e.g. motility in cells and cellular differentiation. Laboratory included. Lab fee: Level 4. Prerequisite: Cellular and Developmental Biology or approval of instructor.

643 Microscopy (UAH) 4 hrs.
Introduction to the various methods of preparation for transmission electron microscopy and analysis of electronmicrographs. Supporting techniques such as phase microscopy, autoradiography, scanning electron microscopy, negative staining, and cytochemistry. Lab fee: Level 6. Prerequisites: graduate standing and approval of instructor.

644 Topics in Cell and Developmental Biology and Biological Fine Structure (UAH) 2 hrs.
Discussion of current topics in cell biology with emphasis on student participation. Both plant and animal cells will be emphasized. Depending on the number of students, some terms may be devoted to short research problems. Prerequisites: BYS 543 or 643 or approval of instructor.

646 Molecular Genetics (UAH and A&MU) 3 hrs.
Molecular mechanisms underlying genetic principles. Structure of genes and chromosomes; primary, secondary, and tertiary structure of DNA; DNA replication; genetic recombination; RNA transcription; translation and genetic code; regulation of gene function; evolution at molecular level. Prerequisites: BYS 319 and BYS-CH 361.

647 Enzymology (UAH) 4 hrs.
Detailed study of enzymes including protein synthesis; primary, secondary, tertiary and quaternary structure; nomenclature, physiological and catalytic function; enzyme kinetics, and metabolic regulations of enzyme activity. Prerequisite: BYS 542 or CH 561 or approval of instructor.

648 Enzymology Laboratory (UAH) 2 hrs.
Techniques of isolation, purification, and characterization of enzymes. Prerequisite: BYS 647. Lab fee: Level 5.

653 Taxonomy of the Immature Insect (UAH and A&MU) 4 hrs.
Studies of the literature, comparative morphology and techniques of identification of immature stages of the insect, methods of collecting and preserving the immatures. Lab fee: Level 3. Prerequisite: BYS 455 or approval of instructor.

660 Ecosystem dynamics (UAH) 4 hrs.
An analytical approach (including simulation and modeling) to the interactions of organisms in terrestrial, aquatic, and marine ecosystems. One 4-hour lab a week. Lab fee: Level 3. Field trips required. Prerequisites: BYS 564 and 562.

661 Advanced Population Ecology (UAH) 4 hrs.
Interaction of population structure, genetic properties, and ecology factors in controlling dynamics and evolutionary character of natural population. One 4-hour lab a week. Lab fee: Level 3. Prerequisites: BYS 312, BYS 564 or 565, or approval of instructor.

690 Seminar (UAH and A&MU) 1 hr.
Student reports on current journal articles. Graduate students should attend whether enrolled for credit or not.

691 Special Topics (UAH and A&MU) 1-4 hrs.
Literature search relative to topics of interest under supervision of instructor. For graduate students.
Research (UAH and A&MU)  
2-4 hrs.
Individual investigations on graduate level of biological problems under supervision of graduate faculty member. A special problem may be carried out at Marine Environmental Sciences Consortium, Dauphin Island, Alabama. Available to thesis students. Lab fee: Level 2 for 2 hours; Level 3 for 3 hours; Level 4 for 4 hours; Level 4 for 5 or 4 hrs; Level 3 for 3 hrs; Level 2 for 2 hrs.

Master's Thesis (UAH and A&MU)  
1-4 hrs.
Requirement each term student is working and receiving direction on master's thesis. Minimum of two terms required for MS students. Maximum of 9 hours credit upon successful completion of master's thesis.

Graduate courses offered at Alabama A&M (A&MU)

Advanced Undergraduate — Graduate Courses

510  Radiation Biology (A&MU)  
4 hrs.
Characteristics of radioisotopes, detection and counting techniques and instrumentation, tracer techniques, health and safety system. Prerequisite: consultation with instructor.

511  Biological Control (A&MU)  
4 hrs.
Components of resistance, use of parasites, predators and microorganisms, foreign exploration, shipment, release and establishment of imported parasites and predators.

512  Histotechniques (A&MU)  
3 hrs.
Microscopic study of the various tissues and organs of the animal systems.

513  Microbial Physiology (A&MU)  
3 hrs.
Relationships between structure and biochemical functions in microorganisms. Lab fee: Level 4. Prerequisite: microbiology, organic chemistry, and biochemistry.

523  Principles of Cirology (A&MU)  
4 hrs.
Principles of viral infectivity, multiplication, and chemical constitution; laboratory techniques for their isolation, cultivation, identification, and enumeration. Prerequisite: BYS 221.

526  Microbial Ecology (A&MU)  
4 hrs.
Relationships of soil and aquatic microorganisms and their importance in ammonification, nutrification, and other biological processes. Prerequisite: BYS 221.

533  Medical Physiology I (A&MU)  
4 hrs.
Nerve and muscle cell function, fluid and electrolyte environment of body tissues, blood, heart, circulatory, and nervous systems. Prerequisite: organic chemistry, preferably biochemistry.

534  Medical Physiology (A&MU)  
4 hrs.
Continuation of Mammalian Physiology I with consideration of kidney function, respiratory, digestive, reproductive, and endocrine systems. Prerequisite: Medical Physiology I.

535  Endocrinology (A&MU)  
4 hrs.
Current developments on anatomy, physiology, chemistry, and regulations of major endocrine glands. Laboratory sessions in biological and chemical assays of hormones. Prerequisite: ZOO 409.

540  Molecular Biology (A&MU)  
4 hrs.
Structure, behavior, and function of larger biological molecules including biological oxidations, metabolism of carbohydrates, lipids, amino acids, and genetic aspects of metabolism. Prerequisite: CHE 301 Organic Chemistry.

546  Cytogenetics (A&MU)  
4 hrs.
Analysis of composition, morphology, and behavior of genes, especially as the relate to function, development, and heredity. Prerequisite: BIO 406.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title (School &amp; School)</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>549</td>
<td>Analytical Biochemistry Laboratory (A&amp;MU)</td>
<td>2 hrs.</td>
<td>Advanced laboratory course dealing with modern techniques of molecular biology and biochemistry.</td>
</tr>
<tr>
<td>551</td>
<td>Insect Physiology (A&amp;MU)</td>
<td>4 hrs.</td>
<td>Metabolism and utilization of carbohydrates, lipids, and nitrogen compounds; energy production, neuromuscular mechanisms, hormones and morphogenesis; role of organs and organ systems in metabolism. Prerequisites: general entomology or equivalent, advanced biochemistry.</td>
</tr>
<tr>
<td>552</td>
<td>Insect-Pest Management (A&amp;MU)</td>
<td>4 hrs.</td>
<td>Insect surveys, ecological basis for control, plant and animal resistance to insects, control by parasites, predators, microorganisms, management by genetics principles, chemical attractants, chemical repellents, sterilization, insecticides, and integrated systems of pest management. Prerequisite: general entomology or advanced applied entomology.</td>
</tr>
<tr>
<td>553</td>
<td>Insect Taxonomy and Morphology (UAH &amp; A&amp;MU)</td>
<td>4 hrs.</td>
<td>Classification of insects, external and internal anatomy of insects with emphasis on comparative and functional aspects. Lab fee: Level 3. Prerequisite: BYS 455.</td>
</tr>
<tr>
<td>560</td>
<td>Environmental Biology (A&amp;MU)</td>
<td>3 hrs.</td>
<td>Principles of interaction between living systems and their resources. Current problems in management of our natural resources including new approaches in management of pest populations.</td>
</tr>
<tr>
<td>570</td>
<td>Plant Pathology (A&amp;MU)</td>
<td>4 hrs.</td>
<td>History, nonparasitic, and parasitic diseases incited by bacteria, fungi, plasmodiophorales, nematodes, and viruses. Disease control through exclusion, eradication, protection, and post resistance. Prerequisite: BIO 344.</td>
</tr>
<tr>
<td>590</td>
<td>Problems in Biological Sciences (A&amp;MU, Plan III Only)</td>
<td>4 hrs.</td>
<td>Problems of elementary and secondary school teachers of science in all areas of biological sciences. Relations of biological organisms to their environment, stressing climatic and soil factors that influence their distribution and adaptations. Provision for individual investigation in biological science.</td>
</tr>
<tr>
<td>622</td>
<td>Applied and Industrial Microbiology (A&amp;MU)</td>
<td>4 hrs.</td>
<td>Examine by microbiological assay sewage disposal and waste water treatment plants. Microorganisms of industrial importance in biological production of antibiotics, vitamins, organic acids, and alcohols. Prerequisite: microbiology.</td>
</tr>
<tr>
<td>631</td>
<td>Medical Pharmacology (A&amp;MU)</td>
<td>5 hrs.</td>
<td>Lecture and laboratory course. 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. Prerequisites: Medical Physiology I and II.</td>
</tr>
</tbody>
</table>
642 Advanced Cell Physiology (A&MU) 4 hrs.
Biochemical and biophysical cytology. The cell as matter, life history of the cell, molecular
basis of cellular activities, enzymes and energy conversions, functional localizations in
subunits of the cell, mechanisms of motility, structure and function of cell membranes,
effects of radiation on cells, biochemical control mechanisms, cellular differentiation and
interaction between cells, hypotheses of cellular origins. Prerequisites: molecular biology,
physics, cytology, biochemistry. Laboratory included.

645 Human Cytogenetics and Its Clinical Application (A&MU) 3 hrs.
Review of normal human chromosome structure and normal chromosome segregation and
morphology with clinical consideration.

Economic thresholds, economic injury levels, population dynamics, residues in food crops,
chemical control, insect transmission of plant disease, and livestock. Prerequisite: general
entomology.

672 Advanced Systematic Botany (A&MU) 4 hrs.
Classification, nomenclature, and taxonomic theory of vascular plants. Prerequisite: plant
taxonomy.
Chemistry

Degree: Master of Science
Doctor of Philosophy in cooperation with The University of Alabama, Tuscaloosa and The University of Alabama, Birmingham.

Chairman: J.K. Baird, Professor; theoretical aspects of radiation chemistry and diffusion-controlled reactions.

Professors:
Arendale, W.F.; chemometrics, organoselenium compounds.
McManus, S.P.; functionalized polymers, nucleophilic displacement reactions.
Riley, C.; laser photochemistry, electrodeposition in low gravity.

Associate Professors:
Coble, H.D.; coordination compounds
Emerson, M.T.; x-ray structure analysis resolution enhancement of spectra.
Loo, B.H.; surface enhanced Raman spectroscopy, electrochemistry.
Young, R.B., Adjunct; regulation of gene expression in muscle.

Associate Research Professor:
Gregory, J.C.; cosmic ray astronomy, interaction of atomic oxygen with surfaces.

Research in the Department of Chemistry is pursued along all five of the main subdivisions of the subject (analytical, biochemistry, inorganic, organic, and physical). This work traditionally has been closely linked with projects underway at the nearby U.S. Army’s Redstone Arsenal and NASA’s Marshall Space Flight Center. For example, graduate students are currently investigating methods for the destruction of chemical warfare agents. Others are using state-of-the-art instrumentation to develop experiments in chemical hydrodynamics for test on flights of the Space Shuttle. Students have access not only to the University Library, with 5000 holdings in chemistry and 150 current chemical journal subscriptions, but also to the U.S. Army Redstone Scientific Information Center, which is one of the best scientific libraries in the country. This exposure to research in major U.S. Government laboratories provides students with a background, which is attractive to both industrial and government employers.

Equipment

Major equipment in the Chemistry Department includes: IBM 200 MHz Fourier transform nuclear magnetic resonance spectrometer equipped for both liquid and solid phase studies, Bruker 90 MHz nuclear magnetic resonance spectrometer, Varian X-band and K-band electron spin resonance spectrometers, mass spectrometers, molecular beam scattering machine, Perkin-Elmer and Beckman infrared
spectrophotometers, Jarrell-Ash 2 meter spectrometer, Cary 14 scanning and Beckman DB-G visible-ultraviolet spectrometers, Raman spectrometer with laser excitor, Picker x-ray diffractometer and several atomic absorption spectrometers, differential scanning calorimeter, polarography system, stopped flow kinetics Paerkin-Elmer high pressure liquid chromatograph, gas chromatographs and various CW and pulsed lasers. The University has a recently upgraded UNIVAC 1100/70 computer, while the Chemistry Department has a PDP 11-50 and numerous Sperry personal computers available for student use.

Admission Requirements

General requirements of the School of Graduate Studies 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. The ACS-approved degree includes lecture and laboratory work in elementary chemistry, organic chemistry, physical chemistry, inorganic chemistry, analytical chemistry (including instrumental analysis), elementary physics, and mathematics through linear algebra and differential equations. 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 may be required. The time required to complete the M.S. Degree may then be proportionally increased.

Master of Science

General requirements of the School of Graduate Studies under Plan I or Plan II must be satisfied. The M.S. degree is a general degree in chemistry. As such, it is based upon a core sequence of courses emphasizing four of the five main subdivisions of chemistry.

Plan I. This plan requires 24 semester hours of graduate coursework, which must include the core sequence consisting of CH 531, 600, 631, 640, 642, and 561 or 621. CH 621 is preferred if students have not completed CH 421 or CH 521 at UAH or the equivalent elsewhere. Additional requirements include a thesis, two units of seminar, and reading competence in German or Russian. The faculty may accept other languages under special circumstances. Demonstration of computer machine language skills or B grades or better in CS 113 and 208 may also be substituted. International students may replace CS 113/208 with English courses or by a demonstrated mastery of English. (See the department chairman for further information.) A particular program of study must be planned in consultation with a member of the chemistry faculty assigned by the department chairman as a temporary advisor. After students following Plan I select their thesis topic, a supervisory committee will be appointed.

Plan II. The requirement is for 33 or more semester hours of coursework, of which 18 hours must be in chemistry. The coursework must include the core sequence CH 531, 600, 631, 640, 642, and 561 or 621. CH 621 is preferred if students have not completed CH 421 or 521 at UAH or the equivalent elsewhere. Half of any coursework taken in departments other than chemistry must be at the 600 level or above. A particular program of study must be planned in consultation
with a member of the chemistry faculty assigned by the department chairman as an advisor. A final comprehensive examination is required, consisting of written examinations over each of two subdisciplines of chemistry. Foreign language proficiency is not obligatory, and a thesis is not required.

Because Plan II does not require any experimental work, it is not recommended for students seeking employment as industrial laboratory chemists.

**Doctor of Philosophy**

The Ph.D. in Chemistry may be obtained at UAH through co-operative study with the University of Alabama in Tuscaloosa (UA) or the University of Alabama in Birmingham (UAB). The Ph.D. requirements of the School of Graduate Studies and the Chemistry Department at either UA or UAB must be fulfilled. Consult the respective graduate catalogs. The following considerations are made for UAH cooperative students:

1. Only nine months of residency are required in Tuscaloosa or Birmingham.
2. Cumulative examinations may be taken at UAH.
3. Research may be done at UAH.
4. One or two UAH chemistry faculty members may serve on the dissertation committee.

**Undergraduate Chemistry Courses (CH)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>331</td>
<td>Organic Chemistry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>332</td>
<td>Organic Chemistry</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>333</td>
<td>Organic Chemistry</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>335</td>
<td>Organic Chemistry Laboratory I</td>
<td>1 hr.</td>
</tr>
<tr>
<td>336</td>
<td>Organic Chemistry Laboratory II</td>
<td>1 hr.</td>
</tr>
<tr>
<td>337</td>
<td>Organic Chemistry Laboratory III</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>341</td>
<td>Chemical Thermodynamics</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>342</td>
<td>Chemical Dynamics</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>343</td>
<td>Introduction to Quantum Chemistry</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>345</td>
<td>Experimental Physical Chemistry I</td>
<td>1 hr.</td>
</tr>
<tr>
<td>346</td>
<td>Experimental Physical Chemistry II</td>
<td>1 hr.</td>
</tr>
<tr>
<td>361</td>
<td>General Biochemistry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>362</td>
<td>General Biochemistry Laboratory</td>
<td>1 hr.</td>
</tr>
<tr>
<td>401</td>
<td>Inorganic chemistry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>421</td>
<td>Instrumental Analysis</td>
<td>4 hrs.</td>
</tr>
</tbody>
</table>
Graduate Chemistry Courses (CH)

521 Chemical Instrumentation 4 hrs.
Use of basic instrumentation in electrochemical, chromatographic, and spectrophotometric analysis. Laboratory work emphasis in general utility of operational amplifiers in making chemical measurements and introduction to digital logic. Lab fee: Level 4. Prerequisite: CH 346.

525 Environmental Chemistry 3 hrs.
Principles of quantitative analyses related to minor components of a sample. Applications selected from principal analyses necessary to maintain environmental quality of air, water, and soil. Selection of conditions for collecting reliable samples, concentration of components with techniques for increasing concentration of selected component, relationships between physical and chemical changes in sample and signal output of predominant transducers, and translation of chemical analysis into meaningful specifications. Lecture only. Prerequisite: CH 521 or 123; EG 311, 342.

531 Physical Organic Chemistry 3 hrs.
Introduction to theoretical organic chemistry. Bonding, methods for determining reaction mechanisms, reactive intermediates, and stereochemistry. Prerequisite: CH 333, 343, or approval of instructor.

540 High Polymer Chemistry 3 hrs.
Theory of polymer formation and structural dependence of polymer properties. Prerequisites: CH 337, 342.

549 Spectroscopy and Molecular Structure 3 hrs.
Intermediate level treatment of principles of spectroscopy and their application to determination of molecular structure. Prerequisite: CH 343.

553 Introductory Quantum Mechanics I 3 hrs.
Prerequisites: CH 343, PH 351, MA 244, 251, 352. (Same as PH 551).

554 Introductory Quantum Mechanics II 3 hrs.
Prerequisite: CH 553. (Same as PH 552).

560 X-Ray Structure Determination 4 hrs.
The course will examine both theoretical and practical aspects of molecular structure determination by x-ray diffraction methods. Topics include diffraction of x-rays, symmetry operations and space groups, methods of data collection, theory of structure factors and Fourier synthesis, least squares methods of structure refinement. Extensive laboratory and computer work included. Lab fee: Level 4. Prerequisites: senior standing in chemistry or physics and approval of the instructor.

561 Biochemistry I 3 hrs.
Structural chemistry and function of biomolecules, mechanisms of biochemical reactions, enzyme kinetics, and energy transfer. Prerequisite: CH 333 or CH 351. (Same as BYS 547).

562 Biochemistry II 3 hrs.
Metabolism, biosynthesis of macromolecular precursors, storage, transmission, and expression of genetic information, and molecular physiology. Prerequisite: CH 561. (Same as BYS 548).

565 Molecular Biochemistry Laboratory 2 hrs.
Practical experience in isolation and characterization of biomolecules. Lab fee: Level 4. Prerequisite: CH 562.

600 Advanced Inorganic Chemistry 3 hrs.
Survey with emphasis on structure and reactivity of inorganic compounds. Prerequisite: CH 401.
601 Structural Methods in Inorganic Chemistry 3 hrs.
Physical methods applied to determination of structure of inorganic compounds. Prerequisite: CH 600.

602 Chemistry of Coordination Compounds 3 hrs.
Modern bonding theory and stereochemistry of coordination compounds. Prerequisite: CH 600.

603 Chemistry of Nonmetal Compounds 3 hrs.
Chemistry of selected nonmetal compounds. Prerequisite: CH 601.

621 Methods of Chemical Analysis 3 hrs.
Literature, seminar course. Theory and methodology of various techniques of chemical analysis. Prerequisite: CH 521 or CH 421.

631 Advanced Organic Chemistry I 3 hrs.
Systematic study of reaction mechanism of various types of organic compounds. Prerequisite: CH 531.

632 Advanced Organic Chemistry II 3 hrs.
Complementary to previous courses. Special classes of compounds and natural products.

633 Synthetic Organic Chemistry 3 hrs.
Reactions and principles in synthesis of simple and complex organic compounds. Prerequisite: CH 632.

640 Advanced Chemical Thermodynamics 3 hrs.
First, second, and third laws of thermodynamics and applications. Brief introduction to statistical thermodynamics. Prerequisite: CH 343, MA 251, or approval of instructor.

641 Statistical Thermodynamics 3 hrs.
Principles leading to the development of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. Thermodynamic properties calculated from partition functions. Prerequisite: CH 640.

642 Advanced Chemical Dynamics 3 hrs.
Velocity of chemical reactions in homogeneous and heterogeneous systems. Absolute rate theory, collision theory, scattering, and concept of reaction cross sections. Prerequisite: CH 640.

643 Quantum Chemistry 3 hrs.
Application of quantum theory to the chemical bond. Prerequisite: CH 640.

661 Biological Macromolecules 3 hrs.
Detailed analysis of structures of proteins, nucleic acids, and complex polysaccharides. Prerequisite: CH 562.

699 Master's Thesis 3 or 6 hrs.
Required each term a student is working and receiving direction on master's thesis. Minimum of two terms required.

705 Selected Topics in Inorganic Chemistry 3 hrs.
Prerequisite: CH 600 and approval of instructor.

721 Selected Topics in Analytical Chemistry 3 hrs.
Prerequisite: CH 621 or equivalent and approval of instructor.

735 Selected Topics in Organic Chemistry 3 hrs.
Prerequisite: CH 633 and approval of instructor.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>745</td>
<td>Selected Topics in Physical Chemistry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Prerequisite: CH 643 and approval of instructor.</td>
<td></td>
</tr>
<tr>
<td>765</td>
<td>Selected Topics in Biochemistry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Prerequisite: CH 661 and approval of instructor.</td>
<td></td>
</tr>
<tr>
<td>780</td>
<td>Chemistry Seminar</td>
<td>1 hr.</td>
</tr>
<tr>
<td></td>
<td>Minimum of two terms required of students working toward M.S. degree.</td>
<td></td>
</tr>
<tr>
<td>799</td>
<td>Doctoral Dissertation</td>
<td>3, 6, or 9 hrs.</td>
</tr>
<tr>
<td></td>
<td>Required each term student is working and receiving direction on doctoral dissertation.</td>
<td></td>
</tr>
</tbody>
</table>
Computer Science

Degree: Master of Science
Doctor of Philosophy

Chairman: S. G. Shiva, Professor; artificial intelligence, VLSI design, distributed processing.

Professor: Johannes, J. D.; artificial intelligence, operating systems, text processing.

Associate Professors:
Amin, A. T.; fault tolerant computing, computer networks, artificial intelligence.
Hooper, J. W.; programming languages, simulation, software engineering.

Assistant Professors:
Choi, U. J.; databases, programming languages, operating systems.
Graves, S. J.; distributed processing, software engineering, algorithm analysis.
Ranganath, H. S.; image processing, pattern recognition, artificial intelligence.

Computer Science has become a central discipline for research and training in physical, biological, medical and social sciences, business and engineering. The department is dedicated to computer science education at the undergraduate and graduate levels through quality instruction and research. The graduate program in computer science, which is application-oriented rather than purely theoretical, prepares students for research in computer science and provides advanced training for those who wish to enter university, industry or government service.

The department uses the campus-wide computer system (UNIVAC 1100/70) and Sperry Personal Computers for instruction and research. It also has access to excellent computing facilities at NASA and BMD Systems Command. In addition, it has a Microcomputing Laboratory used for classes in logic design, computer architecture, and micro-computer system design. The laboratory contains several Motorola 6800 based micro-computers and Digi-designer stations.

Minors in Computer Science

Graduate students wishing to have a minor in computer science should take CS 513 and 517, observing the pre-requisites.

Admission Requirements

Requirements for admission to the program conform to policies of the School of Graduate Studies. In addition, the following courses are needed: (a) Mathematics: MA 153, 154, 233, 244 and 385; and (b) Computer Science: CS 108, 208, 214 or MA 440, 424, 490, 513 and 517. Additional coursework may be required to remove deficiencies in undergraduate studies.
A minimum score of 500 on the quantitative portion of the aptitude test of the GRE is required for unconditional admission. The advanced portion of the GRE is not required. The Miller Analogies Test is not acceptable.

**Master of Science**

The Master of Science degree is conferred under Plan I or Plan II. In addition, all students must take the following four core courses: CS 613 (Advanced Computer Architecture), CS 617 (Design and Analysis of Algorithms), CS 624 (Programming Languages), and CS 690 (Operating Systems). Typical minors (see below) are in Administrative Science, Computer Engineering, Engineering Management, Mathematics and Operations Research. Other minors may be approved by the chairman of the department.

**Plan I.** A minimum of 24 semester hours of coursework and the writing of an acceptable thesis. Coursework includes: (a) 15 to 18 semester hours of graduate credit in core and major elective courses, and (b) 6 to 9 hours of courses in an approved minor area. Students must pass a comprehensive final examination.

**Plan II.** A minimum of 33 semester hours, including: (a) 24 to 27 semester hours of graduate credit courses in core and major electives, (b) 6 to 9 semester hours of courses in an approved minor area. Students must pass a comprehensive final examination.

The following departmental policies also apply:

1. Courses numbered between 530 and 599 may be taken for graduate credit (with prior approval of the student’s advisor). To receive credit toward a master’s degree, students must attain a minimum grade of B in all core courses and in each CS course numbered less than 600. In addition, students must attain a B average in CS graduate courses.

2. A program of study must be planned in consultation with a member of the computer science faculty assigned by the department chairman as temporary advisor. The program of study is subject to approval by the Chairman of the Computer Science Department and the Dean of the School of Graduate Studies. After students following Plan I select their thesis topic, a supervisory committee will be appointed. For Plan II students a committee will be appointed just before the comprehensive examination.

**Doctor of Philosophy**

A statement of procedures for admissions and administration of the Ph.D. program in computer science may be obtained from the Computer Science Department office.

Admission to the Ph.D. program in computer science is dependent upon the performance in the preliminary examination. Students entering UAH with an M.S. Degree or previous graduate training are required to take the preliminary examination at their earliest opportunity.
Major/Minor Subjects

A minimum of 60 hours of graduate course credit (36 hours in the major and 24 hours in the minor) and 18 dissertation credit hours are required for the Ph.D. in computer science.

The major must include CS 530, 603, 613, 617, 624, and 690. A minimum of 15 additional semester hours must be selected from a single area (foundations of computer science, software systems, artificial intelligence, or computer architecture). At least 6 semester hours must be at the 700 level.

The minor must include 9 semester hours of graduate-level mathematics, 15 hours outside of one of the four main areas (see above), and be approved by the candidate's advisory committee.

Admission to Candidacy

To be admitted to candidacy for the Ph.D. degree, students must first pass the qualifying examination. Prior to taking this examination, applicants must be considered adequately prepared in the major and minor fields by the advisory committee. Additionally, the following requirements must be satisfied:

(a) completion of at least 18 semester hours of graduate coursework in residence at UAH,

(b) Completion of the language requirements as outlined by the School of Graduate Studies.

The qualifying examination may be taken no more than twice; it is designed to test students' fitness for pursuing a research project in their chosen areas and to test their general knowledge of computer science.

Dissertation

A significant portion of the dissertation must be submitted for publication in an approved journal with international circulation.

Undergraduate Courses (CS)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>415</td>
<td>Introduction to Digital Computer Design</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>424</td>
<td>Introduction to Programming Languages</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>470</td>
<td>Computer Applications in Economics and Business II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>490</td>
<td>Systems Software</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>499</td>
<td>Senior Project</td>
<td>3 hrs.</td>
</tr>
</tbody>
</table>
Special Courses (CS)

The following courses serve as prerequisites for students entering the Computer Science graduate program. They are not open to Computer Science undergraduates and cannot be taken for credit by Computer Science undergraduate and graduate majors. They can be included in a graduate minor by non-CS majors.

513 Computer Architecture 3 hrs.
Review of combinational and sequential logic design, register transfer concept, logic design of memory, arithmetic unit, control unit, and I/O system of simple computer. Architectural trade-offs; representative computer architectures including a micro-, mini-, and large-scale computer system. Lab fee: Level 4. Prerequisites: CS 490.

517 Data Structures 3 hrs.
Basic concept of data, Linear lists, sublists, strings, arrays, queues, stacks, trees and graphs. Storage systems and structures and storage allocation and collection. Efficient algorithms for creating, sorting, merging, searching structured data. Formal specification of data structures, data structures in programming languages, and generalized data-management systems. Lab fee: Level 3. Prerequisite: CS 490.

Graduate Courses (CS)

530 Artificial Intelligence 3 hrs.
Basic methodologies and techniques, heuristic search, modeling and representation of knowledge, deduction and problem solving, languages and system. Some application areas; automatic programming, robots, machine vision, natural language systems, automatic-theorem proving, game playing, and information-processing psychology. Lab fee: Level 3. Prerequisite: CS 317 or approval of instructor.

586 Microprocessor Architecture 3 hrs.
History of microprocessors and typical applications; architecture; four, eight, and sixteen bit processors, register and bus structures, I/O and interrupt structures; memories: RAM, and ROM. Instruction sets, addressing modes, stacks, interfacing fundamentals; programming and interfacing projects. Lab fee: Level 3. Prerequisite: CS 415 or 513.

603 Formal Languages and Automata Theory 3 hrs.
Formal definition of programming languages. Definition of formal grammars: regular, context-free and context sensitive phrase-structure. Definition of automata: finite-state, pushdown, linear-bounded automata, Turing Machines. Relationship between formal languages and automata. Lab fee: Level 3. Prerequisite: CS 214 and 624 or approval of instructor.

612 Compiler Design 3 hrs.
Review of programming language structures, translation, loading, execution, and storage allocation. Compilation of expressions and statements; organization of a compiler including compile-time and run-time symbol tables, lexical analysis, syntax analysis, object-code generation and error diagnostics. Compiler writing tools: Lab fee: Level 3. Prerequisite: CS 624.

613 Advanced Computer Architecture 3 hrs.
Associative, parallel, and pipeline architectures; multiple processor systems, and concepts of high-order language architectures. Computer networks, performance evaluation, selected architectures including micro-, mini-, and large-scale computer systems. Lab fee: Level 3. Prerequisite: CS 415 or CS 513.

617 Design and Analysis of Algorithms 3 hrs.
Strategies of algorithm synthesis and analysis. Design methodologies of classical algorithm categories such as: divide-and-conquer, greedy method, dynamic programming, search and traversals, back-tracking, and branch-and-bound. Computational complexity and important theoretical results from lower- and upper-bound studies, NP-hard and NP-complete problems. Lab fee: Level 3. Prerequisite: CS 317 or CS 517.
624 **Programming Languages** 3 hrs.
Definition and classification of programming languages. Concepts, designs, and use of languages, such as block-structured, string-processing, and list-processing languages. Unified approach to general-purpose languages, comparative analysis of languages, and design of a specific language. Recent developments; syntax, and semantics. Lab fee: Level 3. Prerequisite: CS 424 and CS 317 or CS 517.

640 **Automatic Pattern Recognition** 3 hrs.
Discriminant analysis, maximum likelihood decisions, deterministic and non-deterministic approaches for trainable classifiers, preprocessing and feature extraction, clustering, syntactic pattern recognition. Pattern recognition in image analysis. Lab fee: Level 3. Prerequisites: MA 244, 385.

642 **Computer Processing of Digital Images** 3 hrs.
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. Lab fee: Level 3. Prerequisites: MA 244, MA 385.

645 **Interactive Computer Graphics** 3 hrs.
Interaction graphics application program fundamentals. User friendly interactive dialogue design, hardware and software concepts-windowing, clipping, and logical interaction handling; data structures and geometric transformation useful for modeling objects especially in hierarchical form; device independent algorithms as well as shading, texturing and models for representing color in realistic synthetic photographs. Evolution of display processor architecture with respect to functional distribution. Lab fee: Level 4. Prerequisites: CS 624, 640.

650 **Software Engineering** 3 hrs.
Life-cycle stages of a software system, including requirements, design, implementation, testing, and maintenance. Project management issues. Software design, structured programming, and program testing techniques in software system development. Projects to illustrate software engineering advancements. Lab fee: Level 3. Prerequisite: CS 624.

686 **Microcomputer Systems** 3 hrs.
Systems study including standard peripheral interfacing, analog interfacing, design, development and implementation of firmware, bi-polar slice sequence control, high speed fixed and floating point arithmetic units. Cross assemblers, down loaders, and large machine interfacing. One or more system design projects using extant devices in the micro-computing laboratory. Lab fee: Level 4. Prerequisite: CS 586 or equivalent.

687 **Data Base Systems** 3 hrs.

690 **Operating Systems** 3 hrs.
Techniques of constructing operating system control programs including management of system, jobs, and data; multiprogramming, multiprocessing, and timesharing systems. Lab fee: Level 3. Prerequisite: CS 617.

695-698 **Selected Topics in Computer Science** 3 hrs.
Courses in special topics requested by students. Prerequisites: approval of instructor.

699 **Master's Thesis**
Required each term student is working and receiving direction on master's thesis. Minimum of two terms is required. Maximum of 9 hours of credit upon successful completion of master's thesis.
703 Theory of Programming Languages 3 hrs.
Syntactic analysis and semantic interpretation of programming languages based on research
and results in formal languages and associated compiler techniques. Identification of
research directions and potential research projects in programming languages. Lab fee:
Level 3. Prerequisite: CS 603.

713 Distributed Processing systems 3 hrs.
Computer network configurations, communication protocols, and architectural tradeoffs;
distributed data bases; operating systems and software issues. Reconfiguration, recovery,
and reliability, specification and design of distributed systems: case studies. Prerequisites:
CS 613 and 690.

730 Advanced Artificial Intelligence and Heuristic Programming 3 hrs.
Definition of heuristic versus algorithmic methods, rationale of heuristic approach, description
of cognitive processes, and approaches to mathematical induction. Heuristic programming
techniques including use of list-processing languages. Class and individual projects to
illustrate concepts. Lab fee: Level 3. Prerequisites: CS 530 and 624.

735 Computer Vision 3 hrs.
The construction of explicit, meaningful descriptions of physical objects from images.
Generalized and segmented images and image-like entities, geometric structures expressed
as quantitative models of images. Relational structures using knowledge bases and symbolic
descriptions and understanding via matching, inference and goal achievement. Lab fee:
Level 4. Prerequisites: CS 530, CS 640.

742 Image Processing Algorithms and Architectures 3 hrs.
Algorithms and data structures for image enhancement, segmentation, object recognition and
image sequence analysis; real-time versus non real-time image processing; computer
architectures for fast image processing; cellular logic array processors, distributed array
processors, systolic array processors; binary array processors, etc. Lab fee: Level 4.
Prerequisites: CS 642, CS 613.

750 Advanced Software Engineering 3 hrs.
Experimental framework of software engineering. Design of experiments to evaluate
different methods and techniques in software development, operation, and maintenance.
Quality and productivity issues. Review of current literature. Student-design software
engineering experiments as course project. Lab fee: Level 3. Prerequisite: CS 650.

760 Pattern-Directed Inference Systems 3 hrs.
Studies of concept information, language understanding, problem solving, inferential
reasoning, and memory organization as applied to pattern-directed inference systems.
Theory as well as design and implementation issues in pattern-directed inference systems.
Lab fee: Level 4. Prerequisites: CS 730.

790 Advanced Operating Systems 3 hrs.
Time-sharing and distribution queuing models, models of program behavior, concurrence,
multilevel memory allocation and paging, algorithms, analysis of file structures and I/O
scheduling. Measurement techniques and analysis. Lab fee: Level 4. Prerequisite: CS 690.

795-798 Advanced Selected Topics 3 hrs.
Courses in special topics requested by students. Prerequisite: approval of instructor.

799 Doctoral Dissertation
Required each term student is working and receiving direction on doctoral dissertation.
Maximum of 18 hours credit.
Environmental Science (Non-degree Program)

Acting Coordinator: Modlin, R. F.; Associate Professor, Biological Sciences; Physiological ecology and environmental analysis.

Faculty: Faculty members for this program have academic appointments in established University programs and local industry. University programs include Biological Sciences, Chemistry, Engineering, and the Johnson Environmental and Energy Center.

Environmental Science courses are taken as part of a minor, as part of a certificate program in environmental science, as part of a composite major, and as electives. The certificate program prepares scientists, mathematicians, and engineers to solve problems relating to man’s interaction with the natural environment. The certificate is a supplement to the master’s degree or doctorate. It signifies that holders have broadened their perception of the physical and organic environment by studying the entire spectrum of natural science and by specializing in environmental aspects of their field.

Requirements for a Minor/Certificate in Environmental Science:

Minors and certificates in environmental science may be earned by students in any field with the approval of the student’s advisor. Individual advisors will tailor programs to meet the student’s educational needs.

Environmental Science (ES)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>512</td>
<td>Environmental Transport</td>
<td>3 hrs</td>
</tr>
<tr>
<td></td>
<td>Prerequisites: PH 101, 102. MA 154.</td>
<td></td>
</tr>
<tr>
<td>521</td>
<td>Environmental Data Analysis</td>
<td>3 hrs</td>
</tr>
<tr>
<td></td>
<td>Overview of computer hardware, software, communications, and terminals. Univac control languages, management information systems, overview of techniques of modeling, and simulation as applied to air, water, and noise pollution. Prerequisites: computer programming, systems analysis, and statistics.</td>
<td></td>
</tr>
<tr>
<td>525</td>
<td>Environmental Chemistry</td>
<td>3 hrs</td>
</tr>
<tr>
<td></td>
<td>Principles of quantitative analyses related to minor components of a sample. Applications selected from principal analyses necessary to maintain environmental quality of air, water, and soil.</td>
<td></td>
</tr>
<tr>
<td>553</td>
<td>Atmospheric Radiation</td>
<td>3 hrs</td>
</tr>
<tr>
<td></td>
<td>Principals of radiative transfer, blackbody radiation, absorbitivity-emissivity characteristics of the atmosphere, atmospheric optics, plane parallel models, clouds.</td>
<td></td>
</tr>
<tr>
<td>593</td>
<td>Directed Studies in Environmental Science</td>
<td>1-4 hrs</td>
</tr>
<tr>
<td></td>
<td>Supervised compilation, summarization, and discussions of environmental investigations, regulations, and topics. Examples of directed studies include: ATMOSPHERIC PHYSICS, ENVIRONMENTAL BIOPHYSICS, ATMOSPHERIC DYNAMICS, ATMOSPHERIC THERMODYNAMICS.</td>
<td></td>
</tr>
<tr>
<td>663</td>
<td>Advanced Topics in Atmospheric Science</td>
<td>1-3 hrs</td>
</tr>
<tr>
<td></td>
<td>To include Satellite and Radar Meteorology and Numerical Atmospheric Modeling.</td>
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</tbody>
</table>
Mathematics and Statistics

Degrees: Master of Science
Master of Arts
Doctor of Philosophy in cooperation with The University of Alabama, Tuscaloosa.

Chairman: P. M. Gibson, Professor; linear algebra, combinatorics.

Professors:
Doss, D.C.; statistics.
Hoomani, J.; combinatorics, statistics.

Associate Professors:
Chang, M.H.; probability, optimal control theory, stochastic processes.
Cook, F.L.; mathematical modeling, differential equations, orthogonal polynomials.
Forte, A.; geometry, group theory, number theory.
Slater, P.J.; graph theory, combinatorics, computer graphics.

Assistant Professors:
Castellano, B.M.; computer graphics, topology, topological algebra.
Cromer, T.L.; integral equations, mathematical modeling of epidemics.
Dow, S.J.; combinatorics, geometry.
Howell, K.B.; elasticity theory, partial differential equations.
Krishna, K.; numerical analysis.
Morales, C.; functional analysis, operator theory.
Siegrist, K.T.; probability, stochastic processes, reliability theory.
Welstead, S.T.; integral equations, orthogonal polynomials, difference equations.

The graduate program in the Department of Mathematics and Statistics fosters advanced mathematical education through closely integrated instruction and research. The program’s options and concentration areas lead students to examine in greater depth those concepts and techniques introduced at the undergraduate level and further expose them to more sophisticated concepts and techniques. Because the faculty considers that mathematics majors should effectively apply their training to today’s technological problems, special emphasis is given to applied mathematics.

Admission Requirements

In addition to fulfilling School of Graduate Studies admission requirements, all applicants for graduate study in mathematics should have completed the equivalent of a complete calculus sequence, a linear algebra course, MA 440, MA 502, and 6 additional hours in upper-division mathematics courses. Students deficient in more than two undergraduate courses in mathematics must remove these deficiencies before admission to the mathematics program. Such students should consult the chairman of the department on how best to remove these deficiencies.
For unconditional admission, applicants must satisfy requirements of the School of Graduate Studies. Only the aptitude portion of the Graduate Record Examination (GRE) is required by the department. The Miller Analogies Test, administered regularly on campus, is accepted by the department in lieu of the GRE for conditional admission.

**Degree Requirements**

Entering graduate students will have a variety of mathematical backgrounds and goals. Consequently, programs of study leading to the M.A. or M.S. degree can vary considerably. For the M.S. degree, a program of study must include a minor area in the School of Science or the School of Engineering. For the M.A. degree, a minor area is not required. All minors must be outside of mathematics and must include at least 6 hours of approved graduate coursework.

Each graduate student is assigned an advisor who works closely with the student to design an individualized program to meet the student's needs and the School of Graduate Studies requirements. Programs that include a thesis (Plan I) require at least 24 hours of coursework. Programs without a thesis (Plan II) require at least 33 hours of coursework. Students should explore with their advisor which plan is better for their particular objectives. For example, students who believe they might seek a Ph.D. degree, whether in mathematics or another area, should give serious consideration to writing a thesis as part of their program of study.

**Master of Science, Master of Arts, Doctor of Philosophy**

The graduate faculty offers courses in mathematics (MA) and statistics (ST) to satisfy the requirements for M.A. and M.S. degrees in mathematics and to satisfy individual needs for courses to supplement other areas of study.

The Ph.D. in Mathematics can be earned through a cooperative program with the Tuscaloosa campus. In that program, all but two semesters of coursework can be taken at UAH. The dissertation advisor can be a member of the UAH faculty. Students interested in the cooperative Ph.D. program should contact the Chairman of the Mathematics and Statistics Department for details.

Four main groups of M.A., M.S., or Ph.D. students have been identified:

(a) Those who plan to work in industry or government and will need considerable depth in areas of probability and statistics. A non-thesis program might be MA 544, 570, 585, 653, 656, 685, ST 687, MA 686 or ST 787, and three approved elective courses.

(b) Those who plan to work in industry or government and will need depth, breadth, or both in other applicable areas. For a student desiring a broad general background, a non-thesis program might be MA 526, 542, 544, 570, 585, 615, 625, 640, 656, and two approved elective courses. For a student who wishes to concentrate in numerical analysis, a non-thesis program might be MA 515, 525, 526, 544, 570, 614, 615, and four approved elective courses. Other concentration areas could be differential equations, optimization, or combinatorics and graph theory.
(c) Those who plan to concentrate their studies in mathematical areas that do not directly relate to problems in industry or government. A non-thesis program might be MA 542, 570, 653, 656, 671, two of MA 643, 644, 670, 754, 756, and four approved elective courses.

(d) Those teachers who hold the Class B Middle/Junior High or Secondary School Teacher’s Certificate and who wish to earn the Class A Teacher’s Certificate. A non-thesis program might be MA 542, 544, 570, 585, 614, 633, ST 687, 9 hours of appropriate education courses, and one approved elective course.

A sample thesis program for a student in group (a), (b), or (c) would include some of the courses listed above and a thesis. A thesis would be included instead of the additional coursework required in a nonthesis program.

**Undergraduate Mathematics Courses (MA)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>415</td>
<td>Introduction to Numerical Analysis I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>425</td>
<td>Introduction to Mathematical Modeling</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>440</td>
<td>Algebraic Structures with Applications</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>452</td>
<td>Introduction to Real Analysis (See MA 502)</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>490</td>
<td>Selected Topics in Undergraduate Mathematics</td>
<td>1-3 hrs.</td>
</tr>
</tbody>
</table>

**Graduate Mathematics Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>502</td>
<td>Introduction to Real Analysis</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Sequences, limits, continuity, differentiation of functions of one real variable, Riemann integration, uniform convergence, sequences and series of functions, power series, and Taylor series. Prerequisite: MA 352 or 440 or approval of instructor.</td>
<td></td>
</tr>
<tr>
<td>515</td>
<td>Introduction to Numerical Analysis II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Numerical solution of ordinary differential equations, solution of linear and nonlinear algebraic systems, iterative methods in matrix algebra, error analysis, and convergence properties of selected methods. Lab fee: Level 3. Prerequisites: MA 244, 352, MA 415 or EG 396, CS 113 or equivalent.</td>
<td></td>
</tr>
<tr>
<td>521</td>
<td>Introduction to Complex Analysis</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>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. Prerequisite: MA 502 or approval of instructor.</td>
<td></td>
</tr>
<tr>
<td>525</td>
<td>Intermediate Differential Equations</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Systems of linear ordinary differential equations, first order systems with constant coefficients, plane autonomous systems, stability, and selected topics related to properties and characterization of solutions. Prerequisite: MA 352 or approval of instructor.</td>
<td></td>
</tr>
<tr>
<td>526</td>
<td>Partial Differential Equations I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Systems of first order ordinary differential equations, first order quasilinear partial differential equations, general first order partial differential equation by Cauchy’s method of characteristics, higher-order equations, canonical forms, separation of variables, Fourier series, wave equation, heat equation, and potential equation. Prerequisite: MA 352.</td>
<td></td>
</tr>
<tr>
<td>527</td>
<td>Vector Analysis</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Brief review of vector algebra and calculus of vector-related functions, representation of vector operators in curvilinear coordinates, line and surface integrals, theorems of Gauss, Green, and Stokes, Jacobian, and changes of variables in multiple integrals. Prerequisite: MA 352 or approval of instructor.</td>
<td></td>
</tr>
</tbody>
</table>
530 Introduction to Fourier Analysis 3 hrs.
Fourier series and Fourier transforms with emphasis on the one- and two-dimensional transform. Topics include the basic properties of the Fourier transform, the computation and analysis of the transforms of various functions and functionals, Green’s functions, convolution, and applications. Prerequisites: MA 244, 352.

534 Introduction to Integral Equations 3 hrs.
Volterra equations, convolution equations, the resolvent, Fredholm equations, Green’s functions, the Fredholm alternative, and approximate methods of solution. Prerequisites: MA 244, 352.

540 Combinatorics 3 hrs.
Counting, pigeonhole principle, permutations and combinations, generating functions, principle of inclusion and exclusion, Polya’s theory of counting. Prerequisite: MA 440 or approval of instructor.

542 Algebra 3 hrs.
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. Prerequisite: MA 440 or approval of instructor.

544 Linear Algebra 3 hrs.
Vector spaces, bases, linear transformations, matrices, determinants, eigenvalues, similarity, matrix limits, dual spaces, bilinear forms, quadratic forms, orthogonal and unitary transformations. Prerequisites: MA 244 and at least one MA course at 300 level or above.

551 Functions of Several Variables 3 hrs.
Topology of $\mathbb{R}^n$, limits, continuity, and differentiation of functions of several real variables, Jacobians, implicit function and inverse function theorems, Riemann integration of functions of several real variables, and change of variables theorem for multiple integrals. Prerequisite: MA 502.

570 Metric Spaces with Applications 3 hrs.
Basic metric spaces, continuous functions, compactness, connectedness, completeness, Arzela-Ascoli theorem, Stone-Weierstrass theorem, contraction mappings, applications to existence and uniqueness of solutions of differential and integral equations. Prerequisites: MA 502, 551 or approval of instructor.

585 Probability 3 hrs.
Probability theory and its applications. Independent trials, discrete and continuous random variables, law of large numbers, basic distributions, sums of independent random variables, sequences of random variables, central limit theorem, and convergence in distribution. Prerequisites: MA 251 and one of MA 385, EG 390, ST 281, or approval of instructor.

590 Selected Topics in Mathematics 3 hrs.
Courses in requested selected topics. Prerequisite: Approval of instructor.

614 Numerical Methods for Linear Algebra 3 hrs.
Norms and vector spaces, matrix factorizations and direct solution methods, least squares methods, stability and conditioning, iterative refinement and updating decompositions, algebraic eigenvalue problems, and QR algorithms. Lab fee: Level 4. Prerequisites: MA 415 or equivalent, MA 544, CS 113 or equivalent.

615 Numerical Methods for Partial Differential Equations 3 hrs.
Finite difference methods for parabolic, elliptic, and hyperbolic partial differential equations, error analysis, stability, and convergence of finite difference methods. Lab fee: Level 4. Prerequisites: MA 415 or equivalent, MA 526 or equivalent, CS 113 or equivalent.

621 Special Functions 3 hrs.
Gamma and beta functions, probability integral and applications, orthogonal polynomials, Bessel functions and their applications, spherical harmonics and their applications, hypergeometric functions. Prerequisite: MA 521.

151
625 Calculus of Variations 3 hrs.
Problems in calculus of variations, necessary and sufficient conditions for extrema of a
definite integral in both parametric and nonparametric representations in the plane, Bolza
problem. Prerequisite: MA 502 or approval of instructor.

626 Partial Differential Equations II 3 hrs.
Potential theory, variational and transform methods, integral equations, perturbation theory,
and special topics in the theory of partial differential equations and their applications.
Prerequisite: MA 526.

633 Geometry 3 hrs.
Axioms of incidence and order, affine structure of the plane, metric properties, isometries,
similarity transformations, the group of angles, orientation. Prerequisites: MA 440, 544 or
approval of instructor.

640 Graph Theory 3 hrs.
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
542.

643 Group Theory 3 hrs.
Isomorphism theorems, permutation groups, basis theorem and fundamental theorem for
finite abelian groups, the Remak-Krull-Schmidt theorem, Sylow theorems, normal series,
solvable groups, extensions, and selected topics in representation theory. Prerequisite: MA
542.

644 Matrix Theory 3 hrs.
Functions of matrices, invariant polynomials, elementary divisors, similarity of matrices,
normal forms of a matrix, matrix equations, generalized inverses, non-negative matrices,
localization of eigenvalues. Prerequisite: MA 544.

652 Advanced Differential Equations 3 hrs.
Approximate methods, oscillations and periodic solutions, stability and Liapunov theory,
delay equations, and selected topics. Prerequisite: MA 502, 525.

653 Real Analysis I 3 hrs.
Characterization of open and closed sets, Lebesgue measure of open, closed, G-delta and
F-sigma sets, sigma algebra of measurable sets, measurable functions, theorems of Riesz,
Egorov, and Luzin, sequences of measurable functions, Riemann integral, Lebesgue integral
of bounded, nonnegative functions and of general measurable functions, Fatou’s lemma,
and Lebesgue-dominated convergence theorem. Prerequisite: MA 570 or MA 551 and one
MA course at the 540 level or above.

656 Complex Analysis I 3 hrs.
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. Prereq-
uisites: MA 502, 551 or approval of instructor.

670 Introduction to Functional Analysis 3 hrs.
Normed and inner product spaces, finite dimensional spaces, product and quotient spaces,
equivalent norms, Hahn-Banach theorem, principle of uniform boundedness, open-mapping
theorem, Riesz representation theorem, complete orthonormal sets, Bessel’s inequality,
Parseval’s identity, and conjugate spaces. Prerequisite: MA 570.

671 General Topology 3 hrs.
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. Prerequisite: MA 570.
685 Stochastic Processes with Applications I
Discrete and continuous Markov chains, Poisson processes, counting and renewal processes, and applications. Prerequisites: MA 585, 244 or approval of instructor.

686 Stochastic Processes with Applications II
Gaussian and Wiener processes, general Markov processes, special types of processes from queueing and risk theory, and selected advanced topics. Prerequisite: MA 685 or approval of instructor.

690 Special Topics in Mathematics
Courses in requested special topics. Prerequisite: Approval of instructor.

699 Master's Thesis
Required each term a student is working and receiving direction on his master's thesis. A minimum of two terms is required for Plan I MA students. Maximum of 9 hours credit awarded upon successful completion of the master's thesis.

754 Real Analysis II
Vitali's covering theorem, differentiability of monotone functions, functions of bounded variation, absolute continuity, Lebesgue integral of derivative of an absolutely continuous function, Minkowski and Hölder inequalities, $L^p$ spaces, Riesz-Fischer representation theorem, abstract measure spaces, equivalence and singularity of measures, Radon-Nikodym theorem, Fubini's theorem, signed measures, and selected topics. Prerequisite: MA 653.

756 Complex Analysis II
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. Prerequisite: MA 656 or approval of instructor.

790 Graduate Seminar
Selected topics for students in the cooperative PhD program. Prerequisite: Approval of instructor.

799 Doctoral Dissertation
Required each term a student is working and receiving direction on his Ph.D. thesis in the cooperative Ph.D. program. Prerequisite: Approval of instructor.

Statistics (ST)

687 Theory of Statistics I
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. Prerequisites: MA 244, 585.

787 Theory of Statistics II
Continuation of hypothesis testing, likelihood ratio and unbiased tests, uniformly most powerful tests, power function, nonparametric tests, statistical decision theory, distribution and linear models. Prerequisite: ST 687.
Physics

Degrees
Master of Science
Doctor of Philosophy

Chairman
Smalley, L. L., Professor; theoretical physics, general relativity.

Professors
Barr, T. A.; experimental physics, laser physics.
Chan, C. H.; theoretical physics, quantum electronics.
Duthie, J. G. M. (Adjunct); astronomy, optics.
Hendricks, J. B.; experimental physics, low temperature, superconductivity.
McKnight, W. B.; experimental physics, laser, quantum electrons.
Sung, C.C.; theoretical physics, solid state.
Tandberg-Hanssen, E. A. (Adjunct); astrophysics, solar physics.
Wu, S. T. (Adjunct); aerospace engineering, solar physics, plasma dynamics.

Associate Professors
Bartell, F. O.; Optics, Radiometry, Infrared.
Comfort, R. H.; Atmospheric and magnetospheric physics.
Davis, J. H.; Experimental physics, solid state.
Emslie, A. G.; Theoretical physics, solar physics.
Fennelly, A. J.(Adjunct); Theoretical physics, optics gravitation physics.
Horwitz, J. L.; Atmospheric and magnetospheric physics.

Assistant Professors
Olsen, R. C.; Atmospheric and magnetospheric physics.
Paciesas, W. S.; X-ray and gamma-ray astronomy.
Stone, N. H. (Adjunct); solar physics, magnetospheric physics.
Wu, M. K.; Solid state physics.

The undergraduate program provides a broad base in physical principles for a terminal, professional degree in physics while the graduate program provides a smooth transition to a more comprehensive and rigorous treatment of physical principles. The physics curriculum is broad-based through the master's degree, thereupon narrowing into sub-fields and specializations for doctoral studies.

The Department of Physics recognizes three broad areas of emphasis in basic and applied research:

1. Space sciences including studies of magnetospheric physics, atmospheric physics, solar physics, solarterrestrial physics, astrophysics, low-temperature physics, relativity, plasma physics and zero g effects.
2. Solid state/materials including studies of critical phenomena, crystal growth, electromagnetic properties of matter, thermal properties of materials, electron spin resonance, and solid state theory.
3. Optics/quantum electronics including studies of laser physics, propagation, laser media and materials, optical properties of matter and electromagnetic scattering.

Degree Requirements

Besides meeting the requirements established by the School of Graduate Studies for advanced degrees, the Physics Department requires a) the advanced portion of the GRE for unconditional admission, and b) a departmental placement examination to be given during the first term of graduate study. Normally, students must take both, but under special circumstances the advanced portion of the GRE may be substituted for the placement exam. The placement examination is administered to help advisors and students determine the best course of study. It should be followed by the completion of a program of study.

Master of Science

Students must take PH 792 (Physics Seminar) for two terms. Two options are available for the Master of Science degree under Plan II.

A. Theoretical Physics Option: PH 601, 622, and 631 are required. PH 732, 751, 752 are also recommended. This option is designed for students who desire to complete course requirements early for an advanced degree program.

B. Applied Physics Option: PH 601, 622, and 631 are required and at least three additional courses which stress applications to various branches of physics. Since many of these topics involve current theory and research, advance topics normally occur under the heading Selected Topics. Frequently offered selected topics courses include Fourier optics, laser physics, electron-spin, resonance, microwave properties of solids, physics of plasmas, superconductivity. These additional courses can best be arranged through consultation with the adviser.

Each candidate for the Master of Science degree must also pass the comprehensive examination, which is normally administered during spring term.

The physics faculty encourages students to carry out programs of study oriented toward applied physics. For this purpose, selected topics courses, PH 680-689 and PH 780-789 are offered frequently in areas such as laser physics, properties of materials, and phases of matter.

Doctor of Philosophy

A statement of procedures for admission to the Ph.D. program in physics may be obtained from the Physics Department office.

Admission to the Ph.D. program in physics is dependent on performance on the Master of Science Comprehensive Examination. Students entering UAH with an M.S. degree or previous graduate training in physics must take the UAH Comprehensive Examination at their earliest opportunity.

A minimum of 48 hours of graduate course credit is required for the Ph.D. in physics. PH 601, 622, 631, 732, 751, 752 and a minimum of 12 credit hours in courses numbered 600 or above must be taken. Students in the Ph.D. program are required to take PH 792 (Physics Seminar) for three terms. Courses in addition to
those enumerated above are selected in consultation with student's advisory committee. Transfer of credit from other institutions requires approval of the graduate faculty in physics. Although a minor subject is not required, students are encouraged to develop an interdisciplinary program of study.

The Physics Department requires a score of 35th percentile or better in each language on the Graduate School Foreign Language Tests administered by the Educational Testing Service. To show in-depth knowledge of one language, students must score in the 65th percentile or better on the ETS examination.

After having earned 42 hours of graduate credit, students must then pass the departmental qualifying examination. However, the department may require the examination after two or more years of full-time graduate work or the equivalent in part-time work. This examination may be taken no more than twice. It tests students' general fitness for pursuing a research project in their chosen area and their general knowledge of physics.

Finally, a significant portion of the dissertation must be submitted for publication in an approved journal with international circulation.

**Physics (PH)**

Prerequisites for physics courses listed may be waived by instructor or department chairman for auditors or student with equivalent experience. Undergraduate courses (see general UAH Undergraduate Catalog for complete description).

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>321</td>
<td>Thermal and Statistical Physics</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>323</td>
<td>Energy Studies</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>331</td>
<td>Intermediate Electricity and Magnetism I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>337</td>
<td>Electronics</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>342</td>
<td>Geometrical Optics I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>343</td>
<td>Physical Optics I with Laboratory</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>351</td>
<td>Quantum Physics</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>401</td>
<td>Intermediate Mechanics</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>431</td>
<td>Intermediate Electricity and Magnetism II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>442</td>
<td>Geometrical Optics II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>444</td>
<td>Electro-Optics</td>
<td>3 hrs.</td>
</tr>
</tbody>
</table>

**Graduate Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>506</td>
<td>Introduction to Astrophysics of Stellar Systems</td>
<td>3 hrs.</td>
</tr>
</tbody>
</table>

Analysis of structure of main sequence stars; radiation theory, color-magnitude diagrams and their interpretation. Dynamics of simple and many-body systems - the restricted 3-body problem, Hamilton-Jacobi methods, Liouville's and Jean's theorems and their application to galactic structure. General relativity and application to cosmology. Prerequisites: PH 401, MA 352. Spring.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>521</td>
<td><strong>Thermal Physics</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Thermal phenomena on macroscopic and statistical basis and principles and laws governing them. Prerequisite: PH 431. Summer.</td>
<td></td>
</tr>
<tr>
<td>531</td>
<td><strong>Introduction to Plasma dynamics</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td>536</td>
<td><strong>Introduction to Space Physics</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Charged Particles in electric and magnetic fields, cosmic rays and trapped radiation; introduction to plasmas, including collisions and macroscopic effects. Prerequisite: PH 321, 431. Spring.</td>
<td></td>
</tr>
<tr>
<td>541</td>
<td><strong>Optics I</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Geometrical optics review. Physical optics: interference, diffraction, partial coherence, polarization, interaction of radiation with matter. Prerequisite: PH 431. Fall.</td>
<td></td>
</tr>
<tr>
<td>545</td>
<td><strong>Introduction to Lasers</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td>551</td>
<td><strong>Introductory Quantum Mechanics I</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Background of quantum theory, wave-particle duality and uncertainty principle, basic postulates of quantum mechanics, angular momentum and spin; simple systems in one, two, and three dimensions. Perturbation theory, scattering theory, applications. Prerequisites: PH 351, 401, 431. Fall. (Same as CH 553).</td>
<td></td>
</tr>
<tr>
<td>552</td>
<td><strong>Introductory Quantum Mechanics II</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Continuation of PH 551. Prerequisite: PH 551. Winter. (Same as CH 554).</td>
<td></td>
</tr>
<tr>
<td>601</td>
<td><strong>Classical Dynamics I</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td>607</td>
<td><strong>Mathematical Methods I</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Review 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. Prerequisite: MA 521. Fall.</td>
<td></td>
</tr>
<tr>
<td>609</td>
<td><strong>Mathematical Methods II</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Orthogonal functions, Gamma functions, Bessel functions, Legendre functions, special functions, Fourier series, integral transforms and equations. Prerequisite: 607. Winter.</td>
<td></td>
</tr>
<tr>
<td>622</td>
<td><strong>Kinetic Theory and Statistical Mechanics I</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Theomodynamics review, kinetic theory, classical statistical mechanics, canonical and grand canonical ensembles, quantum statistical mechanics, Bose and Fermi statistics, partition function. Prerequisites: PH 521, 552, MA 521. Fall.</td>
<td></td>
</tr>
<tr>
<td>631</td>
<td><strong>Electromagnetic Theory I</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td>641</td>
<td><strong>Optics II</strong></td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Continuation of PH 541. Selected topics from advanced optics, Fresnel and Fraunhofer diffraction, theory of aberrations, theory of partial coherence including laser applications.</td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
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</tr>
<tr>
<td>644</td>
<td>Radiometry</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>702</td>
<td>Classical Dynamics II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>711</td>
<td>Problems in Physics I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>751</td>
<td>Quantum Mechanics I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>753</td>
<td>Quantum Mechanics III</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
<tr>
<td>760</td>
<td>Solid State Physics I</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Semiconductor crystals, superconductivity, dielectric polarization, ferroelectric crystals, diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, magnetic resonance, optical phenomena in insulators, point defects and dislocations. Prerequisite: PH 660 or equivalent. Prerequisite or parallel: PH 631. Spring.</td>
<td></td>
</tr>
<tr>
<td>761</td>
<td>Solid state Physics II</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>Continuation of PH 760. Selected topics from quantum theory of solid state physics including many-body technique, transport properties, optical properties, superconductivity. Prerequisites: PH 752, 760. Fall.</td>
<td></td>
</tr>
<tr>
<td>780-789</td>
<td>Selected Topics</td>
<td>3 hrs.</td>
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<tr>
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