UNIVERSITY OF ALABAMA IN HUNTSVILLE

ACCREDITED BY
THE SOUTHERN ASSOCIATION OF
SCHOOLS AND COLLEGES

HUNTSVILLE, ALABAMA

CATALOG 1969-70

VOLUME 3, NO. 1
The UAH Term System

The UAH operates on a system in which four identical terms, each spanning 12 weeks, constitute a calendar year.

Credit for course work is granted in standard semester hour units.
ACADEMIC CALENDAR
1969 - 1970

FALL TERM - 1969

Freshman Orientation ........................................... September 2, Tuesday
Application Deadline ............................................. August 20, Wednesday
Fall Placement Tests ............................................. August 23, Saturday
Registration .......................................................... September 3-4
Deferred Examinations ............................................. September 6, Saturday
Classes Begin 8:00 a.m. .......................................... September 8, Monday
Late Registration .................................................... September 8-11
Mid-Term ................................................................. October 11
Examinations ........................................................... November 17-20

WINTER TERM - 1969

Early Registration ..................................................... October 29 - November 12
Winter Placement Tests ............................................ November 15, Saturday
Application Deadline ............................................... November 18, Tuesday
Registration ............................................................ November 25, Tuesday
Thanksgiving Holidays Begin 5:00 p.m. ...................... November 26, Wednesday
Classes Begin 8:00 a.m. ............................................. December 1, Monday
Late Registration ....................................................... December 1-4
Deferred Examinations ............................................. December 6, Saturday
Christmas Holidays Begin 5:00 p.m. ......................... December 23, Tuesday
Classes Resume 8:00 a.m. .......................................... January 5, Monday
Mid-Term ................................................................. January 13, Tuesday
Examinations ........................................................... February 20-25

SPRING TERM - 1970

Early Registration ..................................................... February 4-18
Spring Placement Tests ............................................. February 21, Saturday
Application Deadline ............................................... February 23, Monday
Registration ............................................................ March 2, Monday
Deferred Examinations ............................................. March 21, Saturday
Spring Holidays Begin ............................................... March 9, Monday
Classes Begin 8:00 a.m. ............................................. March 16, Monday
Late Registration ....................................................... March 16-19
Mid-Term ................................................................. April 18
Examinations ........................................................... May 25-28
Commencement .......................................................... May 30-31
SUMMER TERM - 1970

Early Registration ............... May 6-20
Summer Placement Tests .......... May 23, Saturday
Application Deadline ............. May 28, Thursday
Registration ........................ June 4, Thursday
Classes Begin 8:00 a.m. ......... June 8, Monday
Late Registration .................... June 8-11
Deferred Examinations .......... June 6, Saturday
Mid-Term ............................. July 11
Examinations ....................... August 17-20
Commencement ........................ August 21, Friday

CLASS PERIODS

<table>
<thead>
<tr>
<th>Period</th>
<th>Time</th>
<th>Period</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8:00 a.m. - 9:15 a.m.</td>
<td>M</td>
<td>8:00 a.m. - 10:00 a.m.</td>
</tr>
<tr>
<td>B</td>
<td>9:25 a.m. - 10:40 a.m.</td>
<td>P</td>
<td>10:10 a.m. - 12:10 p.m.</td>
</tr>
<tr>
<td>C</td>
<td>10:50 a.m. - 12:05 p.m.</td>
<td>Q</td>
<td>1:40 p.m. - 3:40 p.m.</td>
</tr>
<tr>
<td>D</td>
<td>12:15 p.m. - 1:30 p.m.</td>
<td>R</td>
<td>3:50 p.m. - 5:50 p.m.</td>
</tr>
<tr>
<td>F</td>
<td>1:40 p.m. - 2:55 p.m.</td>
<td>S</td>
<td>6:00 p.m. - 8:00 p.m.</td>
</tr>
<tr>
<td>G</td>
<td>3:05 p.m. - 4:20 p.m.</td>
<td>T</td>
<td>8:10 p.m. - 10:10 p.m.</td>
</tr>
<tr>
<td>H</td>
<td>4:35 p.m. - 5:50 p.m.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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The University of Alabama in Huntsville (UAH) is a new branch of an institution established in 1831. Although the University of Alabama initiated academic programs in Huntsville in 1950, it was 1963 before degree opportunities at the master's level were provided, and 1964 before degree programs were initiated at the baccalaureate level. The first master's degree based on work begun and completed in Huntsville was awarded in 1964; the first UAH undergraduate degrees were awarded in 1968.

This brief chronology indicates that the UAH program is in the process of being developed. It was brought into being and is growing to meet the needs of a concentration of scientific and technological enterprise and a rapidly expanding community.

Because the UAH program is new, it is relatively unfettered by tradition and patterns of established practice. This should facilitate finding means of providing educational opportunity attuned to changing situations and the needs of tomorrow. This also imposes on students and faculty a greater than usual responsibility, because each step tends to create new paths which others will follow. It is our intention to be innovative, even experimental, to explore what is new, to evaluate existing programs continually, to develop and establish curricula and pedagogical techniques calculated to help students live and perform better in a complicated environment.

UAH is supported by the State, Federal, and local governments, generous individuals, and industries. The existing programs strive for superiority within limited areas and though expansion is anticipated, wide variety of specialties is not planned for the foreseeable future.
The degree programs at UAH are administered by: the Division of the Humanities; the Division of Social and Behavioral Sciences; the Division of Natural Sciences and Mathematics; and the Division of Engineering.

The Division of the Humanities offers the Bachelor of Arts degree with majors in art, English, and history. Courses are also offered in education, modern foreign languages (French, German, Russian, Spanish), music, philosophy, and speech. Graduate courses are offered in education.

The Division of Social and Behavioral Sciences offers the Bachelor of Arts degree with majors in economics and psychology. Courses are also offered in political science and sociology. Graduate courses are offered in the administrative sciences.

The Division of Natural Sciences and Mathematics offers the Bachelor of Arts degree with majors in biology and mathematics and the Bachelor of Science degree with majors in biology, chemistry, mathematics, and physics. Courses are also offered in earth sciences. Graduate programs are offered that lead to the Master of Science degree with majors in chemistry, mathematics, and physics. Post master's level courses and research opportunities are also available.

The Division of Engineering offers the degrees Bachelor of Science in Engineering and Master of Science in Engineering. The undergraduate program is founded on a unified engineering curriculum with options of specialization in electrical engineering, engineering mechanics, fluid and thermal engineering, and industrial and systems engineering. This curriculum requires a number of liberal education courses and emphasizes a strong grounding in mathematics, physics, and chemistry. The graduate program in engineering provides for specialization in four areas of study at the master's level and, in addition, provides courses and research opportunities at the post master's level.

The Office of Special Non-Credit Courses and Conferences offers short courses, conferences, seminars, and institutes in a variety of subjects without degree credit.

As a part of the University of Alabama system, UAH is accredited by the Southern Association of Schools and Colleges.

The UAH Library is being developed to give maximum support to the academic and research programs. Its more than 55,000 volumes of monographs and journals reflect great care in selection; its more than 150,000 items in such forms as microfiche, federal documents, maps, technical reports, and sound recordings provide
supplementary sources for special purposes. Acquisition of library resources is given high priority in UAH development.

The availability of the facilities of the Redstone Scientific Information Center, with its holdings in the scientific and technical areas that make it possibly the finest technical library in the Southeast, adds substantial strength to UAH programs, particularly at the graduate level.

Students admitted to UAH have achieved academic records that compare favorably with those in larger and older educational institutions. Through evaluations of previous academic records and entrance examinations, UAH attempts to insure admission to those who are well qualified for collegiate education. Students are assured that faculty members are present to help but not "oversee" them; and because of assumed maturity, students are expected to seek counseling and special assistance as needed.

The faculty at UAH has been assembled from leading universities across the United States and five foreign countries. The quality of this faculty is evident when measured by its writings, its research, and its reputation in the academic world.

The University of Alabama in Huntsville is an institution which has some distinctive features and some unusual strengths. The information contained in this publication is designed to outline in more detail the policies, purposes, and programs of the University of Alabama in Huntsville.
FACILITIES

The 332 acre campus of the University of Alabama in Huntsville is located in Northwest Huntsville adjacent to Research Park. The six University buildings, all of which have been constructed since 1960, exemplify modern functional design and contain modern equipment.

Morton Hall houses admissions and student affairs offices and most of the classes and offices in the undergraduate programs of the Division of the Humanities and the Division of Social and Behavioral Sciences.

The science-engineering building contains classrooms and laboratories for the undergraduate physical and biological sciences, chemistry, and engineering programs and most of the faculty offices for the Division of Natural Sciences and Mathematics, and the Division of Engineering. The building is equipped with modern laboratory equipment including a pent-house containing a live animal room and greenhouse.

The three-story library building is the first phase of a library complex and will form the center of a cluster of academic buildings projected for the campus. Volume capacity of the library is approximately 100,000. The library has open-access stacks and features a student seminar room and student typing area. Services of subject specialists are available for the students.

Graduate Studies Building contains executive administrative offices, graduate classrooms and faculty offices.

The Research Institute houses offices and laboratory space and equipment to support research in the aerospace and missile related sciences and engineering, science and technology surveys and applications, management, social sciences, and life sciences.

The two-story Student Union has facilities for dining, sports, assemblies, dramatic presentations, and other recreational activities. It also contains meeting rooms, offices for the Student Government Association, student newspaper, yearbook, and a bookstore.
THE RESEARCH INSTITUTE

The Research Institute of the University of Alabama in Huntsville was created with the strong support of the community, local and state governments, and federal agencies. It provides research leadership, management services, facilities, and equipment for faculty, research associates, and graduate students to acquire new knowledge, principally in the space-related fields. With few exceptions, the academic members of the Research Institute are actively engaged in the instructional program of undergraduate and graduate study at the University of Alabama in Huntsville.

A key feature of the Research Institute is the contiguity of the disciplines which fosters communication and encourages an interdisciplinary approach to research. Other important benefits derive from this particular and rather unique organization. It is a point for exposure of graduate students to a research environment, a place for recognition and dissemination of current research of the faculty to the scientific and technological community, and a place for pooling research instrumentation to make it optimally accessible to University personnel.
ADMISSIONS INFORMATION

The University of Alabama in Huntsville welcomes inquiries and applications from students who are attracted to the type of studies offered at UAH. Application for admission should be made well in advance of the date of proposed entrance but not more than one calendar year. (See UAH calendar for application deadline dates for specific terms.)

Prospective students are encouraged to apply during their senior year in high school. Tentative admission can be granted on the basis of ACT scores and high school records through the junior year. Work completed in the senior year and proof of graduation will be reviewed before a student will be finally accepted for admission.

Applicants may be requested to furnish information related to character, supplemental to that required on the application forms. UAH reserves the right to refuse admission to persons when there is evidence that their presence might be deemed detrimental to the best interest of the institution or its students.

How to Apply

ADMISSION TO THE FRESHMAN CLASS

Plan A

High school graduates may be admitted as freshmen at the University of Alabama in Huntsville on the basis of acceptable high school records and scores achieved on the American College Testing (ACT) Program examinations. (ACT scores are not required for applicants who were graduated prior to 1961.)

All applicants should present a minimum of 16 high school units in the following categories:

- 4 Units English
- 1 Unit History or Social Studies
- 1 Unit Algebra
- 1 Unit Geometry
- 9 Units of Electives (At least 5 electives should be academic in nature.)

UAH urges high school students to include in their elective courses additional units in mathematics, foreign languages, natural sciences, and social studies. The Division of Engineering and the Division of Natural Sciences and Mathematics strongly recommend that the additional elective units include two units of college preparatory mathematics. Applicants who plan to enter the Division of
Engineering or major in a natural science should also include 1 unit of physics and 1 unit of chemistry. Students will find it to their advantage to follow the divisional recommendations in their choice of high school electives so that they may be able to begin their college program at the appropriate level.

Applicants having deficiencies in the specifically required courses may be admitted in good standing. The deficiencies must be removed during the first year of enrollment in a manner approved by the appropriate division director. Courses taken to remedy entrance deficiencies cannot be used to satisfy degree requirements.

Plan B

Persons who have not been graduated from high school may be admitted on the basis of satisfactory scores achieved on the General Educational Development Entrance Test (GED).

APPLICATION PROCEDURE

Applicant must submit:

1. Completed application forms in duplicate.
2. Non-refundable application fee of $10.00.
3. A Student Medical Form.

In addition, he must request that:

1. Two copies of his high school transcript be sent from the high school to the Office of Student Records and
2. (Plan A) ACT test scores be sent from ACT to the Office of Student Records.
   (Plan B) Official score reports of GED examinations be sent from agency administering tests to the Office of Student Records.

All application materials must be in the Office of Student Records no later than specified dates in the UAH calendar.

ADMISSION OF TRANSFER STUDENTS

Students who have previous academic records at a college or university level may be admitted to UAH as transfer students. Transfer credits are evaluated in the Office of Student Records during the first term of enrollment at UAH. The application of such accepted credits to a particular program of study will be made and approved at the time of official determination of the individual's program of study. It must be understood that acceptance and application of credits are two separate and distinct processes.
If the records show fewer than 21 semester hours of prior work attempted, the applicant may request permission to discard those credits and to be considered for admission to the freshman class. This permission will be granted only once.

Credits earned in terms of quarter hours will be converted to semester hours on the basis of 2/3 of one semester hour for each quarter hour.

**Students Transferring Within The University System**

The University of Alabama is composed of three campuses—Tuscaloosa, Huntsville, and Birmingham. A student enrolled in an undergraduate division at any U. of A. campus may transfer to an undergraduate division at another U. of A. campus so long as he is eligible to continue enrollment in the University. He will receive credit for courses in which a passing grade has been made.

**Students Transferring From Other Institutions**

Applicants with previous records from accredited colleges or universities must have a minimum overall C average on all work attempted and be eligible to return to the last institution attended. An applicant presenting records that are deficient may be admitted on probation upon recommendation of the director of the division in which he plans to major provided:

1. The quality point average is at least 0.75 (1.00 = C); and
2. The quality point deficiency is less than 8.

In the case of students admitted under these conditions, transferred courses with grades of D are not accepted.

If the previous record was earned at an institution not holding regional accreditation, the applicant may be admitted as outlined; but accepted credits will be classified as provisional. Full credit for the provisional credit will be based upon performance during the first 30 semester hours attempted at UAH.

If a student is transferring from a junior college and has previous credits from a senior college, his credits for transfer will be evaluated on an individual basis and may be limited to 64 hours.

**APPLICATION PROCEDURE**

Applicant must submit:

1. Completed application forms in duplicate.
2. Non-refundable application fee of $10.00.
3. A Student Medical Form.
In addition he must request that:

1. Two copies of his high school transcript be sent from the high school to the Office of Student Records.

2. Official transcripts from each collegiate institution attended be sent directly from the previous institutions to the Office of Student Records.

All application materials must be in the Office of Student Records no later than specified dates on the UAH calendar.

**ADMISSION AS AN IRREGULAR POST GRADUATE (IPG)**

Applicants already holding a bachelor's or other higher degree will be considered for admission in the status of irregular post graduates.

A student admitted in this category may take any course at the 500 level or below if he has met the prerequisites. In some instances, a student may, with the approval of the division director, take courses numbered 600 or above; however, credits earned in these courses while a student is classified as an IPG will not carry graduate credit.

Application procedure is the same as that for Admission of Transfer Students. (High school transcripts are not required.)

**ADMISSION AS A SPECIAL STUDENT**

**Non-Matriculated Students**

To qualify as a non-matriculated student a person must be eligible for admission as a regular student, at least 21 years of age, and interested in receiving University credit, but not credit towards a degree.

A student in this category may take no more than two courses per term and may earn no more than 15 semester hours of credit.

So long as a student is in this category he must re-apply each term in order to register for courses.

Completed Non-Matriculated Application Forms (in duplicate), on which the terms for admission are identified, must be submitted to the Office of Student Records for approval prior to the registration period of the term the student wishes to attend.

**Transient Students**

To qualify as a transient student a person must be currently enrolled in good standing at another institution (including either
of the University of Alabama's other two campuses) and interested in attending UAH for one term only.

Completed Transient Application Forms (in duplicate) and a Letter of Good Standing Form must be submitted for approval to the Office of Student Records prior to the registration period of the term the student wishes to attend.

Audit Students

A person desiring to attend courses or lectures without examination or credit may be admitted on the basis of information required on the Audit Application Form. (Regularly admitted students may register to audit credit courses without separate application.) An auditor may not obtain credit in a course by retroactive action after announced deadlines for changes. (See section on Course Changes.)

In certain cases, students will be permitted to attend courses as auditors by giving evidence of extenuating circumstances justifying their enrollment without satisfaction of normal admission requirements.

ADMISSION OF FOREIGN STUDENTS

In addition to fulfilling the specified entrance requirements or their equivalents, foreign students (this applies to all persons whose official residence is other than the United States) must submit a satisfactory score on the Test of English as Foreign Language (TOEFL) unless his native language is English. Each foreign applicant must also give evidence of financial ability to meet the expenses of his intended stay at UAH.

Foreign students are advised to submit applications earlier (preferably 3 months) than announced deadlines for other students. All inquiries should be directed to the Office of Student Records.

READMISSION

A student who has not attended UAH for one or more terms and who wishes to return should consult with the Office of Student Records in order to determine his status and the conditions under which he may resume his studies.

ADMISSION TO THE GRADUATE SCHOOL

Detailed information concerning admission to the Graduate School will be found in the section, Division of Graduate Programs.
FINANCIAL INFORMATION

FEES

APPLICATION FEE ................................................................. $10.00

PLACEMENT TEST FEE ............................................................. $10.00

TUITION AND ALL GENERAL FEES PER TERM

FULL-TIME STUDENTS (UNDERGRADUATE)

<table>
<thead>
<tr>
<th></th>
<th>Alabama Resident</th>
<th>Non-Resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course and Buildings Fee</td>
<td>$135.00</td>
<td>$135.00</td>
</tr>
<tr>
<td>Student Activity Fee</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Out-of-State Fee</td>
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<td>100.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$140.00</strong></td>
<td><strong>$240.00</strong></td>
</tr>
</tbody>
</table>

FULL-TIME STUDENTS (GRADUATE)

<table>
<thead>
<tr>
<th></th>
<th>Alabama Resident</th>
<th>Non-Resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course and Buildings Fees</td>
<td>$220.00</td>
<td>$220.00</td>
</tr>
<tr>
<td>Out-of-State Fee</td>
<td></td>
<td>100.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$220.00</strong></td>
<td><strong>$320.00</strong></td>
</tr>
</tbody>
</table>

Part-Time Students (Undergraduate-Alabama Resident) 6 hours or less:

- Registration Fee ............................................................. $ 5.00
- Course and Buildings Fee per Semester Hour ......................... 17.00
- For Non-Residents (students residing out-of-state at time of registration), an additional charge is prorated on the basis of $100 for full-time students.
- Student Activity Fee (optional) ........................................ 5.00

Part-Time Students (taking Graduate Education Courses)

- Registration Fee ............................................................. 3.00
- Registration Fee for Courses on Semester Basis ..................... 4.50
- Course and Buildings Fee per Semester Hour .......................... 25.00
- Student Activity Fee (optional) ........................................ 5.00

Part-Time Students (Graduate-Alabama Resident) 4 hours or less:

- Registration Fee ............................................................. 3.00
- Course and Buildings Fee per Semester Hour .......................... 50.00
- Student Activity Fee (optional) ........................................ 5.00
- For Non-Residents (students residing out-of-state at time of registration), an additional charge is prorated on the basis of $100 for full-time students.
Audit Fee — Same as for Credit.

Fees for non-credit courses vary and are announced in individual brochures.

### OTHER CHARGES

<table>
<thead>
<tr>
<th>Service</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change of Course Fee</td>
<td>$5.00</td>
</tr>
<tr>
<td>Examination Fee (Deferred or Special)</td>
<td>2.00</td>
</tr>
<tr>
<td>(A student missing more than two examinations in one term is charged a maximum fee of $5.00.)</td>
<td></td>
</tr>
<tr>
<td>Installment or Deferred Payment Fee</td>
<td>2.00</td>
</tr>
<tr>
<td>Laboratory Fee (Biology, Chemistry, Physics)</td>
<td>15.00</td>
</tr>
<tr>
<td>Registration for Students Writing Thesis</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>Applied Music</strong></td>
<td></td>
</tr>
<tr>
<td>2/3 Hour Private Instruction</td>
<td>20.00</td>
</tr>
<tr>
<td>1 1/3 Hours Private Instruction</td>
<td>30.00</td>
</tr>
<tr>
<td>Late Payment Fee</td>
<td>10.00</td>
</tr>
<tr>
<td>Late Deferred Penalty</td>
<td>5.00</td>
</tr>
<tr>
<td>Late Registration Fee (in addition to regular registration fee)</td>
<td>10.00</td>
</tr>
<tr>
<td>Returned Check Handling Fee</td>
<td></td>
</tr>
<tr>
<td>(1st Check)</td>
<td>1.00</td>
</tr>
<tr>
<td>(2nd Check)</td>
<td>2.00</td>
</tr>
<tr>
<td>(3rd Check)</td>
<td>5.00</td>
</tr>
<tr>
<td>Transcript Fee (First transcript fee—charge for each additional copy)</td>
<td>1.00</td>
</tr>
<tr>
<td>No transcript will be issued for a person who has a financial obligation to the University.</td>
<td></td>
</tr>
<tr>
<td><strong>Cap and Gown Rental</strong>—Handled through UAH Bookstore**</td>
<td></td>
</tr>
<tr>
<td>Diploma Fee</td>
<td></td>
</tr>
<tr>
<td>Bachelor’s and Master’s Degrees</td>
<td>15.00</td>
</tr>
<tr>
<td>Diploma Fee (If qualifications for graduation are not met and if diploma has been ordered)</td>
<td>5.00</td>
</tr>
<tr>
<td>Duplicate Diploma</td>
<td>7.50</td>
</tr>
<tr>
<td>Thesis Binding Fee (3 copies)</td>
<td>13.00</td>
</tr>
<tr>
<td>Each Additional Copy</td>
<td>4.25</td>
</tr>
</tbody>
</table>

Regulations concerning traffic and parking will be distributed at the time of registration.

### Payment Of Fees

A Fee Statement showing total amount due will be mailed to each student each term. Payment should be made by check if possible and mailed to the Finance Office along with the Fee Statement. If a student does not receive a Fee Statement within several days after registration, he should contact the Finance Office. It is the student’s responsibility to see that his account is paid by the final day for payment indicated on the statement.
Fees may be paid in three installments. An additional charge of $2.00 is made for this option. A statement will be mailed to the student for each installment due. Payment must be made by a deadline date designated on the statement; otherwise, a late penalty will be charged.

Withdrawals And Refunds

After a student has enrolled, he will be carried on the class rolls until such time as written notification is received that he has withdrawn. It is the student’s responsibility to withdraw officially in accordance with University regulations. Basic fees (course, buildings fund, and lab fee) will be pro-rated according to the withdrawal schedule below:

<table>
<thead>
<tr>
<th>Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withdrawal after registration is completed but before first class meeting of the course</td>
</tr>
<tr>
<td>Withdrawal during first week of classes</td>
</tr>
<tr>
<td>Withdrawal during second week of classes</td>
</tr>
<tr>
<td>Withdrawal during third week of classes</td>
</tr>
<tr>
<td>Withdrawal after third week of classes</td>
</tr>
</tbody>
</table>

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

STUDENT AID

The University of Alabama in Huntsville has several programs to assist capable students in financing their college education.

Students of academic promise who can demonstrate financial need are encouraged to apply for assistance. Realistic financial planning is an essential part of college preparation. UAH helps students find employment and awards scholarships and loans to qualified students as its resources permit. In planning a program of financial assistance, consideration should be given to the advisability of combining scholarships, loans, and part-time employment since none of these alone is adequate in extreme cases.

The Financial Aids and Placement Office has prepared a booklet, Financial Aids to Students, which lists scholarships, grants, loans, and types of employment available to students.

A student should make his financial plans well in advance of entering the University. He is advised to write to the Financial Aids and Placement Office requesting the booklet mentioned above at the same time that he makes application to the University. Applications for student aid must be filed at the Financial Aids and Place-
ment Office prior to March 1 for the coming school year. No award implies automatic renewal and, a new application must be submitted by the above deadline each year.

COLLEGE SCHOLARSHIP SERVICE

The University of Alabama in Huntsville participates in the College Scholarship Service of the College Entrance Examination Board. The amount of financial aid granted a student is based upon financial need. To help the University judge student need and award aid fairly, UAH asks parents to fill out a Parents’ Confidential Statement form of their income, assets, and liabilities. On the basis of this financial statement, the University can determine the gap between what parents and the student can provide and what the student’s education will cost.

The following table indicates what the University considers a reasonable contribution toward a student’s annual expenses:

<table>
<thead>
<tr>
<th>Parents' income before federal taxes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 4,000</td>
<td>$300</td>
<td>$110</td>
<td>$ 0</td>
<td>$ 0</td>
</tr>
<tr>
<td>6,000</td>
<td>750</td>
<td>540</td>
<td>350</td>
<td>220</td>
</tr>
<tr>
<td>8,000</td>
<td>1220</td>
<td>950</td>
<td>710</td>
<td>560</td>
</tr>
<tr>
<td>10,000</td>
<td>1690</td>
<td>1350</td>
<td>1060</td>
<td>890</td>
</tr>
<tr>
<td>12,000</td>
<td>2150</td>
<td>1730</td>
<td>1400</td>
<td>1190</td>
</tr>
</tbody>
</table>

Some things considered in determining a reasonable parental contribution are salaries of both parents, additional income, net worth of business or farm, real estate holdings, savings, investments, special family circumstances (such as additional costs of two working parents), number of dependents, student’s earnings and assets, extraordinary expenses (such as business or medical), and debts for certain purposes. Special circumstances such as job expense, debts, support of elderly relatives or other children in college also are taken into account.

Types Of Financial Aids

Scholarships: All scholarships at UAH are awarded for the academic year (nine months) and are not available for the summer term. Nearly all of these scholarships are awarded on a merit-need basis. Most available scholarships vary from $200.00 to $600.00.

It is not necessary, and often not advantageous, to apply for a particular scholarship. The student’s need and scholastic ability will be the factors considered in determining the value of the scholarship offered him. When a student completes the regular scholarship application form he will be considered for all under-
graduate scholarships awarded by the University of Alabama in Huntsville.

Loans: In some cases it is advisable to borrow to finance an education; however, caution is advised in borrowing. Generally, a student should not rely primarily on loans to finance his education. A student is usually advised not to borrow more than half of what he needs to meet his expenses.

National Defense Student Loan Program: Under Title II of the National Defense Act of 1958, students in good standing and with financial need may apply for National Defense Student Loan funds. The act directs that need be the primary consideration for granting such a loan. Terms of this loan apply to both undergraduate and graduate students.

Subject to the availability of funds, an undergraduate student may borrow for college expenses in one year a sum not exceeding $1,000, and during his entire course in higher education, a sum not exceeding $5,000. Graduate or professional students may borrow as much as $2,500 a year, up to a maximum sum of $10,000. The borrower must sign a note for his loan. The repayment period and interest do not begin until nine months after the student ends his studies. The loans bear interest at the rate of three per cent a year on the unpaid balance, and repayment of principal may be extended over a ten-year period.

Guaranteed Student Loan Program: To help students from middle or upper-income families, a Guaranteed Student Loan Program is now authorized. Under this program, a student may borrow from a bank or other financial institutions. Both graduate and undergraduate students may borrow as much as $1,500 a year. Students who have pursued full-time courses of study during an academic year or its equivalent may qualify for up to an additional $500 during periods of accelerated study, not to exceed $2,000 in a 21 month period.

Grants: Educational Opportunity Grants: Grants ranging from $200 to $1,000 a year will be awarded to students of exceptional financial need who would not, except for the Grant, be financially able to attend college.

Grants are restricted to undergraduate students and may be renewed for the four years of undergraduate work.

Work-Study Program: The College Work-Study Program provides part-time employment for full-time students who need financial aid to attend college.
In determining eligibility, preference will be given to students from low-income families. The needs of other students then may be met to the extent that funds are available.

A student may begin participation in this program after he has been accepted for admission by UAH. He may work 40 hours a week at this time until he is actually enrolled. While enrolled for classes he may work an average of 15 hours per week. Most undergraduate students employed will earn between $1.30 and $1.45* per hour. Skilled graduate students will earn about $2.00 per hour.

Job Placement

In addition to assisting students in obtaining financial aid, UAH provides the following job placement services to all students and alumni:

1. Part-time employment opportunities either in the local community or within the University;
2. Full-time placement opportunities for graduating UAH seniors and for UAH alumni.

Law Enforcement Education Program

As authorized by the Omnibus Crime Control and Safe Streets Act of 1968 (PL 90-351), a Law Enforcement Student Grant and Loan Program has been established by the Law Enforcement Assistance Administration to encourage and help to assist financially, persons pursuing or interested in pursuing law enforcement careers.

UAH participates in the Law Enforcement Student Grant Program. This program makes available payments for tuition and fees not exceeding $200 per academic term for students enrolled full-time or part-time in an undergraduate or graduate program leading to a degree or certificate in an area related to law enforcement. Recipients must be full-time employees of a publicly funded law enforcement agency and must agree to remain in the service of the employing agency for a period of two years following completion of any course of study funded by a grant.

Applications are available in the UAH Financial Aids and Placement Office. It is advised that these forms be obtained, completed, and returned well in advance of the period of study for which they apply.

Veterans

Under Public Law 89-358, which affects most veterans, the veteran receives his allowance directly from the government. He in turn is responsible for paying his fees directly to the University.

*Effective Feb. 1, 1970—$1.45 to $1.60 per hour.
The Veterans Administration will make full payment only when the student’s schedule includes at least 10 semester hours each term. In order to facilitate the prompt and accurate reporting of the student’s status and course load, it is necessary that the student complete a brief form at the Office of Student Records every term he is enrolled.

It is the student’s responsibility to keep himself in good standing with the Veterans Administration and to respond to notification of changes in regulations.
STUDENT LIFE

Student Government Association

The Student Government Association promotes the welfare of students in all areas of University life. Its primary purpose is to help improve the educational environment. This includes promoting academic innovation and working closely with faculty and administration toward making desirable changes in institutional policies.

Through a substantial budget, the SGA develops and sponsors programs to enrich the student's cultural, intellectual, and social life; to make the University community as complete as possible; and to broaden the student's interests and knowledge.

The SGA helps finance dances and other social activities, the UAH Rowing Club, the intramural sports program, the UAH Film Series, the school newspaper, the yearbook, and the UAH Cultural Series; it also subsidizes the student union program.

Student Publications

“Exponent,” the official student newspaper, is published bi-weekly. Debris, the yearbook, is published annually. These campus publications are edited and managed by UAH students with the advice and general direction of joint student-faculty Publications Board. All UAH students are eligible for staff membership. The editors are elected by the student body.
UAH Rowing Club

The UAH Rowing Club provides an opportunity for students to develop physically and emotionally within a framework of cooperation and teamwork.

The crew competes regularly against other crews of the Southern Rowing Association and with representatives of the Big Ten, the Ivy League, and other athletic conferences. Included in these are such schools as: Purdue, University of Wisconsin, Dartmouth College, University of Virginia, Citadel, Florida Southern College, Rollins College, University of Tampa, East Carolina University, and Jacksonville State University.

The UAH crew also participates in the following major regattas: Miami, Cypress Gardens, Mid-American, President's Cup, and Dad Vail.

Membership is open to any interested UAH male student.

UAH Intramural Organization

The aim of the Intramural Organization is to provide an opportunity for all students to enjoy satisfying experiences related to their particular needs. The philosophy of the organization is based upon the concept that students should have freedom of choice, equality of opportunity, and responsibility for sharing in planning, supervising, and administering the program.
All regularly enrolled students and members of the faculty and staff are eligible to take part in intramural activities. These include: basketball, cross country, flag football, golf, soccer, softball, table tennis, tennis, track, and volleyball.

In addition the Organization participates in the following sports on an intercollegiate basis: baseball, basketball, soccer, and tennis.

**Choral Organizations**

UAH has four choral groups: The UAH Choir, The Premier Singers, The Village Singers, and The Summer Chorus. Membership is open to all students; course credit is offered. Participation in any of the four groups may be repeated. (See course listings in the *Division of the Humanities* section for details.)

**Circle K**

Circle K, a service organization sponsored by the Metropolitan Kiwanis Club, is open to all interested men students.

**Gamma Sigma Sigma**

Gamma Sigma Sigma is a service sorority for women students. GSS is affiliated with the National Gamma Sigma Sigma and is open to women students interested in service to school, community, and nation.
World Perspective Club

Members of the World Perspective Club meet monthly to discuss topics related to current events and current social problems. The meetings are held in the homes of the history faculty giving students an opportunity to exchange ideas with their teachers in a social and informal setting.

The members also raise funds for various service projects.

Any interested student may join.

The Engineering Society

The Engineering Society provides an opportunity for engineering students to meet and discuss matters of interest relevant to the engineering profession and to the UAH community. The Society sponsors guest speakers, social functions, and explores the opportunities in the engineering profession.

Society of Physics Students

The UAH Chapter of the Society of Physics Students promotes educational activities for all students interested in physics, and awards recognition and distinction to students who have achieved high scholarship in physics by electing them to the status of Sigma Pi Sigma membership within the society.

The University Cultural Series

The University Cultural Series, jointly sponsored by the SGA and the UAH faculty and administration, presents lecturers and performances to stimulate the cultural interests of the students. Full-time students may draw one free ticket to each event; part-time students may purchase one ticket at half price. Tickets are available in advance at the Information Desk in Morton Hall.

UAH Film Series

The UAH Film Series, free to UAH students, shows art, foreign, and classic movies monthly. The intent behind the Series is to provide the student with a wide cultural background in film and give him an opportunity to investigate the social and economic importance of film as an art form.
STUDENT ACADEMIC INFORMATION

Placement Tests

All students who are beginning college level course work in English, mathematics, chemistry, or a foreign language (if taken in high school) are placed at the level best suited to their academic preparation and background as determined by a battery of tests. For the student's best advantage, advanced coursework in each of these subject matter areas will be prescribed on the basis of the results of these tests.

Only the aforementioned academic areas are subject to academic placement.

Placement tests are administered only to those students who have been admitted to UAH. The tests are given each term (see UAH calendar). A $10.00 fee is required for the administering and evaluating of the tests.

Student Counseling

Personal and vocational counseling is offered through the Office of Student Affairs.

Academic advising is provided by the faculty.

Courses of Instruction

Courses are described under the sections of the various divisions.

All courses listed will be offered at times which will be announced in printed schedules each term. There is no assurance of a particular course being scheduled in any given term or year.

Registration

Dates of registration, of late registration, and tentative dates of early registration are listed in the UAH calendar. Any student eligible to register may take part in early registration.

How to Change a Course

Once a student has completed registration, all changes in his schedule must be made on a Change of Course Form and recorded in the Office of Student Records. Changes made any other way are void.

CREDIT TO AUDIT

A student is permitted to change a course from credit to audit only during the first three weeks of classes.
REMOVAL OF COURSE FROM SCHEDULE

1. In the case of a cancelled class, submission of a Change of Course Form by the student facilitates correcting his record.

2. In the case of a "drop before class," a Change of Course Form must be submitted prior to the first scheduled meeting of the class.

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 section on Withdrawal.)

OTHER KINDS OF CHANGES

The following kinds of changes may be accomplished only during the designated hours of regular and late registration. (See UAH calendar.)

1. Change from one course to another.

2. Change from one section to another section of the same course. (Approval of the director of the division in which the course is taught is required on the Change of Course Form.)

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.

How to Withdraw

A student may withdraw from one or more courses or from UAH by completing the Request for Withdrawal Form secured from the Office of Student Records. Regardless of the circumstances under which withdrawal becomes necessary, a student must carry out withdrawal procedures.

The official date of withdrawal is the date on which the withdrawal forms are received in the Office of Student Records. Action will be taken on courses involving withdrawals based on the following conditions:

1. A grade of W will be assigned if the withdrawal occurs during the first three weeks of class.

2. A grade of W or WF will be assigned if the withdrawal occurs between the end of the third week and the beginning of the sixth week of classes.

3. A grade of F will be assigned if the withdrawal occurs after the beginning of the sixth week except in cases of extenuat-
ing circumstances. If the student so desires, he may submit the circumstances in writing on a Request for Withdrawal Form and ask for a review by his division director.

Conduct

A student enrolling in the University assumes an obligation to conduct himself in a manner compatible with the University’s function 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.

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 by all students 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 prior arrangement with the course instructor (except in extenuating circumstances) will be classified unexcused, and a failing grade in the course will be assigned.

(Refer to X under Grades and Quality Points for regulations concerning deferred examinations. Students taking deferred examinations must pay a fee of $2.00.)

Course Numbering System

<table>
<thead>
<tr>
<th>Range of Numbers</th>
<th>Year Student Normally Takes Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>001-099</td>
<td>Refresher (non-credit)</td>
</tr>
<tr>
<td>100-199</td>
<td>Freshman</td>
</tr>
<tr>
<td>200-299</td>
<td>Sophomore</td>
</tr>
<tr>
<td>300-399</td>
<td>Junior (upper level)</td>
</tr>
<tr>
<td>400-499</td>
<td>Senior (upper level)</td>
</tr>
<tr>
<td>500-599</td>
<td>Advanced undergraduate credit but graduate credit awarded by permission</td>
</tr>
<tr>
<td>600-799</td>
<td>Graduate</td>
</tr>
</tbody>
</table>
Student Classification

A regular student is classified as indicated in the following table when he has completed the number of semester hours shown.

<table>
<thead>
<tr>
<th>Semester Hours Earned</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman ..................</td>
<td>0-29</td>
<td>30-59</td>
<td>60-91</td>
<td>.92 up</td>
</tr>
</tbody>
</table>

Academic Workload

A full-time undergraduate student is one who is enrolled in courses totaling at least 9 semester hours. The maximum number of semester hours in which a student will be permitted to enroll in one term is 13, including simultaneous correspondence courses. Under exceptional circumstances, permission may be granted by division directors to take additional hours. (Equivalents will be used for non-credit and audit courses.) A part-time undergraduate student is one who is enrolled in courses totaling 1-8 semester hours.

Students will be given much responsibility for independent study. Careful budgeting of time will be necessary if the desired academic goals are to be reached. Accordingly, full-time students are advised to limit their employment. Experience has shown that approximately 20 hours per week constitutes an average work load that will allow needed time for adequate study.

For students who, for financial reasons, need to be employed to a greater extent, a reduction in course load is suggested. From the standpoint of allowing sufficient time for the amount and quality of work necessary to meet a student's academic goals, fully employed undergraduate students normally will find that they should take no more than two courses.

Grades and Quality Points

<table>
<thead>
<tr>
<th>Grades</th>
<th>Quality Pts./Sem. Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (90-100) Superior</td>
<td>3</td>
</tr>
<tr>
<td>B (80-89) Above Average</td>
<td>2</td>
</tr>
<tr>
<td>C (70-79) Average</td>
<td>1</td>
</tr>
<tr>
<td>D (60-69) Passing</td>
<td>0</td>
</tr>
<tr>
<td>F (0-59) Failure</td>
<td>0</td>
</tr>
</tbody>
</table>

I — Incomplete. Assigned by the instructor when a student has failed to satisfy some minor requirements 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.

X — Absent from examination. 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 of the term of next regular enrollment of the student. (See section on Examination and UAH calendar.)

W — Withdrawal. Assigned by the OFFICE OF STUDENT RECORDS when a student withdraws from a course with passing work. (See section on Withdrawal.)

WF — Withdrawal Failing. Assigned by the OFFICE OF STUDENT RECORDS when a student withdraws from a course with failing work. (See section on Withdrawal.)

A grade of S (Satisfactory) or U (Unsatisfactory) is assigned in some courses.
The last grade received in a course taken more than once will be the official and only grade of the course for purposes of evaluation of quality points; but a student is charged with hours attempted each time he registers for a credit course and receives a grade other than W, S, or U.

Grades submitted to the Office of Student Records can be changed only by submission by the instructor of a corrected grade sheet containing a written explanation of the error. The corrected grade sheet must be approved by the director of the academic division concerned.

Quality Point Average

The quality point average 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, S, or U is assigned are not included.

Student Grade Report

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

Honors

HONOR SCHOLAR

A student earning 9 or more semester hours in a term with a quality point average of 2.50-3.00 is distinguished by being identified as an Honor Scholar. A student who takes less than 9 semester hours per term and establishes a quality point average of 2.50-3.00 will, at the end of the term in which at least 9 semester hours are completed, be designated as an Honor Scholar.

SCHOLAR

A student earning 9 or more semester hours in a term with a quality point average of 2.00-2.49 is recognized by having his name placed on the list of Scholars. A student who takes less than 9 semester hours per term and establishes a quality point average of 2.00-2.49 will, at the end of the term in which at least 9 semester hours are completed, have his name placed on the list of Scholars.

For these purposes, a part-time student's work will be considered in blocks that do not overlap.

Academic Probation and Suspension

A beginning student is subject to scholastic review at the end of the term in which he has attempted a total of at least 9 semester
hours of work. At the time of review, if he has not passed one-half of work attempted or attained a quality point average of 0.5, he is placed on scholastic probation.

A transfer student is subject to scholastic review at the end of the term in which he has attempted at least 8 semester hours. At the time of review, if his quality point average is less than 1.0, he is placed on scholastic probation.

After the first evaluation, a student's record is examined at the end of the term in which at least 8 semester hours have been attempted from the time of previous review.

At the specified times of review, a student will be placed on scholastic probation if his overall quality point average for work attempted at all institutions is less than 1.0 (C). He also will be placed on probation if his average for work attempted at UAH only is less than 1.0 (C).

<table>
<thead>
<tr>
<th>Overall Quality Point Average</th>
<th>Quality Point Average*</th>
<th>Action Indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 or higher</td>
<td>0</td>
<td>Probation Removed</td>
</tr>
<tr>
<td>Less than 1.0</td>
<td>1.0 or higher</td>
<td>Probation Continued</td>
</tr>
<tr>
<td>Less than 1.0</td>
<td>Less than 1.0</td>
<td>Suspension</td>
</tr>
</tbody>
</table>

*(On last block of work prior to review)  
**(Including transferred deficiencies)

A student suspended for scholastic reasons is eligible to return on scholastic probation at the beginning of the second term following suspension.

When a student is suspended the second time for scholastic reasons, he is permanently disqualified for readmission.

A student whose academic status is indeterminate due to grades of I or X may be permitted to register conditionally. A student with either of these grades should take the necessary steps to remove the incomplete grades within the specified time limits. (See section on Grades and Quality Points.)

**Change of Program**

Students who are pursuing one program of study at UAH and desire to change to another program in another division may petition to do so by making application at the Office of Student Records. Counseling before changing programs may help students avoid losing credits. Application of previously earned credits toward the new program will be determined after the transfer has been approved. A request for a change of program must be approved by the
director of the division to which the change is proposed before the change is effective.

Application for Graduation

Candidates for graduation should file their applications by the end of the fall term preceding the date of anticipated May graduation. Application forms may be obtained at the Office of Student Records.

Students completing degree requirements at other times of the year will be given certified letters of completion and may attend the next graduation ceremony.

Second Bachelor’s Degree

To qualify for a second bachelor’s degree, a student must complete (in addition to credits applied to the first degree) in residence a minimum of 25% of the total degree requirements for the second degree. The second degree must include a new major. The student must meet all other applicable requirements for a degree.

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 request of the student involved.

Official transcripts are not issued to the individual student; however, he may request an unofficial transcript which does not bear the University seal.

The first copy of a transcript is free; a charge of $1.00 is made for each additional transcript issued.

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

Correspondence Study

The maximum amount of correspondence or extension credit allowed from any accredited institution toward a bachelor’s degree at UAH is 25% of the total degree requirements.

Persons interested in taking correspondence study courses at the University of Alabama in Tuscaloosa may contact the Extension Division, University of Alabama, P.O. Box 2987, University, Alabama 35486.
UNDERGRADUATE ACADEMIC PROGRAMS

The undergraduate academic programs of the University of Alabama in Huntsville are administered by four divisions:

1. Division of Humanities
2. Division of Social and Behavioral Sciences
3. Division of Natural Sciences and Mathematics
4. Division of Engineering

The University of Alabama in Huntsville endorses a philosophy of education which sees the need for both a solid core of liberal learning and study in areas of the student's choice. In the Division of the Humanities, the Division of Social and Behavioral Sciences, and the Division of Natural Sciences and Mathematics, this is made possible through a degree program with three phases: general education; area of concentration; and electives.

The general education phase provides the foundation for liberal learning. The courses represent a broad spectrum of intellectual attainments, including writing, literature, history, social sciences, natural sciences, mathematics, and foreign languages. Specific requirements for general education have been identified for each degree.

The area of concentration (AOC) phase consists of two parts: a major area of study, and a cluster of supportive courses. The major area of study includes courses chosen by the students and approved within identified limitations from one of the approved major disciplines or a combination of related courses from two or more approved major disciplines. The cluster of courses may be chosen to relate to the major area of study or to provide a background in another area for a student's specific purpose. Each division has defined specific philosophies within the concept.

The elective phase allows a student to broaden and enhance his education plans. A student may count as an elective any course offered by UAH so long as the content does not duplicate the same or lower level of courses being applied to meet the degree requirements.

Academic programs offered at UAH allow a student flexibility in planning an academic career with guidance and counsel and with freedom to cross traditional boundaries of knowledge.

A student should declare his AOC no later than the term in which he completes 64 semester hours.

Detailed information concerning each major area of concentration will be found in the divisional section in which the major is offered.
Division Of The Humanities
Areas of study in which majors are currently offered are:

Art
English
History

Other areas with course offerings are: Education, Modern Foreign Languages (French, German, Russian, Spanish), Music, Philosophy, and Speech.

Division Of Social And Behavioral Sciences
Areas of study in which majors are currently offered are:

Economics
Psychology

Other areas with course offerings are: Political Science and Sociology.

Division Of Natural Sciences And Mathematics
Areas of study in which majors are currently offered are:

Biology
Chemistry
Mathematics
Physics

Courses also are offered in the Earth Sciences.

Division Of Engineering
Major areas in the programs of studies leading to the degree in engineering are:

Electrical Engineering
Industrial and Systems Engineering
Fluid and Thermal Engineering
Engineering Mechanics

Detailed information concerning the unified engineering curriculum will be found in the section of the Division of Engineering.

Professional And Pre-Professional Opportunities
Medical and Dental Programs
Most students entering medical or dental schools do so after earning an undergraduate degree. After consulting the specific re-
quirements of the desired medical or dental school, applicants interested in careers in medicine or dentistry will find that UAH offers programs that will prepare them for admission to the professional school.

Competition for admission to medical and dental schools is great, and students should realize that completion of the admission requirements does not insure acceptance. Since admission to the schools is not assured, students are advised to complete undergraduate degree requirements.

Typical of the requirements for admission to medical colleges are those which follow for the Medical College of Alabama at the University of Alabama in Birmingham:

1. Two academic years of English
2. One academic year of general biology or zoology
3. One academic year of general inorganic chemistry (including qualitative analysis and laboratory work)
4. One academic year of organic chemistry with laboratory work
5. One academic year of physics with laboratory work
6. College algebra and trigonometry

In addition many medical schools require that students take one year of physical chemistry and mathematics through calculus. Students are encouraged to take as much chemistry and mathematics as possible. To reduce duplication in later work, electives taken in biology should be genetics and embryology. A student is advised to choose his program according to his individual interest and ability so that he may fulfill his maximum academic potential.

Typical of the requirements for admission to dental schools are these which follow for the School of Dentistry at the University of Alabama in Birmingham:

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Biology</td>
<td>8</td>
</tr>
<tr>
<td>2. Inorganic chemistry (including qualitative analysis)</td>
<td>8</td>
</tr>
<tr>
<td>3. Organic chemistry</td>
<td>8</td>
</tr>
<tr>
<td>4. Quantitative analysis</td>
<td>4</td>
</tr>
<tr>
<td>5. Physics (including laboratory)</td>
<td>8</td>
</tr>
<tr>
<td>6. College algebra and trigonometry</td>
<td>6</td>
</tr>
<tr>
<td>7. Thirty semester hours of non-science courses to include 6 (preferably 12) semester hours in English. It is recommended that students complete 12 semester hours in a foreign language and include as many</td>
<td></td>
</tr>
</tbody>
</table>
courses in history, political science, economics, philosophy, psychology, and sociology as possible.

8. The completion of a minimum of 90 semester hours of collegiate work.

Students should elect courses in mathematics through calculus and should not elect biology courses that constitute a part of the dental school curriculum.

Nursing

Students interested in nursing as a career can initiate a degree program at UAH and plan to transfer to the School of Nursing at the University of Alabama in Birmingham to complete degree requirements. The curriculum for the first two years may be found in the catalog of the College of Arts and Sciences of the University of Alabama. Students may find it advisable to transfer during the sophomore year to prevent loss of time.

Law

Many schools of law require applicants to obtain a bachelor's degree as a prerequisite for admission. Interested students should examine the requirements of the specific law school which they wish to attend for identification of the needed curriculum.

The University of Alabama School of Law does not prescribe any particular curriculum of pre-law study, but normally requires as a condition for admission that the applicant has successfully completed the following undergraduate work or its equivalent:

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Composition</td>
<td>6</td>
</tr>
<tr>
<td>English or American Literature</td>
<td>6</td>
</tr>
<tr>
<td>American History</td>
<td>6</td>
</tr>
<tr>
<td>Political Science (including U.S. Government)</td>
<td>6</td>
</tr>
<tr>
<td>Principles of Economics</td>
<td>6</td>
</tr>
</tbody>
</table>

Additional recommended courses are philosophy, psychology, sociology, foreign languages, and accounting. Since other requirements must be met, completion of these courses does not insure admission.

Commerce and Business Administration

Students interested in obtaining a degree in one of the concentrations of commerce and business from the University of Alabama will find it possible to complete up to 75% of the undergraduate degree program at UAH. Proper course selection is the responsibility
of the student. Professional courses are validated when a student successfully completes one additional course in the sequence after transfer.

Typical of the requirements for admission to the MBA program are those which follow for the School of Commerce and Business Administration at the University of Alabama in Tuscaloosa.

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>3</td>
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<td>3</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**Education — Teaching Certificates**

A student may complete professional requirements for a Class B Secondary Teaching Certificate in any of the approved major areas of concentration. Students interested in a degree in education involving programs in other major areas or in elementary education may complete up to 75% of the degree requirements at UAH. When preparing such programs, a student should consult the requirements of the particular school to which he may transfer.

**Undergraduate Degree Requirements**

**Degrees Offered**

Programs for the undergraduate degrees of Bachelor of Arts, Bachelor of Science, and Bachelor of Science in Engineering are provided with major AOC's in the indicated areas of specialization:

- Bachelor of Arts: Art, Biology, Economics, English, History, Mathematics, Psychology
- Bachelor of Science: Biology, Chemistry, Mathematics, Physics
- Bachelor of Science in Engineering: Unified Programs with Professional Specializations

**Total Degree Requirements**

1. Minimum requirements for the Bachelor of Arts and Bachelor of Science degrees are 128 semester hours; for the Bachelor of Science in Engineering degree, 136 semester hours. A minimum of 25% of the total requirements and 12 of the last 18 hours must be
completed at UAH after September 1, 1964. Also, unless otherwise specified by the discipline involved, a minimum of 12 semester hours of upper level courses (numbered 300 or above) must be completed at UAH in a student’s AOC (6 hours in his major and 6 hours in his cluster) after September 1, 1964. A minimum of 30% of the total degree requirements (including requirements for the major and the cluster) must be taken in courses numbered 300 or above.

2. The maximum amount of correspondence or extension credit allowed towards a bachelor’s degree is 25% of the degree requirements.

3. An overall average of C is required for all courses taken at: (a.) all institutions; (b.) UAH; and (c.) UAH and overall in the major and in all other courses in the AOC.

General Education Requirements for the BACHELOR OF ARTS DEGREE

<table>
<thead>
<tr>
<th>Humanities</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Composition</td>
<td>6</td>
</tr>
<tr>
<td>Survey of English Literature</td>
<td>6</td>
</tr>
<tr>
<td>Origins and Development of the Contemporary World</td>
<td>6</td>
</tr>
</tbody>
</table>

Social and Behavioral Sciences

Economics, Political Science, Psychology, or Sociology (or Philosophy from the Division of the Humanities) (one discipline) 6

If major is economics or psychology, basic social science requirements should be taken in one of the other areas.

Science — Mathematics 14-16

A student may select any of the following groups:

a. 6 hours mathematics
   8 hours laboratory science in one of biology, chemistry, physics, or earth science

b. 8 hours in each of two laboratory sciences

c. 3 hours mathematics
   8 hours in a physical science or biology
   4 hours in the other area (physical science or biology)
Foreign Language  
(One Language) ........................................... 6-12

Students who have a competence in a language will be placed at the appropriate level by the foreign language faculty and may complete this requirement with 6 hours beyond the elementary level in that language. No credit is advanced for exemption from any portion of the language requirement. Additional specific requirements are listed by disciplines approved to offer a major.

To meet the requirements for the Bachelor of Arts degree, a student will take 44-52 semester hours listed in General Education Requirements. A student may take no more than 64 semester hours in his total AOC program (a major with a supporting cluster). All prerequisites will be included in this 64-hour maximum. He may take up to 52 semester hours in his major, including courses in his major listed in General Education Requirements; however, the latter courses may not be included in the 64-hour maximum in the total AOC program.

General Education Requirements for the
BACHELOR OF SCIENCE DEGREE

Humanities  
<table>
<thead>
<tr>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Composition ........................................ 6</td>
</tr>
<tr>
<td>Survey of English Literature ................................. 6</td>
</tr>
<tr>
<td>Origins and Development of the Contemporary World ........ 6</td>
</tr>
</tbody>
</table>

Social and Behavioral Sciences
Economics, Political Science, Psychology, or Sociology (or Philosophy from the Division of the Humanities) (one discipline) ............................... 6

Natural Science
(8 hours each in two)
Biology, Chemistry, or Physics ................................. 16

Mathematics ....................................................... 9

Foreign Language  
(One language) ........................................... 6-12

Students who have a competence in a language will be placed at the appropriate level by the foreign language
faculty and may complete this requirement with 6 hours beyond the elementary level in that language. No credit is advanced for exemption from any portion of the language requirement. Additional specific requirements are listed by disciplines approved to offer a major.

To meet the requirements for the Bachelor of Science degree, a student will take 44-52 semester hours listed in General Education Requirements. A student may take no more than 64 semester hours in his total AOC program (a major with a supporting cluster). All prerequisites will be included in this 64-hour maximum. He may take up to 52 semester hours in his major including courses in his major listed in general education requirements; however, the latter courses may not be included in the 64-hour maximum in the total AOC program.

Requirements for the

BACHELOR OF SCIENCE IN ENGINEERING DEGREE

The requirements for this degree are identified in the section on the Division of Engineering.
DIVISION OF THE HUMANITIES

The graduate of the University of Alabama in Huntsville should take his place as a responsible citizen through having attained an understanding of man's relation to himself, his fellow man, and the physical and biological world in which he lives. He should be trained in the skills of criticism so that he will be able to gather, organize, and evaluate data. He should be able to communicate his thoughts in correct and effective language. He should enter his adult life with those appreciations and tastes which will prove personally enriching to him and his community.

The Division of the Humanities embraces disciplines and academic programs essential to those objectives that fall in the area of the humanities and education.

Undergraduate Degrees and Study

Within the Division a student seeking a Bachelor of Arts degree must, no later than the close of his sophomore year, declare an Area of Concentration (AOC). This AOC must include a major chosen from one of the following disciplines: art, English, or history; and must include one of the following variations:

(1) An established cluster drawn from one discipline currently offering a major at the University of Alabama in Huntsville. The cluster must include a minimum of 21 semester hours as prescribed by the discipline, 6 of which must be numbered 300 or above;

(2) A cluster drawn from one discipline without an established major which includes 21 semester hours of courses of which at least 6 hours are numbered 300 or above; or

(3) A cluster supporting the major drawn from two or more disciplines which must include a minimum of 21 semester hours, 9 hours of which must be taken in courses numbered 300 or above.

Any cluster chosen by a student is subject to the approval of (1) the student's major discipline; (2) the other discipline or disciplines from which courses in the cluster are drawn; and, (3) the Division Director. Each major discipline has developed appropriate areas of concentration designed to provide a sound curriculum in various areas of interest; however, a student who wishes to deviate from any of the standard AOC's may work out an individual program with the advice of his major discipline subject to the above regula-
tions concerning approval. In addition to the areas where majors and supportive clusters are authorized, courses are offered in education, modern foreign languages (French, German, Russian, Spanish), music, philosophy, and speech.

Students planning to become high school teachers may major in one of the approved areas of concentration and complete requirements for a Class B Secondary Professional Teaching Certificate, State of Alabama. (See following section.)

SPECIAL CURRICULUM FOR THE CLASS B SECONDARY PROFESSIONAL TEACHING CERTIFICATE

Students in the Division of the Humanities, the Division of Natural Sciences and Mathematics, or the Division of Social and Behavioral Sciences who wish to qualify for the Class B Secondary Professional Teaching Certificate must meet the requirements listed below.

I. Academic Area Courses:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td></td>
</tr>
<tr>
<td>a. English Composition</td>
<td>6</td>
</tr>
<tr>
<td>b. Survey of English Literature</td>
<td>6</td>
</tr>
<tr>
<td>Social Sciences</td>
<td></td>
</tr>
<tr>
<td>a. Origins and Development of the Contemporary World</td>
<td>6</td>
</tr>
<tr>
<td>b. Economics, Political Science, or Sociology (History majors are encouraged to choose Political Science or Economics.)</td>
<td>6</td>
</tr>
<tr>
<td>Natural Science</td>
<td>12</td>
</tr>
<tr>
<td>Biological and Physical Science (must include two courses in either a Biological or a Physical Science. The remaining credits must be in the other science).</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>Speech</td>
<td>3</td>
</tr>
<tr>
<td>Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

In addition to the general requirements listed above, students must complete an area of concentration including a major from the Division of the Humanities, and a cluster drawn from the Division of Natural Sciences and Mathematics, the Division of Social and Behavioral Sciences, or the Division of the Humanities, and satisfactorily complete all requirements for a degree in the appropriate division.
II. Professional Education Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED 261</td>
<td>Foundations of Education in the United States</td>
<td>3</td>
</tr>
<tr>
<td>ED 263</td>
<td>Educational Psychology</td>
<td>3</td>
</tr>
<tr>
<td>ED 388</td>
<td>Teaching Secondary School Subjects</td>
<td>3</td>
</tr>
<tr>
<td>ED 490</td>
<td>Principles of High School Teaching</td>
<td>3</td>
</tr>
<tr>
<td>ED 497</td>
<td>Secondary Student Teaching</td>
<td>9</td>
</tr>
</tbody>
</table>

ADMISSION TO THE TEACHER EDUCATION PROGRAM

All students who indicate a definite interest in teaching as a career may submit the Declaration of Intent to Teach as early as the freshman year so that appropriate counseling opportunities may be established to identify course patterns.

During the winter or spring term of the sophomore year, students should make application for admission to the teacher education program. Applicants to the program should:

a. Have a cumulative quality-point average of 1.00 on all work attempted.

b. Have completed at least 70% of the academic areas listed above.

c. Present confidential evaluations prepared on forms provided for this purpose.

APPLICATION FOR STUDENT TEACHING

Before April 15 of the student's junior year, students admitted to the teacher education program should make application for a student teaching assignment for one term of the senior year. The following additional criteria must be met before the student teaching assignment is made.

1. The student must have acquired (a) a grade point average of 1.20 in all work attempted and a grade point average of 1.10 in all work attempted in the major field, or (b) a grade point average of 1.00 in all work attempted and a grade point average of 1.50 in all work attempted in the major field.

2. A grade point average of 1.00 in all work attempted in education courses.

3. Satisfactory completion of all Academic Area Courses.

In addition to fulfilling the general degree requirements, a student must earn as many quality points as hours attempted in professional psychology and education courses.
Near the end of the teacher education program, the student must complete the State Department of Education certification application at the Office of Student Records.

Graduate Study in Education

A student admitted to the graduate program of the College of Education at the University of Alabama in Tuscaloosa may apply a maximum of 12 semester hours earned at the Huntsville Campus toward the master's degree.

A student interested in graduate study in education should refer to the Graduate School Catalog and the College of Education Catalog of the University of Alabama in Tuscaloosa for complete description of admission requirements and courses. Students are advised to seek counseling in establishing their program needs.

Graduate work for the Master of Arts degree is offered by the College of Education in: administration and supervision; art education; business education; counseling and guidance (including student personnel work in higher education and vocational rehabilitation counseling); curriculum study and research; educational psychology (including a program for the preparation of reading improvement specialist); elementary education; health, physical education, and recreation; home economics education; music education; school librarianship; secondary education; special education for exceptional children; and vocational industrial education.

Visual Art (Art)

Area of Concentration (AOC) with Visual Art Major

The art program is planned to provide the necessary background for graduate work in art, a career in art, and for cultural enrichment.

Two basic patterns have been established for the degree candidate in art: Plan 1 is designed to be most helpful to the greatest number of students; Plan 2 is designed for students of exceptional ability.

The basic degree requirements include 6 semester hours of history of art (Art 100 and 101); a foundation program of 16 to 18 semester hours of courses in the 100 series; and upper division work of 22 semester hours as detailed below.

Opportunities for specialization within the visual art degree program are: art history, painting, communication graphics, sculpture, and art teacher training.
To enable UAH visual art graduates to compete effectively with graduates from institutions offering the Bachelor of Fine Arts degree, the UAH visual art program requires that studio courses meet 90 hours during a term for 2 semester hours credit.

Requirements for a major: Art 100 and 101 are required of all art majors.

Plan I. Visual Art Program

I. Major in Studio Specialties (painting, communication graphics, and sculpture):

Lower Division Foundation Program (16 semester hours)—
  drawing, 6 hours (3 courses); design, 6 hours (3 courses); and sculpture, 4 hours (2 courses).

Upper Division (22 semester hours):
  Junior Year: 6 hours (3 courses) in a major studio area (painting, communication graphics, or sculpture) at the 300 level; 7 hours, consisting of 4 hours (2 courses) 2 hours each in a different studio area at the 300 level; and 3 hours in art history.
  Senior Year: 6 hours (3 courses) in a major studio area at the 400 level and 3 hours of art history at the 300 level or above.

II. Major in the Art History Specialty:

Lower Division Foundation Program (18 semester hours) 6 hours of art history (including Art 109 and 3 hours in a course above the 100 level); 12 hours studio courses (all at the 100 level), consisting of drawing, 4 hours (2 courses); design, 4 hours (2 courses); sculpture, 2 hours (1 course); and 2 additional hours in an elective studio course at the 100 level.

Upper Division (22 semester hours):
  Junior Year: 9 hours in art history (3 courses) at the 300 level; 4 hours in studio (2 courses), each in a different studio area.
  Senior Year: 9 hours in art history (3 courses), two of which are at the 400 level.

III. Major in Visual Art with Certification:

Class B Secondary Professional Certificate (Grades 7-12)
Categories of Requirements for Teacher Certification are:

A. Visual Art Major with Specialty in either Studio or Art History
   1. Studio Specialty. Art courses should include a minimum of 30 hours.
      a. Art History: 6 hours (2 of 3 courses at the 100 level).
      b. Studio: 16 hours from the Lower Division as specified for the Studio Specialty; 8 hours (4 courses) in the Upper Division (300 level or above) from at least two fields, selected from design, painting, or sculpture. At least one of these courses should be in painting.
   2. Art History Specialty. Art courses should include a minimum of 28 hours.
      a. Art History: 6 hours from Art 100, 101, 109; 12 additional hours of art history including at least three courses at the 300 level. One of the 400 level courses is recommended.
      b. Studio: (10 hours.) 8 hours (4 courses) at the 100 level including one course from each of the studio areas (drawing, design, and sculpture); one additional course (2 hours) in painting.

B. Required Cluster Program: 21 hours selected from subjects approved by the State Department of Education on file in the Art Office. If part of the cluster is included in the general education requirements, additional art courses may be selected.

C. Basic requirements for teacher certification are identified elsewhere in the section on The Division of the Humanities. Teacher certification requirements (other than listed in basic core) will include Art Methods (ED 388) and Practice Teaching in Art (ED 497).

Plan II. Visual Art Program for the Exceptional Student

This program is designed for individuals who wish to meet the exacting demands of graduate study and for students of exceptional ability and commitment. Students who wish to enter this program must receive the consent of the Discipline Chairman not later than the third term prior to graduation.

Plan II may be followed in two ways in a 134-hour degree program:

A. Independent Study in the candidate's specialty, leading to a one-man exhibition or the presentation of a research paper at a seminar meeting in the last term of the senior year; or

B. Six additional semester hours of work in art history may be scheduled by the studio major or 6 additional semester hours work in studio may be scheduled by the art history major.
Selected examples of a student's art work may be retained at the discretion of the art faculty to add to a permanent collection.

An art student transferring to UAH from another institution must submit information on previous training and representative samples of his art work to the art faculty for evaluation. This should be done in advance of initial registration. Advanced placement in regard to UAH art courses will be determined by the art faculty on the basis of the examples of art work and supporting data. Transfer students who receive a degree with a specialty in visual art from UAH must take at least 12 semester hours of visual art courses numbered 300 or above at UAH. A student having a cluster in visual art must take at least 6 semester hours of this work at UAH.

### Visual Art (ART)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>ART HISTORY SURVEY I: ANCIENT AND MEDIEVAL ART.</td>
<td>3 hrs.</td>
</tr>
<tr>
<td></td>
<td>A survey of the architecture, sculpture, painting, and decorative arts of the ancient and medieval worlds, considered in relation to the conditions under which they were produced.</td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>ART HISTORY SURVEY II: RENAISSANCE AND MODERN.</td>
<td>3 hrs.</td>
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<tr>
<td></td>
<td>A survey of the architecture, sculpture, painting, and other art manifestations of the Western World from 1400 to the present. The cultural setting, the determining influences, and the creative projections of the individual artists in each period are considered.</td>
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</tr>
<tr>
<td>109</td>
<td>INTRODUCTION TO CRITICISM AND APPRECIATION OF ART.</td>
<td>3 hrs.</td>
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<td></td>
<td>Introduction to basic aspects of and factors in criticism and appreciation of art, including an introduction to phenomenological aesthetics. Exploration of avenues of appreciation open to and used by individuals of varying backgrounds. A brief review of art movements of the 19th and 20th centuries in relation to pertinent influences in the environment as modified or structured by individual creativity. (Not applicable to art history requirements for studio specialties).</td>
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<tr>
<td>120</td>
<td>TWO-DIMENSIONAL FORM IN DESIGN.</td>
<td>2 hrs.</td>
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<tr>
<td></td>
<td>An introduction to the primary fundamentals of two-dimensional design, encompassing analytical and intuitive work in dot, line, and plane on the pictorial surface.</td>
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<tr>
<td>121</td>
<td>COLOR IN DESIGN.</td>
<td>2 hrs.</td>
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<tr>
<td></td>
<td>An investigation into the physiological, psychological, and physical properties of color, with experimental studio work in both the subjective and objective evaluation of color usage.</td>
<td></td>
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<tr>
<td>122</td>
<td>THREE-DIMENSIONAL FORM IN DESIGN.</td>
<td>2 hrs.</td>
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<tr>
<td></td>
<td>Studio analysis and development of forms by the use of basic principles of three-dimensional expression and manipulation.</td>
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<tr>
<td>140</td>
<td>SCULPTURAL USE OF ORGANIC MATERIAL.</td>
<td>2 hrs.</td>
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<tr>
<td></td>
<td>Introduction in clay to three-dimensional sculptural space and practice in mold-making and casting techniques.</td>
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</tr>
<tr>
<td>141</td>
<td>SCULPTURE: METAL ASSEMBLAGE.</td>
<td>2 hrs.</td>
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<tr>
<td></td>
<td>Welded metal as sculpture—oxy-acetylene and arc welding.</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>DRAWING WITH DARK-ON-LIGHT MEDIA.</td>
<td>2 hrs.</td>
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<tr>
<td></td>
<td>Introduction to two-dimensional form and expression through the use of the more traditional means of line, value, texture, etc.</td>
<td></td>
</tr>
</tbody>
</table>
161. DRAWING WITH FLUID MEDIA.  2 hrs.  
Introduction to the use of inks, washes, oils, gouache, etc., in art-image making.

162. DRAWING LIGHT-ON-DARK MEDIA.  2 hrs.  
Introduction to the additive use of light reflectivity in drawing, especially useful in preparation for painting about mass in space.

163. DRAWING WITH COLLAGE.  2 hrs.  
Introduction to the problems and possibilities inherent in the drawing systems that involve reorganizing preformed visual references.

164. LINE AND PERSPECTIVE.  2 hrs.  
Introduction to basic drafting techniques with studies in line and linear perspective. Suggested for communication graphics specialists.

Upper Division

300. HISTORICAL SURVEY OF AMERICAN ART.  3 hrs.  
A survey of the visual arts in America from the Colonial Period to the present, with consideration of the changes in the status of the visual arts in American culture in successive periods. In connection with architecture, prototypes that have influenced American building forms and furnishings are reviewed. Prerequisite: Art 100 or 101 or approval of instructor.

301. HISTORICAL SURVEY OF CLASSICAL ART.  3 hrs.  
A survey of the developmental changes in the visual arts in Greece and the Roman Empire and the cultural interrelationship involved. Examples are presented of the influence of classical art on later art forms in Europe and America. Prerequisite: Art 100 or 101 or approval of instructor.

302. HISTORICAL SURVEY OF MEDIEVAL ART.  3 hrs.  
A survey of the architecture, sculpture, and decorative arts, including manuscript illumination of the Middle Ages in relation to the environmental cultures in which these arts evolved. Prerequisite: Art 100 or 101 or approval of instructor.

303. HISTORICAL SURVEY OF RENAISSANCE ART.  3 hrs.  
The visual arts of the Renaissance in Italy and Europe. The emergence of the artists as a creative personality and the role of the visual arts in the development of Renaissance civilization. Renaissance sources of art forms used in later centuries. Prerequisite: Art 100 or 101 or approval of instructor.

304. HISTORICAL SURVEY OF CONTEMPORARY ART.  3 hrs.  
A survey of the visual arts in the 20th century and their 19th century antecedents. Implications of the Cultural Explosion of the middle decades of the current century. The changing role of the artist in contemporary society. New concepts of media and relation to environment in the arts of today. Prerequisite: Art 100 or 101 or approval of instructor.

320. ADVANCED DESIGN.  2 hrs.  
Experimental manipulation of imagery in two and three-dimensional media and in film. Research in contemporary art movements. Prerequisite: Art 100 or 101, 120, 121, or approval of instructor.

321. ADVANCED DESIGN.  2 hrs.  
Exploration of design relationships in our physical environment with problems, both real and hypothetical, necessitating individual response and solution. Prerequisite: Art 100 or 101, 120, 121, or approval of instructor.

322. ADVANCED DESIGN WORKSHOP.  2 hrs.  
Selection of individual design problems in image media, requiring individual initiative and research. Drawings, models, research reports, etc. Prerequisite: Art 100 or 101, 120, 121, or approval of instructor.
330. COMMUNICATION GRAPHICS - FUNDAMENTALS.  2 hrs.
Introduction to the tools and practices of the professional graphic designer. A beginning study in the history of contemporary letter forms, with analysis and studio practice in historical calligraphic styles. Prerequisite: Art 100, 101, 120, 121, or approval of instructor.

331. COMMUNICATION GRAPHICS - TYPOGRAPHY.  2 hrs.
Advanced practice in calligraphy. Investigation into the evolution of contemporary type design and usage. Studio work in the basic techniques of typographic layout and typesetting. Prerequisite: Art 100 or 101, 120, 121, or approval of instructor.

332. COMMUNICATION GRAPHICS - ILLUSTRATION.  2 hrs.
Studio practice in contemporary illustrational concepts and commercial techniques. Investigation in the development of the art of illustration from its origin to the present. Prerequisite: Art 100 or 101, 120, 121, or approval of instructor.

340. SCULPTURAL USE OF THE THERMOSET PLASTICS.  2 hrs.
Sculptural manipulation of thermoset resins and foams. Prerequisite: Art 101, 140, or approval of instructor.

341. SCULPTURAL USE OF THE THERMOPLASTICS.  2 hrs.
Manipulation of thermoplastics by bonding, dyeing, forming, and welding. Prerequisite: Art 101, 140, 141, or approval of instructor.

342. CASTING METAL.  2 hrs.
Foundry work in wax and sand casting of bronze and aluminum. Prerequisite: Art 100 or 101, 140, 141, or approval of instructor.

370. OIL PAINTING.  2 hrs.
An advanced course leading to the development of reflex and conscious acquaintanceship with the fusion and additive characteristics of oil paints. Prerequisite: Art 100 or 101; one of Art 120, 121, 122; and one of Art 160, 161, 162, 163, or approval of instructor.

371. TEMPERA PAINTING.  2 hrs.
Advanced course designed to develop capability in the generally opaque and quick-curing tempera media that are so conducive to pictorial and decorative effect. Prerequisite: Art 100 or 101; one of 120, 121, 122; and one of 160, 161, 162, 163, or approval of instructor.

372. MIXED MEDIA.  2 hrs.
Advanced experience in the combination of formerly separate media and motifs: for example, two and three-dimensional, cut-out, film, motion, lights, sound, literary reference, environments, events, etc. Prerequisite: Art 100 or 101; one of 120, 121, 122; and one of 160, 161, 162, 163, or approval of instructor.

360. GRAPHICS: INTAGLIO PRINTMAKING.  2 hrs.
Beginning studio practice in etching and engraving. Prerequisite: Art 100 or 101, 121; and one of Art 160, 161, 162, 163, or approval of instructor.

381. GRAPHICS: PLANOGRAPHIC PRINTMAKING.  2 hrs.
Beginning studio practice in lithography. Prerequisite: Art 100 or 101; and one of Art 160, 161, 162, 163, or approval of instructor.

382. GRAPHICS: RELIEF PRINTMAKING.  2 hrs.
Beginning studio practice in woodcut, wood engraving, lino-cut, and contemporary relief printing techniques. Investigation into historical backgrounds. Prerequisite: Art 100 or 101, 121; and one of Art 160, 161, 162, 163, or approval of instructor.

Senior level courses are designed to make heavy demands on the independent initiative of the degree candidate. He must have completed all foundation courses and all general education requirements before commencing the senior program.
400. ART HISTORY SEMINAR: RENAISSANCE AND BAROQUE. 3 hrs.
Initial survey of Baroque developments in relation to Renaissance art forms. Discussion and guided research on artists, works of art, and related cultural changes in these periods. A research paper is developed by each participant. Prerequisite: Art 100 or 101, 303, junior standing, and approval of instructor.

401. ART HISTORY SEMINAR: MODERN ART. 3 hrs.
Discussion and guided research on the visual arts of the late 19th and 20th centuries. A research paper is developed by each participant. Prerequisite: Art 100, 101, or 108, 304; junior standing, and approval of instructor.

430. ADVANCED STUDIO PROBLEMS IN COMMUNICATION GRAPHICS. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

431. ADVANCED STUDIO PROBLEMS IN COMMUNICATION GRAPHICS. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

432. ADVANCED STUDIO PROBLEMS IN COMMUNICATION GRAPHICS. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

440. ADVANCED STUDIO PROBLEMS IN SCULPTURE. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

441. ADVANCED STUDIO PROBLEMS IN SCULPTURE. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

442. ADVANCED STUDIO PROBLEMS IN SCULPTURE. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

470. ADVANCED STUDIO PROBLEMS IN PAINTING. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

471. ADVANCED STUDIO PROBLEMS IN PAINTING. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

472. ADVANCED STUDIO PROBLEMS IN PAINTING. 2 hrs.
Individual content by consultation. Prerequisite: Senior standing.

Education (Ed)

111. CAREER EXPLORATION. 1 hr.
Educational and Vocational Planning. Prerequisite: 9 hours college credit and placement tests.

261. FOUNDATIONS OF EDUCATION IN THE UNITED STATES. 3 hrs.
The development of education in America and its relation to prospective teachers. Prerequisite: Sophomore standing.

263. EDUCATIONAL PSYCHOLOGY. 3 hrs.
Psychological principles basic to an understanding of the learner, the learning process, and the learning situation. Prerequisite: ED 121 or PY 100 and sophomore standing.

404. PRINCIPLES OF EDUCATION. 3 hrs.
Aims of education and functions of schools in a democratic society.

411. GUIDANCE FOR TEACHERS. 3 hrs.
The sociological, psychological, and philosophical bases for guidance in schools.

456. MENTAL HEALTH IN THE SCHOOL. 3 hrs.
Dynamics of behavior, the recognition of minor maladjustments, the criteria for referral, and classroom practices supporting good mental health. Prerequisite: ED 263 or equivalent and junior standing.
467. TESTS AND MEASUREMENTS. 3 hrs.
Survey of standardized and teacher-made evaluation instruments.

500. SPECIAL PROBLEMS IN EDUCATION. 1-3 hrs.
Independent study. Prerequisite: Senior standing.

549. AUDIO-VISUAL INSTRUCTION. 3 hrs.
Audio-visual media in teaching, the selection, use, and maintenance of audio-visual materials in educational programs. Open only to students in teacher-education curricula.

**Elementary Education**

365. LITERATURE FOR CHILDREN. 3 hrs.
Selection and teaching of literature for elementary school children according to interests, needs, and abilities. Prerequisite: Junior standing and admission to the teacher education program.

370. TEACHING OF READING. 3 hrs.
Materials and methods in the teaching of reading; emphasis upon developing readiness and planning a balanced program. Prerequisite: ED 263, junior standing, and admission to the teacher education program.

378. TEACHING THE LANGUAGE ARTS. 3 hrs.
Theory and practice in teaching composition, spelling, writing, and reading. Prerequisite: ED 263, junior standing, and admission to the teacher education program.

379. TEACHING OF ARITHMETIC. 3 hrs.
Presentation of the subject matter of arithmetic; helping children develop understanding and functional skills. Prerequisite: ED 263, junior standing, and admission to the teacher education program.

482. OBSERVATION AND PARTICIPATION IN TEACHING. 3-6 hrs.
Selected observation and participation in elementary schools. For students in curricula designed for both elementary and secondary schools and for experienced teachers. Prerequisite: Senior standing.

**Secondary Education**

388. TEACHING SECONDARY SCHOOL SUBJECTS. 3 hrs.
(Major area of teaching to be designated.) Materials and methods in the various major fields. Prerequisite: ED 263 and admission to the teacher education program.

490. PRINCIPLES OF HIGH SCHOOL TEACHING. 3 hrs.
Prerequisite: ED 388 and senior standing. This course is taken concurrently with student teaching.

497. SECONDARY STUDENT TEACHING. 9 hrs.
(Major area of teaching to be designated.) Observation and student teaching in secondary schools. Prerequisite: ED 388 and senior standing.

498. SECONDARY STUDENT TEACHING. 3-6 hrs.
(Major area of teaching to be designated.) Observation and student teaching in secondary schools. Prerequisite: ED 388 and senior standing.

**Early Childhood Education**

230. HUMAN DEVELOPMENT. 3 hrs.
Overview of human development from conception to adulthood. Continuity stressed. Practical applications for teachers and parents.
231. TEACHING THE YOUNG CHILD. 3 hrs.
Considers the total pattern of child development, curriculum, learning, methods, and guidance for the child from two to nine years of age.

Special Education

493. EDUCATION OF EXCEPTIONAL CHILDREN AND YOUTH. 3 hrs.
Introduction to the field of exceptional children and youth. Prerequisite: ED 263.

494. STUDENT TEACHING IN SPECIAL EDUCATION. 3 hrs.
Prerequisite: ED 495, 496, and admission to the teacher education program.

495. PSYCHOLOGY AND EDUCATION OF THE MENTALLY RETARDED I. 3 hrs.
Social, emotional, physical, and learning characteristics of retarded children and youth. Prerequisite: ED 263.

496. PSYCHOLOGY AND EDUCATION OF THE MENTALLY RETARDED II. 3 hrs.
Continuation of ED 495 with emphasis upon educational organization and teaching techniques. Prerequisite: ED 493; 495 recommended.

499. EDUCATION AND CARE OF CRIPPLED CHILDREN AND YOUTH. 3 hrs.
Analysis of special problems encountered in teaching orthopedically-involved children and youth; includes cerebral palsied and educational implications and adaptations.

School Librarianship

380. LIBRARY OPERATION AND MANAGEMENT. 3 hrs.
Methods of organizing books and other library materials; includes ordering, processing, circulating, mending, binding, inventory, budgeting, business records, housing, and equipment.

571. FUNCTION AND USE OF THE SCHOOL LIBRARY. 3 hrs.
School libraries in educational programs; includes historical development of libraries, standards, library service to teachers and pupils, use of the library.

573. SELECTION OF MATERIALS. 3 hrs.
Principles, policies, practices and problems in the selection of books and other materials and of techniques in the promotion of their use.

588. BOOKS FOR YOUNG PEOPLE. 3 hrs.
Reading and evaluating books and related materials according to the interests, needs, and abilities of high school age youth.

Graduate Education Courses

The following courses are taught in Huntsville for the graduate program of the College of Education at the University of Alabama in Tuscaloosa. Students are advised to seek counseling in establishing their program needs.

703. SOURCES OF AMERICAN EDUCATIONAL THOUGHT (SAME AS UA EDH 203). 3 hrs.

711. PRINCIPLES OF GUIDANCE (SAME AS UA CGP 211). 3 hrs.

722. MODERN ELEMENTARY SCHOOL PROGRAMS (SAME AS UA EED 222). 3 hrs.

730. MODERN SECONDARY SCHOOL PROGRAMS (SAME AS UA SED 230). 3 hrs.

733. INTRODUCTION TO PUBLIC SCHOOL ORGANIZATION AND ADMINISTRATION (SAME AS UA ACD 233). 3 hrs.

763. CONTRIBUTIONS OF PSYCHOLOGY TO TEACHING (SAME AS UA EPY 263). 3 hrs.

791. PRINCIPLES OF CURRICULUM DEVELOPMENT (SAME AS UA ACD 291). 3 hrs.
English (EH)

Area of Concentration (AOC) with English Major

Requirements for a major: A minimum of 24 to 40 semester hours, excluding General Education Requirements (EH 101-102 or 103-104 and EH 205-206.) The hours are identified as follows, with the provision that one group (but not more than one) must be fulfilled with a course devoted exclusively to the novel (courses marked with an asterisk), and that at least 6 semester hours be taken in courses numbered 400 or above.

| Semester Hours | Basic courses (EH 101-102 or 103-104 and EH 205-206) | 12 |
|               | Shakespeare (EH 360)                                  | 3  |
|               | American Literature (EH 330, 331, 430*, 431*, 432, 530) | 3  |
|               | I. Middle Ages and Renaissance (EH 240, 450, 460, 471)   | 3  |
|               | II. Restoration and 18th Century (EH 380, 381, 470, 492*) | 3  |
|               | III. 19th Century (EH 390, 391, 493*)                  | 3  |
|               | IV. Modern Literature (EH 241, 420, 421, 500)           | 3  |
|               | Electives in English                                   | 6 - 16 |
|               |                                                         | 36 - 52 |

The English major as defined above will form a part of an area of concentration which must include one of the following variations:

(1) An established cluster drawn from one discipline now offering a major which includes a minimum of 21 semester hours, 6 hours of which must be numbered 300 or above;

(2) A cluster drawn from a discipline other than those currently offering a major which includes a minimum of 21 semester hours, 6 hours of which must be numbered 300 or above;

(3) A cluster drawn from two or more disciplines which include a minimum of 21 semester hours, of which 9 hours must be in courses numbered 300 or above.

A student majoring in English will find a variety of AOC’s which will enable him to develop depth and breadth in English and some related areas chosen from the other humanities, the social sciences, mathematics, engineering, and the natural sciences. English model AOC’s are available at the English Office. A student who wishes to plan his own AOC can do so through English counselors and the AOC committee of the English faculty.
A supporting cluster in English must include a minimum of 21 semester hours of which at least 3 must be taken in courses numbered 400 or above, identified as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic courses (EH 101-102 or 103-104 and EH 205-206)</td>
<td>12</td>
</tr>
<tr>
<td>Shakespeare (EH 360)</td>
<td>3</td>
</tr>
<tr>
<td>One course chosen from Groups I, II, or III as listed in requirements for English major</td>
<td>3</td>
</tr>
<tr>
<td>Electives in English</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21</strong></td>
</tr>
</tbody>
</table>

No more than 3 semester hours credit in creative writing (EH 210, 211, 212, 213) may be applied to an English major or cluster without special approval of the English faculty.

Transfer students majoring in English must take at least 12 semester hours of advanced English courses (numbered 300 or above) at UAH. A student with a one-discipline cluster in English must take at least 6 semester hours of advanced English courses (numbered 300 or above) at UAH.

**English (EH)**

003. **WRITING CLINIC.** No credit. Designed for students whose placement test score or class performance indicates the need of remedial work.

101. **FRESHMAN COMPOSITION.** 3 hrs. Emphasis on theme writing, including at least one documented paper related to close critical reading of short stories and the novel. Prerequisite: Placement tests.

102. **FRESHMAN COMPOSITION.** 3 hrs. Emphasis on theme writing, including at least one documented paper related to close critical reading of poetry and drama. Prerequisite: EH 101.

103. **ADVANCED FRESHMAN COMPOSITION.** 3 hrs. Similar to, but more intensive than EH 101. Required of and open only to students whose placement test score indicates superior ability. Prerequisite: Placement tests.

104. **ADVANCED FRESHMAN COMPOSITION.** 3 hrs. Similar to, but more intensive than EH 102. Prerequisite: EH 103.

Courses below are open to students who have completed EH 102 or 104.

110. **ELEMENTARY PUBLIC SPEAKING.** 3 hrs. Theory and practice in the effective preparation and delivery of representative types of speeches. Meets requirements for teacher certification. No credit for student with major in English or with a cluster involving English.

113. **VOICE AND DICTION.** 3 hrs. A beginning course designed to assist the student to improve his personal use of voice. No credit for student with English major or with a cluster involving English.
114. FUNDAMENTALS OF ORAL INTERPRETATION. 3 hrs.
A beginning course to help the student gain the artistic skills needed to communicate literature to listeners. No credit for student with English major or with a cluster involving English.

205. SURVEY OF ENGLISH LITERATURE. 3 hrs.
Anglo-Saxon literature through Milton. Prerequisite: Sophomore standing.

206. SURVEY OF ENGLISH LITERATURE. 3 hrs.
Restoration through 20th century. Prerequisite: EH 205.
Courses below are open to students who have completed EH 206, with exceptions as indicated.

207. MODERN ENGLISH GRAMMAR. 3 hrs.
Study of traditional grammar, with introduction to structural grammar and linguistics.

208. HISTORY OF THE ENGLISH LANGUAGE. 3 hrs.
Survey of the morphological, syntactic, and lexical development of the English language, with emphasis on the structure of the present-day English. Prerequisite: EH 205.

210. FICTION WRITING. 3 hrs.
Practice in the writing of fiction, from conception to revision. Approval of instructor.

211. FICTION WRITING. 3 hrs.
Practice in the writing of fiction, from conception to revision. Approval of instructor.

212. POETRY WRITING. 3 hrs.
Practice in the writing of poetry, from conception to revision. Approval of instructor.

213. POETRY WRITING. 3 hrs.
Practice in the writing of poetry, from conception to revision. Approval of instructor.

240. WORLD LITERATURE. 3 hrs.
Selected major contributions to Western civilization; Homer to Dante.

241. WORLD LITERATURE. 3 hrs.
Selected major contributions to Western civilization; Rabelais to the present.

300. BIBLIOGRAPHY. 1 hr.
Lectures and practice in the techniques and materials of research in English and American literature.

330. MAJOR AMERICAN WRITERS. 3 hrs.
Major writers from the Colonial period to Whitman and Melville.

331. MAJOR AMERICAN WRITERS. 3 hrs.
Dickinson to Eliot and Faulkner.

360. SHAKESPEARE. 3 hrs.
Renaissance background and at least six plays, including history, comedy, and major tragedies.

380. RESTORATION AND EARLY 18TH CENTURY. 3 hrs.
Poetry and non-fictional prose, 1660-1745.

381. LATER 18TH CENTURY. 3 hrs.
Poetry and non-fictional prose, 1745-1780.

390. THE ROMANTIC PERIOD. 3 hrs.
Poetry and non-fictional prose, 1780-1832.
391. **THE VICTORIAN PERIOD.** 3 hrs.
Poetry and non-fictional prose, 1832-1901.

Courses below are open to students who have completed 18 semester hours in English.

420. **MODERN POETRY.** 3 hrs.
Major movements in American and British poetry of the 20th century.

421. **MODERN DRAMA.** 3 hrs.
A study of the major ideas and forces which originated new movements in drama from Ibsen to the present.

430. **THE AMERICAN NOVEL.** 3 hrs.
Thome and form of the American novel from Cooper to James.

431. **THE AMERICAN NOVEL.** 3 hrs.
Representative works from the school of naturalism to the present.

432. **THE SOUTHERN RENAISSANCE.** 3 hrs.
Origin and development of Southern myth with particular emphasis on major writers of the Southern Renaissance.

450. **CHAUCER.** 3 hrs.
Emphasis on *Canterbury Tales* and *Troilus and Criseyde* in middle English.

460. **RENAISSANCE NON-DRAMATIC POETRY.** 3 hrs.
Renaissance poetry exclusive of Shakespeare and Milton.

470. **MILTON AND THE 17TH CENTURY.** 3 hrs.
Milton, cavalier and metaphysical poetry, and selected prose.

471. **ENGLISH DRAMA.** 3 hrs.
From its beginnings to 1642, exclusive of Shakespeare.

492. **THE ENGLISH NOVEL.** 3 hrs.
Critical reading of representative novels, accompanied by historical survey of major trends. Fielding to Thackeray.

493. **THE ENGLISH NOVEL.** 3 hrs.
Critical reading of representative novels, accompanied by historical survey of major trends. George Eliot to present.

Courses below are open to students who have completed 24 semester hours in English.

500. **LITERARY CRITICISM.** 3 hrs.
Major theories and methods, with applications by the student.

530. **AMERICAN LITERATURE SEMINAR.** 3 hrs.
Intensive study of one or more writers, groups, or movements, announced in advance.

540. **ENGLISH LITERATURE SEMINAR.** 3 hrs.
Intensive study of one or more writers, groups, or movements, announced in advance.

**History (HY)**

**Area of Concentration (AOC) with History Major**

A student who wishes to major in history must include in his academic program a minimum of 36 semester hours in history, including HY 101-102 (a part of the General Education Requirements), HY 221-222, and a minimum of 15 semester hours in courses num-
bered 300 or above, one of which must be HY 501 or 502. A student choosing to concentrate in European history is required to take 6 semester hours in American history above HY 221-222. A student wishing to concentrate in American history is required to take 6 semester hours in courses other than American history in addition to HY 101-102. (Transfer students and students at UAH who have not completed HY 101 and 102 before reaching junior standing may substitute HY 391 and 392 in their basic requirements as well as in a history major.)

The history major as defined above will form a part of an area of concentration which must include one of the following variations:

(1) An established cluster drawn from one discipline now offering a major which includes a minimum of 21 semester hours, 6 hours of which must be numbered 300 or above;
(2) A cluster drawn from a discipline other than those currently offering a major which includes a minimum of 21 semester hours, 6 hours of which must be numbered 300 or above;
(3) A cluster drawn from two or more disciplines which include a minimum of 21 semester hours, of which 9 hours must be in courses numbered 300 or above.

A student majoring in history will find a variety of AOC’s which will enable him to develop depth and breadth in history and some related areas chosen from the other humanities, the social sciences, mathematics, and the natural sciences. Available history model AOC’s include the following: American Studies, American Foreign Relations, Graduate School Preparation, General, Pre-professional and Pre-law Preparation, International Studies, Secondary School Teaching, and the Fine Arts. A student who wishes to plan his own AOC can do so through the AOC committee of the history faculty.

Supportive History Clusters

A student interested in an established history cluster must choose appropriate history courses involving a minimum of 21 semester hours and including 6 hours in courses numbered 300 or above. Appropriate history courses may also form a part of a cluster with other disciplines to support another major program. Such a cluster must be approved by the AOC committee of the history faculty and must meet the requirements which it may establish.

History (HY)

101. ORIGINS AND DEVELOPMENT OF THE CONTEMPORARY WORLD, PART I. 3 hrs.
A general survey of the major western civilizations to 1648. Not open to seniors.
102. ORIGINS AND DEVELOPMENT OF THE CONTEMPORARY WORLD, PART II. 3 hrs.
A study of the development of modern institutions, technological advance­ments and values within the Western World from 1648 to the present, with particular attention to the rise and dominance of the West and the reaction of the non-Western world. Not open to seniors.

Courses below are open to all students other than beginning freshmen, with exceptions as indicated.

201. CURRENT AMERICAN ISSUES IN HISTORICAL PERSPECTIVE. 1 hr.
The historical background and present significance of selected topics in twentieth century American experience (examples might include racial problems, the urban crisis, the impact of technology).

202. CURRENT WORLD ISSUES IN HISTORICAL PERSPECTIVE. 1 hr.
A study of selected topics in world history during the twentieth century designed to foster an historical awareness of present day problems (e.g. World Communism, the Meaning of Anti-Semitism, the Emergence of Africa).

221. THE UNITED STATES TO 1877. 3 hrs.
A general survey of the history of the United States from discovery of America through the Civil War.

222. THE UNITED STATES SINCE 1865. 3 hrs.
A general survey of the history of the United States from the end of the Civil War to the present.

225. HISTORY OF ALABAMA. 3 hrs.
A survey of the State’s past from colonial times to the present with empha­sis on its place in United States history.

229. SURVEY OF ANCIENT TIMES. 3 hrs.
A survey of the history of the ancient Near East, Greece, and Rome. Pre­requisite: 101-102 or approval of instructor.

230. THE MEDIEVAL WORLD. 3 hrs.
A survey of the history of Europe from 500 to 1500. Prerequisite: HY 101-102 or approval of Instructor.

237. INTRODUCTION TO LATIN AMERICAN HISTORY: COLONIAL PERIOD. 3 hrs.
A general survey of Latin American history from the discovery to the in­dependence movements, 1808.

238. LATIN AMERICAN HISTORY SINCE 1808. 3 hrs.
A general survey of Latin American history from the independence movements to the present.

240. HISTORY OF FRANCE SINCE 1648. 3 hrs.
A study of political, economic, social, and cultural developments from the Peace of Westphalia to the present. Prerequisite: HY 101-102.

242. HISTORY OF GERMANY SINCE 1648. 3 hrs.
A study of the history of Germany from the close of the Thirty Years’ War to the present with attention being given to the decline and disappearance of the medieval empire, the rise of Brandenburg-Prussia, the unification of Germany, the problems of the Weimar Republic, and the emergence of the Third Reich. Prerequisite: HY 101-102.

247. HISTORY OF ENGLAND TO 1660. 3 hrs.
A general study of England from the earliest times to 1660 with attention to constitutional, political, economic, social, and intellectual developments. Prerequisite: HY 101-102 or approval of instructor.

248. HISTORY OF ENGLAND SINCE 1660. 3 hrs.
A general study of England with attention to constitutional, political, economic, social, and intellectual developments. Prerequisite: HY 101-102 or approval of instructor.
249. CURRENT WORLD HISTORY. 3 hrs.
A study of the present in perspective as it relates to the main themes of world history since 1914.

Courses listed below are open to students who have completed 12 semester hours in history or have junior standing.

364. THE WESTWARD MOVEMENT IN AMERICAN HISTORY SINCE 1803. 3 hrs.
A study of pioneering society, Indian relations, land policies, expansion, and politics of the westward-moving frontier.

369. SOCIAL AND CULTURAL HISTORY OF THE UNITED STATES TO 1865. 3 hrs.
A general study of the social, cultural, religious, and intellectual life of the United States to the end of the Civil War. Prerequisite: HY 221 or approval of instructor.

370. SOCIAL AND CULTURAL HISTORY OF THE UNITED STATES SINCE 1865. 3 hrs.
A general study of the social, cultural, religious, and intellectual life of the United States since the end of the Civil War. Prerequisite: HY 222 or approval of instructor.

373. FOREIGN RELATIONS OF THE UNITED STATES TO 1890. 3 hrs.
A general survey of foreign relations to 1890 with particular attention to the formation of traditional policies. Prerequisite: HY 221, 222, or approval of instructor.

374. FOREIGN RELATIONS OF THE UNITED STATES SINCE 1890. 3 hrs.
A general survey of foreign relations with particular attention to departures from traditional policies and the backgrounds of current situations. Prerequisite: HY 221, 222, or approval of instructor.

375. NINETEENTH-CENTURY RUSSIA, 1801-1905. 3 hrs.
Political, diplomatic, social, economic and intellectual developments in Imperial Russia from Alexander I to the Russo-Japanese War. Emphasis is placed on the influences of Western ideas and Marxism on the institutional structure of Russia. Prerequisite: HY 101-102 or approval of instructor.

376. TWENTIETH-CENTURY RUSSIA, 1905 TO PRESENT. 3 hrs.
The problems and issues involved in the Russian Revolution and the development of the Soviet Union. Prerequisite: HY 101-102 or approval of instructor.

377. HISTORY OF MEXICO SINCE 1810. 3 hrs.
A general study of the political, economic, social, cultural, and religious history of Mexico from the discovery of Mexico to the present.

391. EUROPE, 1648-1815. 3 hrs.
An examination of the economic, commercial, scientific, social, political, and cultural developments in Europe from the Peace of Westphalia to the close of the Napoleonic Wars.

392. EUROPE SINCE 1815. 3 hrs.
A study of Europe from the end of the Napoleonic Wars to the present with equal emphasis on the nineteenth and twentieth centuries. Prerequisite: HY 391 or approval of instructor.

393. MIDDLE EASTERN HISTORY FROM THE NINETEENTH CENTURY TO THE PRESENT. 3 hrs.
The emergence of nationalism among the peoples of the Ottoman Empire, the role of the Western nations in developing Arab nationalism, the conflict of Arab and Western political and economic aspirations. Prerequisite: HY 101-102 or approval of instructor.

Courses listed below are open to students who have completed 15 semester hours in history or 12 semester hours in history with senior standing.

413. THE OLD SOUTH. 3 hrs.
The colonial South through secession including the development and operation of the plantation economy and its extension into new lands, emergence of the ante-bellum social and political patterns of the region, and relationship of the South to the United States. Prerequisite: HY 221, 222, or approval of instructor.
414. THE NEW SOUTH. 3 hrs.
A study of the economic, social, and political readjustments of the late nineteenth century, and the vast changes in the South during the twentieth century. Prerequisite: HY 221, 222, or approval of instructor.

418. CONSTITUTIONAL HISTORY OF THE UNITED STATES. 3 hrs.
A study in the growth and development of the American constitutional system with emphasis on those aspects of constitutional growth which relate closely to the fundamental structure of American government and social order. Prerequisite: HY 221, 222, or approval of instructor.

424. AMERICAN HISTORY TO 1800. 3 hrs.
A study of the American Colonies within the British Empire, the Revolution, the Confederation, the Constitutional Convention, and the Federalist Period. Prerequisite: HY 221, 222, or approval of instructor.

428. AMERICAN HISTORY, 1800-1850. 3 hrs.
A study of Jeffersonian Democracy, Jacksonian Democracy, and the era of Manifest Destiny. Prerequisite: HY 221, 222, or approval of instructor.

434. THE CIVIL WAR AND RECONSTRUCTION. 3 hrs.
A study of the sectional struggle leading to secession of the South, and the political, military, economic, and social aspects of Civil War and Reconstruction. Prerequisite: HY 221, 222, or approval of instructor.

437. THE FOUNDATIONS OF MODERN AMERICA, 1865-1900. 3 hrs.
An intensive examination of the period from 1865 to 1900 with particular attention to the origins of twentieth-century United States. Prerequisite: HY 221, 222, or approval of instructor.

438. TWENTIETH CENTURY AMERICAN HISTORY. 3 hrs.
A study of the United States in the twentieth century with particular attention to the period since World War II. Prerequisite: HY 221, 222, or approval of instructor.

445. THE RELATIONS OF THE UNITED STATES AND LATIN AMERICA. 3 hrs.
A detailed study of the interrelationships of the United States with Latin America from 1776 to the present. Prerequisite: HY 238 or approval of instructor.

446. THE RELATIONS OF THE UNITED STATES AND THE FAR EAST. 3 hrs.
A study of the interrelationships of the United States with the Far East since 1784 with particular attention to China and Japan. Prerequisite: HY 221, 222, or approval of instructor.

447. THE HIGH MIDDLE AGES, C. 1000-1300. 3 hrs.
A study of the political, economic, and cultural features of Europe at the time when medieval civilization was at its height. Prerequisite: HY 391 or approval of instructor.

448. THE LATER MIDDLE AGES AND THE RENAISSANCE, C. 1270-1520. 3 hrs.
A study of Europe in the era of transition from medieval to modern times, stressing political, economic, social, and cultural factors. Prerequisite: HY 391 or approval of instructor.

A study of the religious crisis of the sixteenth century in its political, economic, and intellectual setting. Prerequisite: HY 391 or approval of instructor.

475. EUROPE IN THE SEVENTEENTH CENTURY. 3 hrs.
A study of Europe from the Edict of Nantes to the Peace of Utrecht with major emphasis upon the Thirty Years' War and the ascendancy of France under Louis XIV. Prerequisite: HY 391 or approval of instructor.

476. THE AGE OF REASON, 1713-1789. 3 hrs.
An analysis of the intellectual, social, economic, and political developments in Europe from the Peace of Utrecht to the outbreak of the French Revolution. Prerequisite: HY 391 or approval of instructor.
477. EUROPE IN THE AGE OF REVOLUTION, 1789-1848. 3 hrs.
A study of revolution and reaction, nationalism, liberalism, and democracy from the French Revolutions of 1848. Prerequisite: HY 391 or approval of instructor.

483. EUROPE, 1848 TO 1914. 3 hrs.
An intensive study of Europe in the period of intensification of national power and imperialism, culminating in the outbreak of the War of 1914. Prerequisite: HY 392 or approval of instructor.

484. EUROPE SINCE 1914. 3 hrs.
An intensive study of Europe focusing on the two world wars and the rise of totalitarianism. Prerequisite: HY 392 or approval of instructor.

501. SENIOR SEMINAR IN AMERICAN HISTORY. 3 hrs.
A course in historiography, research and writing, and recent interpretations in the field of American history. Open only to seniors who are majoring in, or who have a cluster in, history.

502. SENIOR SEMINAR IN EUROPEAN HISTORY. 3 hrs.
A course in historiography, research and writing, and recent interpretations in the field of European history. Open only to seniors who are majoring in, or who have a cluster in, history.

503. DIRECTED READINGS IN HISTORY. 3 hrs.
A program of independent reading in one field of history, to be selected in consultation with an advisor. Open only to seniors majoring in history.

Modern Foreign Languages (ML)

Course Numbers

The course numbering system of UAH has been coded additionally for courses in modern foreign languages so that the middle digit indicates each separate language.

<table>
<thead>
<tr>
<th>Language</th>
<th>Middle Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>0</td>
</tr>
<tr>
<td>German</td>
<td>1</td>
</tr>
<tr>
<td>Spanish</td>
<td>2</td>
</tr>
<tr>
<td>Russian</td>
<td>3</td>
</tr>
</tbody>
</table>

ML 102, 112, 123 are not open to freshmen who have had two years of the indicated language in high school. ML 001, 011, 021 are review courses for students who have had two years of high school work in a language and whose placement score indicates need for further preparation before entering the intermediate course in that language. These review courses carry no credit toward meeting the language requirement, but do apply toward elective credit.

Modern Foreign Languages (ML)

001. FRENCH REVIEW.
Three hours as an elective.

011. GERMAN REVIEW.
Three hours as an elective.
021. SPANISH REVIEW.  
Three hours as an elective.

101. ELEMENTARY FRENCH.  
(No credit without ML 102).  
3 hrs.

102. ELEMENTARY FRENCH.  
Prerequisite: ML 101.  
3 hrs.

111. ELEMENTARY GERMAN.  
(No credit without ML 112).  
3 hrs.

112. ELEMENTARY GERMAN.  
Prerequisite: ML 111.  
3 hrs.

121. ELEMENTARY SPANISH.  
(No credit without ML 122).  
3 hrs.

122. ELEMENTARY SPANISH.  
Prerequisite: ML 121.  
3 hrs.

131. ELEMENTARY RUSSIAN.  
(No credit without ML 132).  
3 hrs.

132. ELEMENTARY RUSSIAN.  
Prerequisite: ML 131.  
3 hrs.

201. INTERMEDIATE FRENCH.  
Prerequisite: ML 102 or placement.  
3 hrs.

202. INTERMEDIATE FRENCH.  
Prerequisite: ML 201.  
3 hrs.

211. INTERMEDIATE GERMAN.  
Prerequisite: ML 112 or placement.  
3 hrs.

212. INTERMEDIATE GERMAN.  
Prerequisite: ML 211.  
3 hrs.

213. INTERMEDIATE SCIENTIFIC GERMAN.  
For pre-professional students and others majoring in the natural sciences.  
Prerequisite: ML 112.  
3 hrs.

214. INTERMEDIATE SCIENTIFIC GERMAN.  
Prerequisite: ML 211 or 213.  
3 hrs.

221. INTERMEDIATE SPANISH.  
Prerequisite: ML 122 or placement.  
3 hrs.

222. INTERMEDIATE SPANISH.  
Prerequisite: ML 221.  
3 hrs.

231. INTERMEDIATE RUSSIAN.  
Prerequisite: ML 132.  
3 hrs.

232. INTERMEDIATE RUSSIAN.  
Prerequisite: ML 231.  
3 hrs.

234. INTERMEDIATE SCIENTIFIC RUSSIAN.  
Prerequisite: ML 231.  
3 hrs.

301. ADVANCED FRENCH.  
Rapid reading, conversation, literature. Prerequisite: ML 202.  
3 hrs.

303. FRENCH CONVERSATION.  
Oral drills, pronunciation exercises, simple oral reports. Prerequisite: ML 202.  
3 hrs.

304. ADVANCED FRENCH COMPOSITION AND USAGE.  
Primarily a composition course with emphasis on idiomatic expression. Prerequisite: ML 202 or 303 or approval of instructor.  
3 hrs.
305. SURVEY OF FRENCH LITERATURE. 3 hrs.
A study of French literature of the seventeenth and eighteenth centuries. Reading of selections from the important authors, lectures, and reports. Prerequisite: ML 301 or approval of instructor.

306. SURVEY OF FRENCH LITERATURE. 3 hrs.
A continuation of ML 305. French literature from 1800 to the present. Prerequisite: ML 301 or 305 or approval of instructor.

307. FRENCH CIVILIZATION. 3 hrs.
Prerequisite: ML 202.

308. FRENCH PHONETICS. 3 hrs.
Prerequisite: ML 202.

311. GERMAN CONVERSATION. 3 hrs.
Prerequisite: ML 212 or 214.

312. ADVANCED GERMAN COMPOSITION AND USAGE. 3 hrs.
Prerequisite: ML 212, 214, or 311, or approval of instructor.

313. SURVEY OF GERMAN LITERATURE. 3 hrs.
A study of German literature from its beginnings through the eighteenth century. Prerequisite: ML 212 or 214 or approval of instructor.

314. SURVEY OF GERMAN LITERATURE. 3 hrs.
A continuation of ML 313. Prerequisite: ML 212, 214, or 313, or approval of instructor.

315. THE GERMAN "NOVELLE" FROM GOETHE TO KAFKA. 3 hrs.
Prerequisite: ML 212 or 214; 311 or 312, or approval of instructor.

317. CONTEMPORARY GERMAN LITERATURE. 3 hrs.
Modern German literature of the 20th century. Prerequisite: ML 212 or 214 and 311 or 312 or approval of instructor.

319. NINETEENTH CENTURY GERMAN LITERATURE. 3 hrs.
Prerequisite: ML 212 or 214 or approval of instructor.

323. SPANISH CONVERSATION, COMPOSITION, AND PHONETICS. 3 hrs.
Prerequisite: ML 222.

331. RUSSIAN CONVERSATION AND COMPOSITION. 3 hrs.
Prerequisite: ML 232 or 234 or approval of instructor.

333. RUSSIAN MASTERPIECES IN ENGLISH TRANSLATION. 3 hrs.
Prerequisite: EH 206 or ML 232, or approval of instructor.

335. RUSSIAN CULTURE AND CIVILIZATION. 3 hrs.
Prerequisite: ML 232 or 234 or approval of instructor.

401. NINETEENTH CENTURY FRENCH NOVEL. 3 hrs.
A study of the development of the French novel in the first half of the nineteenth century. Reading and discussion of complete novels, with lectures and reports. Prerequisite: ML 306 or approval of instructor.

402. NINETEENTH CENTURY FRENCH NOVEL. 3 hrs.
Continuation of ML 401. Prerequisite: ML 306 or approval of instructor.

410. NINETEENTH CENTURY GERMAN DRAMA. 3 hrs.
Prerequisite: ML 313 or 314.

413. THE AGE OF GOETHE I. 3 hrs.
A study of representative works of Goethe and Schiller and their most prominent contemporaries. Prerequisite: Two courses at 300 level or approval of instructor.
A maximum of 6 semester hours in choral organization courses (190, 191, 192, 193) may be applied as elective credit toward total degree requirements; however, students may continue to participate in these courses and receive college credit for them.

Music (MU)

100. FUNDAMENTALS OF MUSIC. 3 hrs.
Basic music presented in a practical way for the student who has little or no musical training. Normally, students who expect to major in music should not expect degree credit in this course.

101. THEORY OF MUSIC I. 3 hrs.
Intensive training in the fundamentals of musicianship, dealing principally with the mechanical aspects of music — clefs, notation, scales, intervals, meters, rhythms, and musical terminology. Extensive practice in sight-singing, melodic, harmonic, and rhythmic dictation, and practice at the keyboard. Prerequisite: Approval of instructor.

102. THEORY OF MUSIC II. 3 hrs.
A continuation of MU 101. Prerequisite: MU 101.

103. THEORY OF MUSIC III. 3 hrs.
A continuation of MU 102. Prerequisite: MU 102.

110. INTRODUCTION TO MUSIC. 3 hrs.
A general course designed to promote the understanding of music through better listening practices.

111. AMERICAN FOLK MUSIC AND JAZZ. 3 hrs.
An introductory study of the history and development of American folk music and jazz. Special attention is given to current developments.

190. UAH CHOIR. 1 hr.
Mixed voices singing the serious choral repertoire. Open to all students of University. May be repeated.

191. PREMIER SINGERS. 1 hr.
Mixed voices singing "pop" and folk music. Open to all students of University. May be repeated.

192. HUNTSVILLE VILLAGE SINGERS. ½ hr.
Select, small ensemble of mixed voices. Open to all students of University by audition. May be repeated.

193. SUMMER CHORUS. 1 hr.
Mixed voices singing a variety of choral music. Open to all students of University. May be repeated.

201. ADVANCED THEORY OF MUSIC IV. 3 hrs.
A study of advanced principles involved in the art of musical composition, with extensive practice in advanced sight-singing, keyboard work, and dictation. Prerequisite: MU 103.

202. ADVANCED THEORY OF MUSIC V. 3 hrs.
A continuation of MU 201. Prerequisite: MU 201.

203. ADVANCED THEORY OF MUSIC VI. 3 hrs.

204. ANALYSIS OF MUSIC FORM. 3 hrs.
An intensive study of representative small and large compositions of the sixteenth through the twentieth centuries for structure and form. Prerequisite: MU 103, 110, or approval of instructor. Offered upon demand.
220. **PIANO PEDAGOGY.** 2 hrs.
A presentation of the materials, techniques and practices used in the teaching of beginners and students through lower advanced grades of piano, combined with practical experience.

227. **CONDUCTING.** 2 hrs.
Basic techniques of choral and instrumental conducting. Prerequisite: MU 101 and 102 or approval of instructor. Offered upon demand.

311. **HISTORY OF MUSIC I.** 3 hrs.
A survey of the development of music as an art in Western civilization to 1750. Emphasis is given to an acquaintance with representative musical works and style and to the understanding of musical concepts in the light of their historical background. Prerequisite: MU 103, 110, or approval of instructor.

312. **HISTORY OF MUSIC II.** 3 hrs.
A survey of the development of music as an art in Western civilization from 1750 to the present. Emphasis is given to an acquaintance with formal and stylistic problems through the study of representative works and an understanding of specific musical concepts in the light of their historical and general cultural context. Prerequisite: MU 311.

**Applied Music**

All beginning and transfer students who plan to take private instruction for music credit are required to demonstrate prior to registration their level of proficiency to the instructor. To advance to the next one hundred level of instruction (e.g., from 133 to 231), each student must perform before a faculty jury. The jury may retain students at any level until proper achievement is reached for advancement. Students not intending to major in music who are enrolled in MU 130 or 140 do not require a jury and may repeat private instruction as long as the instructor agrees that satisfactory progress is being made. Lessons are normally sixty minutes in length.

130. **PRIVATE INSTRUCTION IN PIANO.** ¾ hr.
For non-music credit. May be repeated. Prerequisite: MU 100 or approval of instructor.

For music credit.

140. **PRIVATE INSTRUCTION IN VOICE.** ¾ hr.
For non-music credit. May be repeated. Prerequisite: MU 100 or approval of instructor.

141, 142, 143, 241, 242, 243, 341, 342, 343, 441, 442, 443. **PRIVATE INSTRUCTION IN VOICE.** 1-½ hr.
For music credit.

**Philosophy (PHL)**

101. **INTRODUCTION TO THE THEORY OF KNOWLEDGE.** 3 hrs.
To acquaint the student with methods of careful thinking and careful statement.
102. INTRODUCTION TO LOGIC.  
To acquaint the student with the methodology of valid reasoning.  3 hrs.

103. INTRODUCTION TO THE PROBLEMS OF PHILOSOPHY.  
A consideration of the fundamental problems of experience.  3 hrs.

104. INTRODUCTION TO ETHICS.  
A search for the norms and standards of human conduct.  3 hrs.

201. HISTORY OF PHILOSOPHY.  
A consideration of the development of philosophical ideas from Thales to Aristotle.  3 hrs.

202. HISTORY OF PHILOSOPHY.  
A continuation of the development of philosophic ideas from Aristotle to Kant.  3 hrs.

203. HISTORY OF PHILOSOPHY.  
A further continuation of the development of ideas from Kant to the Twentieth Century.  3 hrs.

204. AMERICAN PHILOSOPHY.  
Prerequisite: PHL 102.  3 hrs.

205. INTRODUCTION TO AESTHETICS.  
A search for objective standards in the arts. Prerequisite: 6 hours of philosophy.  3 hrs.

206. INTRODUCTION TO METAPHYSICS.  
A consideration of the nature of reality. Prerequisite: PHL 102 and 6 hours of philosophy.  3 hrs.

220. PHILOSOPHY OF RELIGION.  
A critical evaluation of religious concepts, creeds, dogma, from the standpoint of philosophic inquiry. Prerequisite: PHL 101 or 102.  3 hrs.
DIVISION OF SOCIAL AND BEHAVIORAL SCIENCES

Social and behavioral sciences encompass those areas of knowledge relating to the behavior of man and the culture he has created. As the world grows more complex it becomes necessary to understand the nature of man and his relationship with his fellows. While the approach is scientific in terms of assumptions and methods, it is also humanistic in its implications since the problems it addresses relate to the kind of social milieu which is possible and desirable. The social and behavioral sciences perform a dual function. On the one hand they constitute particularly complex areas of technical knowledge, while on the other, they function as carriers and critics of the value system in our society. The undergraduate program at UAH is designed to perform both roles.

Undergraduate Degrees and Study

Within the Division a student seeking a Bachelor of Arts degree must declare his Area of Concentration (AOC) no later than the close of his sophomore year. This AOC must include a major chosen from either economics or psychology with a supportive cluster being taken from the Division of Social and Behavioral Sciences, the Division of the Humanities, or the Division of Natural Sciences and Mathematics.

In addition to the areas where majors and supportive clusters are authorized, courses are offered in political science and sociology.

Graduate Study

Graduate courses are offered in the field of administrative science.

Economics (EC)

Area of Concentration (AOC) with Economics Major

The economics discipline requires that the student desiring an area of concentration (AOC) in economics must include in his program 21 semester hours of core courses (in addition to EC 142-143) which include the following: EC 231, 310, 340, 341, 345, 352, 448. A student may, with the advice and consent of the economics faculty, make limited substitutions in the core courses. In addition to these courses the student is required to take an additional 18 hours of other courses offered in the discipline in his area of interest. Various AOC models have been set up by the economics faculty, some of which are in the following areas: General Economics, Accounting and Statistics, Management and Administrative Science, and Fi-
nance. A student may choose any of the areas mentioned above or any other AOC that can be developed in consultation with and approval of the economics faculty.

A student wishing an AOC with an economics major must choose a supportive cluster consisting of 21 semester hours of courses drawn from one or a combination of disciplines other than economics.

An example of an AOC for a degree in economics for students interested in graduate work in economics may be:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 231</td>
<td>Business Statistics</td>
<td>3</td>
</tr>
<tr>
<td>EC 241</td>
<td>Marketing Economics</td>
<td>3</td>
</tr>
<tr>
<td>EC 310</td>
<td>Introduction to Mathematical Economics</td>
<td>3</td>
</tr>
<tr>
<td>EC 325</td>
<td>Intermediate Statistics</td>
<td>3</td>
</tr>
<tr>
<td>EC 340</td>
<td>Macro Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EC 341</td>
<td>History of American Economic Growth</td>
<td>3</td>
</tr>
<tr>
<td>EC 345</td>
<td>Micro Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EC 352</td>
<td>Money and Banking</td>
<td>3</td>
</tr>
<tr>
<td>EC 430</td>
<td>Introduction to Econometrics</td>
<td>3</td>
</tr>
<tr>
<td>EC 446</td>
<td>International Economics and Trade</td>
<td>3</td>
</tr>
<tr>
<td>EC 448</td>
<td>Development of Economic Theory</td>
<td>3</td>
</tr>
<tr>
<td>EC 491</td>
<td>Contemporary Economic Theory</td>
<td>3</td>
</tr>
<tr>
<td>EC 585</td>
<td>Comparative Economic Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

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An example of an AOC for a degree in economics for students interested in entering the labor force with a degree in economics may be:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 111</td>
<td>Principles of Accounting</td>
<td>3</td>
</tr>
<tr>
<td>EC 231</td>
<td>Business Statistics</td>
<td>3</td>
</tr>
<tr>
<td>EC 241</td>
<td>Marketing Economics</td>
<td>3</td>
</tr>
<tr>
<td>EC 261</td>
<td>Principles of Business Organization</td>
<td>3</td>
</tr>
<tr>
<td>EC 310</td>
<td>Introduction to Mathematical Economics</td>
<td>3</td>
</tr>
<tr>
<td>EC 325</td>
<td>Intermediate Statistics</td>
<td>3</td>
</tr>
<tr>
<td>EC 340</td>
<td>Macro Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EC 341</td>
<td>History of American Economic Growth</td>
<td>3</td>
</tr>
<tr>
<td>EC 345</td>
<td>Micro Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EC 352</td>
<td>Money and Banking</td>
<td>3</td>
</tr>
<tr>
<td>EC 380</td>
<td>Business Fluctuations</td>
<td>3</td>
</tr>
<tr>
<td>EC 448</td>
<td>Development of Economic Theory</td>
<td>3</td>
</tr>
<tr>
<td>EC 561</td>
<td>Managerial Economics</td>
<td>3</td>
</tr>
</tbody>
</table>

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Supportive Economics Cluster

A student whose area of interest is in a discipline other than economics, but wishing a supportive cluster in economics, may, in consultation with and approval of the economics faculty, choose (a) 21 semester hours of appropriate courses offered in the economics discipline, or (b) appropriate courses offered in economics as part of a cluster with other disciplines to support his major area of interest.

The following are examples of possible clusters with a major in various other disciplines:

With Mathematics
EC 142 Principles of Economics 3
EC 143 Principles of Economics 3
EC 340 Macro Economic Analysis 3
EC 345 Micro Economic Analysis 3
EC 448 Development of Economic Theory 3
EC 491 Contemporary Economic Theory 3
EC 565 Technological Economics 3

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With History
EC 142 Principles of Economics 3
EC 143 Principles of Economics 3
EC 340 Macro Economic Analysis 3
EC 344 European Economic History 3
EC 345 Micro Economic Analysis 3
EC 448 Development of Economic Theory 3
EC 485 Comparative Economic Systems 3

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With Industrial Engineering
EC 142 Principles of Economics 3
EC 143 Principles of Economics 3
EC 231 Business Statistics 3
EC 235 Intermediate Statistics 3
EC 340 Macro Economic Analysis 3
EC 345 Micro Economic Analysis 3
EC 430 Introduction to Econometrics 3

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With Psychology
EC 142 Principles of Economics 3
EC 143 Principles of Economics 3
Economics (EC)

111. PRINCIPLES OF ACCOUNTING. 3 hrs.
Basic principles of accounting emphasizing individual proprietorships.

112. PRINCIPLES OF ACCOUNTING. 3 hrs.
Accounting principles for partnerships and corporations. Prerequisite: EC 111.

142. PRINCIPLES OF ECONOMICS. 3 hrs.
Introduction to economic analysis and its use in dealing with business or governmental problems. Material in the first term concentrates on national income, price levels, employment, and simple demand and supply theory.

143. PRINCIPLES OF ECONOMICS. 3 hrs.
A continuation of EC 142. Concentrates on more advanced value theories, including problems of monopoly or partial monopoly, distribution of income along functional lines, international economics, and economic growth. Prerequisite: EC 142.

213. INTERMEDIATE ACCOUNTING. 3 hrs.
Intensive study of balance sheet accounts and their interrelationship to income and expense accounts. Prerequisite: EC 112.

221. BUSINESS LAW. 3 hrs.
Introductory course emphasizing the legal environment in business.

231. BUSINESS STATISTICS. 3 hrs.
Collection, classification, and presentation of data, measures of central tendency and dispersion, introduction to probability distribution and sampling theory, confidence limits and tests of significance, chi-square and "t" distribution. Prerequisite: MA 109 or 111.

235. ECONOMIC GEOGRAPHY. 3 hrs.
Spatial relationships between various resources, location factors in primary, secondary, and tertiary activities, geographic patterns of production, processing, and distribution of commodities.

241. MARKETING ECONOMICS. 3 hrs.
Survey of marketing activities, principles, structures, functions, policies, prices, costs, and quantitative problems from the social, consumer, and management points of view. Prerequisite: EC 143.

251. CORPORATE FINANCIAL POLICY. 3 hrs.
Promotional, financial, and structural features of the basic types of business organizations. Prerequisite: EC 112, 143.

261. PRINCIPLES OF BUSINESS ORGANIZATION. 3 hrs.
Basic theories and principles of organization as they are developing in modern society. Prerequisite or parallel: EC 143.

262. MANAGEMENT AND LABOR ECONOMICS. 3 hrs.
Psychological and institutional factors as well as economic analysis of the major aspects of such problems as employment, wages, hours, unionism, labor-management relations, and social security. Prerequisite or parallel: EC 143.
310. INTRODUCTION TO MATHEMATICAL ECONOMICS. 3 hrs.
An introductory treatment of differential and integral calculus, difference and differential equations, determinants and matrices with application to economic problems. Prerequisite: Junior standing, EC 143, MA 125.

313. INCOME TAX PROCEDURE. 3 hrs.
Determination of taxable income and selected aspects of tax accounting for individuals. Prerequisite: EC 112.

314. COST ACCOUNTING. 3 hrs.
Basic theory and procedures involving materials, labor, and manufacturing expenses in job order and process cost systems. Prerequisite: EC 213.

315. INTRODUCTION TO AUDITING. 3 hrs.
Auditing theory and practice, working papers, financial statements, and professional ethics. Prerequisite: EC 213.

322. GOVERNMENT AND BUSINESS. 3 hrs.
Analysis of regulations which government may impose upon business and a survey of basic constitutional principles and legal aspects of the more recent federal legislation affecting business. Prerequisite: EC 251, 261.

325. INTERMEDIATE STATISTICS. 3 hrs.
Index numbers and index number construction, analysis of time series (trends, cyclical, seasonal, and random factors affecting time series), linear regression and correlation, the "F" distribution, introduction to multiple regression and analysis of variance. Prerequisite: EC 231.

340. MACRO ECONOMIC ANALYSIS. 3 hrs.
Comprehensive study of the national economy as a whole including analysis of the national income accounts, consumption, saving, investment, money, interest, employment, price level, monetary and fiscal policy, and economic growth. Prerequisite: EC 143.

341. HISTORY OF AMERICAN ECONOMIC GROWTH. 3 hrs.
A survey of the origins of basic economic institutions in Europe followed by a detailed study of the historical development of these institutions in the United States. No degree credit for students who take HY 221, 222.

344. EUROPEAN ECONOMIC HISTORY. 3 hrs.
Industrial Revolution to current developments covering institutions, activities, economic systems, and policies. Prerequisite: EC 143.

345. MICRO ECONOMIC ANALYSIS. 3 hrs.
More intensive examination of the economic principles underlying value and distribution with additional training in the application of these principles to problems of analysis. Prerequisite: EC 143.

352. MONEY AND BANKING. 3 hrs.
Organization, operation, and economic significance of the monetary and banking systems. Prerequisite: EC 251.

353. PUBLIC FINANCE. 3 hrs.
Principles of taxation, government expenditures, borrowing, and fiscal administration. Prerequisite: EC 143.

363. PERSONNEL ADMINISTRATION. 3 hrs.
Examination of traditional as well as dynamic theories, issues, problems of personnel administration and evaluation of the latest findings of organizational and administrative theories as the altered framework to place personnel administrative practices on a firmer basis than provided by the usual bureaucratic assumption tied together by ideas of human relation skills. The personnel administration needs of today's large, complex business enterprise operations are examined. Prerequisite: EC 261, 262.
371. INTRODUCTION TO BEHAVIORAL SCIENCE. 3 hrs.
Designed to integrate behavioral science concepts (psychology, sociology, anthropology, and physiology), as applied to business and industry, into an effective working tool for the student interested in human relations. Prerequisite: Junior standing or approval of instructor.

380. BUSINESS FLUCTUATIONS. 3 hrs.
Examination of cyclical fluctuations, measurement of business cycles, business cycle theories, models of economic growth, proposals for stabilizing economic activity, and techniques of forecasting business cycles. Prerequisite: EC 143.

416. ADVANCED ACCOUNTING. 3 hrs.
Specialized aspects of accounting, such as liability, owner's equity, and reorganization. Prerequisite: EC 213.

417. GOVERNMENTAL ACCOUNTING. 3 hrs.
Special features of budgetary and fund accounting as applied to municipalities, other governmental units, and institutions such as schools and hospitals. Prerequisite: EC 112.

420. BUSINESS POLICY. 3 hrs.
Analysis of fundamental factors in organization and management. Effects of policy decisions on sales, production, finance, and personnel. The role of the public relations process. The measurement of public opinion as applied to employee, stockholder, community, consumer, and supplier relations. The examination of the theoretical foundation of industrial organization and public responsibilities. Prerequisite: EC 261.

430. INTRODUCTION TO ECONOMETRICS. 3 hrs.
Use of statistical and mathematical tools in economics, structural relationships of economic models, and introduction to economic model building. Prerequisite: EC 310, 325, 340, and 345 or approval of instructor.

446. INTERNATIONAL ECONOMICS AND TRADE. 3 hrs.
Theoretical principles underlying international trade with an application of these principles to recent historical developments and to current national policies. Prerequisite: EC 345 or approval of instructor.

448. DEVELOPMENT OF ECONOMIC THEORY. 3 hrs.
Study of the historical development of economic thought from ancient times to the nineteenth century and from early modern times to the present. Prerequisite: EC 345.

450. WAGE AND SALARY ADMINISTRATION. 3 hrs.
Examination of complexities of the modern corporation's total compensation system, study of administration of systematic wage and salary policies, and review of central concepts relating to personnel recognition and reward. Prerequisite: EC 363.

491. CONTEMPORARY ECONOMIC THEORY. 3 hrs.
Introduction to analytic treatment of classical, neo-classical and contemporary macro- and micro-economic theories, partial and general equilibrium analysis, and treatment dynamic analysis. Prerequisite: EC 310, 340, 345.

495. SEMINAR IN ECONOMICS. 3 hrs.
Intensive analysis of selected theoretical and applied aspects of economics of current or permanent significance. Prerequisite: EC 340, 345.

531. MANAGERIAL FINANCE. 3 hrs.
Examination of principles and tools of analysis available to management. Topics include financial decision-making as a coordinating process, administrative responsibility, short and long-term financial instruments, government regulation, promotion, refunding, capital investment decisions, capital costs and the process of security issues. Prerequisite: EC 251.
554. INTERNATIONAL FINANCE. 3 hrs.
Study of foreign exchange rates under different monetary standards, methods of financing international trade, international financial institutions, proposals for fostering international trade through specialized forms of reserves and problems of international liquidity. Prerequisite: EC 352.

561. MANAGERIAL ECONOMICS. 3 hrs.
Analysis of managerial concepts from the multiple fields of business administration, quantitative and qualitative decision methods including case problems related to the process of economic decision-making and to the formulation of policy at the top-level of the firm. Prerequisite: EC 345.

564. REGIONAL ECONOMICS. 3 hrs.
Introduction to location theory and regional economics, analysis of factors affecting location of economic activity, consideration of differential growth rate among regions, and introduction to methods of regional analysis. Prerequisite: EC 235, 340, and 345 or equivalent.

565. TECHNOLOGICAL ECONOMICS. 3 hrs.
Survey of the economics of change, including basic objectives and constraints as exemplified in the areas of administrative science, operations research, and the other social sciences; the history of economic technology; decision-making; production functions and resource allocations; multiplier and growth effects; public and private policy issues; research and development planning strategies; diffusion of innovation; technology transfer; organizational communication and change; automation effects; model construction; behavioral considerations; and the future of technological planning. Prerequisite: EC 143.

569. WELFARE ECONOMICS. 3 hrs.
Examination of socio-economic criteria and interpretation of optimal economic positions for improvements in resource allocation and welfare. Prerequisite: EC 345.

581. SOCIAL ACCOUNTING. 3 hrs.
Concepts and measurement of social accounting, within the context of past developments and present trends, to articulate the sector accounting structure. Analysis of social accounting systems as they relate to income and product, input-output, flow-of-funds, and balance of payments. Purposes and uses of social accounts to appraise taxation policy, corporate management, productive activity, income distribution, and consumption trends. Prerequisite: EC 340.

585. COMPARATIVE ECONOMIC SYSTEMS. 3 hrs.
Analysis of principal economic systems comparing resource allocation, consumption, pricing, production, investment, income distribution and central planning. Prerequisite: EC 345.

590. MONETARY AND CREDIT POLICY. 3 hrs.
Analysis of monetary and federal reserve policies, their influence on money, price, interest rate and employment with special emphasis on the maintenance of economic stability and progress. Prerequisite: EC 352.

Political Science (PSC)

101. AMERICAN GOVERNMENT. 3 hrs.
A survey of the principles, political institutions, and practices of American national, state, and local government.

103. PROBLEMS OF AMERICAN NATIONAL GOVERNMENT. 3 hrs.
A survey of problems encountered by American governmental units in fields such as foreign affairs, agriculture and business regulation, defense, and education. Prerequisite: PSC 101.

205. WESTERN EUROPEAN CONSTITUTIONAL SYSTEMS. 3 hrs.
An examination of the political systems of Great Britain, France, and West Germany. Not open to freshmen.
212. STATE AND LOCAL GOVERNMENT AND POLITICS. 3 hrs.
A study of the institutions and functions of American state, and local government and their relationship to the political process.

215. INTRODUCTION TO INTERNATIONAL POLITICS. 3 hrs.
A survey of the evolution of the modern state system and the basic forces and principles in international relations. Not open to freshmen.

241. AMERICAN PARTIES AND POLITICS. 3 hrs.
Activities of pressure groups and parties in American politics. Attention is given to the social composition, organization, finance, and nominating processes of parties. Prerequisite: PSC 101. Not open to freshmen.

271. PRINCIPLES OF PUBLIC ADMINISTRATION. 3 hrs.
Administrative principles and practices in public organizations and agencies. Prerequisite: PSC 101, 212.

Courses listed below are open to students who have completed 9 semester hours in Political Science, with exceptions as indicated.

357. THE AMERICAN LEGISLATIVE PROCESS. 3 hrs.
An examination of the constitutional and theoretical foundations of Congress and state legislatures emphasizing problems of structure, procedure, leadership, and legislative reform. Prerequisite: PSC 101 and 6 additional hours in political science.

358. THE AMERICAN EXECUTIVE. 3 hrs.
An examination of the role of the President, governors, and local executives in the American political system.

362. INTRODUCTION TO POLITICAL PHILOSOPHY. 3 hrs.
The fundamental issues of politics as treated by some representative thinkers of the western world.

363. INTRODUCTION TO POLITICAL ANALYSIS. 3 hrs.
The application of behavioral methods in the collection, organization, and analysis of political data.

512. PUBLIC PERSONNEL ADMINISTRATION. 3 hrs.
Purposes, functions, and processes of personnel management at the national, state, and local levels. Prerequisite: PSC 271.

515. FISCAL ADMINISTRATION. 3 hrs.
Governmental revenue and expenditure policies with emphasis on the budget as a method of administrative and fiscal control. Prerequisite: PSC 271, EC 353.

568. ADMINISTRATIVE LAW AND REGULATION. 3 hrs.
Judicial influences and controls on the exercise of administrative authority together with an analysis of governmental regulatory policies. Prerequisite: PSC 271.

572. AMERICAN CONSTITUTIONAL LAW. 3 hrs.
Federal and state constitutional powers and limitations stressing the development of judicial review, the growth of national power, and civil liberties through judicial interpretation. Prerequisite: PSC 101, 212, 271.

Psychology (PY)

Area of Concentration (AOC) with Psychology Major

Requirements for a major are 36 semester hours of psychology, including PY 100, 104; any two of the three courses numbered 200, 202, 204; 302, and 426.
In order to be familiar with laboratory procedures and basic concepts used in psychology, any student taking more than 15 semester hours in psychology and/or who accumulates more hours in psychology than in any discipline other than his major will be expected to have completed PY 104 and two of the 200 level courses.

Below are examples of course clusters in psychology for students who wish to pursue various aspects of the subject. A student may follow one of these approved programs; however, a student is encouraged to select another course pattern if it better serves his objectives.

One possible psychology major for a Liberal Arts student planning graduate work in psychology:

- PY 100 Introduction to Psychology 3
- PY 104 Laboratory Procedures 3
- PY 202 Motivation 3
- PY 204 Perception 3
- PY 302 Elementary Statistics 3
- PY 303 Psychometrics 3
- PY 305 Developmental Psychology 3
- PY 401 Personality 3
- PY 406 Physiological Psychology 3
- PY 408 Human Learning 3
- PY 420 Seminar in Psychology I 3
- PY 426 History and Systems in Psychology 3

Total: 36

Psychology, as combined with Education:

- PY 100 Introduction to Psychology 3
- PY 104 Laboratory Procedures 3
- PY 200 Learning 3
- PY 301 Individual Differences 3
- PY 302 Elementary Statistics 3
- PY 303 Psychometrics 3
- PY 305 Developmental Psychology 3
- PY 401 Personality 3
- PY 408 Human Learning 3

Total: 27

The following are examples of possible clusters with a major in various other disciplines:

With Economics

Social Psychology (SOC 375) is strongly recommended.

- PY 100 Introduction to Psychology 3
- PY 104 Laboratory Procedures 3
- PY 200 Learning 3
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PY 202</td>
<td>Motivation</td>
<td>3</td>
</tr>
<tr>
<td>PY 301</td>
<td>Individual Differences</td>
<td>3</td>
</tr>
<tr>
<td>PY Electives above 300 level</td>
<td></td>
<td>3-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>18-21</strong></td>
</tr>
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**With Mathematics**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>PY 100</td>
<td>Introduction to Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PY 104</td>
<td>Laboratory Procedures</td>
<td>3</td>
</tr>
<tr>
<td>PY 200</td>
<td>Learning</td>
<td>3</td>
</tr>
<tr>
<td>PY 204</td>
<td>Perception</td>
<td>3</td>
</tr>
<tr>
<td>PY 301</td>
<td>Individual Differences</td>
<td>3</td>
</tr>
<tr>
<td>PY Electives above 300 level</td>
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**With Biology**

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<tbody>
<tr>
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<td>Laboratory Procedures</td>
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<tr>
<td>PY 202</td>
<td>Motivation</td>
<td>3</td>
</tr>
<tr>
<td>PY 204</td>
<td>Perception</td>
<td>3</td>
</tr>
<tr>
<td>PY 305</td>
<td>Developmental Psychology</td>
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</tr>
<tr>
<td>PY 406</td>
<td>Physiological Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PY Elective above 300 level</td>
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**With English**

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</thead>
<tbody>
<tr>
<td>PY 100</td>
<td>Introduction to Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PY 104</td>
<td>Laboratory Procedures</td>
<td>3</td>
</tr>
<tr>
<td>PY 107</td>
<td>Principles of Personal Reconciliation</td>
<td>3</td>
</tr>
<tr>
<td>PY 202</td>
<td>Motivation</td>
<td>3</td>
</tr>
<tr>
<td>PY 204</td>
<td>Perception</td>
<td>3</td>
</tr>
<tr>
<td>PY 390</td>
<td>Readings in Psychology I</td>
<td>3</td>
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<td></td>
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</tbody>
</table>

**With History**

<table>
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</thead>
<tbody>
<tr>
<td>PY 100</td>
<td>Introduction to Psychology</td>
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<tr>
<td>PY 104</td>
<td>Laboratory Procedures</td>
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</tr>
<tr>
<td>PY 200</td>
<td>Learning</td>
<td>3</td>
</tr>
<tr>
<td>PY 202</td>
<td>Motivation</td>
<td>3</td>
</tr>
<tr>
<td>PY 408</td>
<td>Human Learning</td>
<td>3</td>
</tr>
<tr>
<td>PY 426</td>
<td>History and Systems in Psychology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Psychology (PY)**

100. **INTRODUCTION TO PSYCHOLOGY.**  
The study of behavior with an emphasis on empirical findings related to major areas of psychology.
104. LABORATORY PROCEDURES. 3 hrs.
An introduction to behavioral research techniques and descriptive statistics. Prerequisite: PY 100.

107. PRINCIPLES OF PERSONAL RECONCILIATION. 3 hrs.
An examination of the application of basic principles in psychology to the origin and resolution of personal conflicts. Prerequisite: PY 100.

200. LEARNING. 3 hrs.
The study of the role of reinforcement in the acquisition and modification of behavior. Both empirical and theoretical material is considered. Prerequisite: PY 100.

202. MOTIVATION. 3 hrs.
The study of the origin and value of the concept of motivation. Prerequisite: PY 100.

204. PERCEPTION. 3 hrs.
A functional analysis of the processing and interpretation of sensory information. Prerequisite: PY 100.

301. INDIVIDUAL DIFFERENCES. 3 hrs.
A study of the factors, both learned and innate, that lead to individually unique patterns of behavior. Prerequisite: PY 100.

302. ELEMENTARY STATISTICS. 3 hrs.
A study of mathematical procedures useful in evaluating data obtained from a population sample. Prerequisite: College Algebra.

303. PSYCHOMETRICS. 3 hrs.
Theory and practice within psychological testing. Prerequisite: PY 100, 302.

305. DEVELOPMENTAL PSYCHOLOGY. 3 hrs.
The developmental process from infancy through adolescence. Special attention is given to the role of the environment in the developmental process. Prerequisite: PY 100.

390. READINGS IN PSYCHOLOGY I. 3 hrs.
Supervised readings in depth in an area of particular interest to the student. Prerequisite: 15 hours PY and approval of Instructor.

391. READINGS IN PSYCHOLOGY II. 3 hrs.
Supervised readings in depth in an area of particular interest to the student. Prerequisite: 15 hours PY and approval of Instructor.

401. PERSONALITY. 3 hrs.
Various theories of personality are examined, along with possible implications for research. Prerequisite: 15 hours PY.

403. ABNORMAL PSYCHOLOGY. 3 hrs.
An examination of major behavior disorders, with an emphasis on empirical findings. Prerequisite: PY 401.

406. PHYSIOLOGICAL PSYCHOLOGY. 3 hrs.
A functional analysis of the neural and endocrinological systems underlying behavior. Prerequisite: 15 hours PY.

408. HUMAN LEARNING. 3 hrs.
Study of contemporary issues and theoretical contingencies regarding factors influencing human learning and forgetting. Prerequisite: 15 hours PY.

409. BEHAVIOR MODIFICATION. 3 hrs.
The application of principles of human learning to the treatment of behavioral problems, neuroses and psychoses. Prerequisite: PY 403.

420. SEMINAR IN PSYCHOLOGY I. 3 hrs.
Student reports on psychological problems within a particular area are presented and discussed. Prerequisite: 15 hours PY and approval of instructor.
421. **SEMINAR IN PSYCHOLOGY II.** 3 hrs.
Student reports on psychological problems within a particular area are presented and discussed. Prerequisite: 15 hours PY and approval of instructor.

422. **INDIVIDUAL RESEARCH I.** 3 hrs.
The student, with the advice of an instructor, will design and execute an original experiment in psychology. Prerequisite: 15 hours PY and approval of instructor.

423. **INDIVIDUAL RESEARCH II.** 3 hrs.
The student, with the advice of an instructor, will design and execute an original experiment in psychology. Prerequisite: 15 hours PY and approval of instructor.

426. **HISTORY AND SYSTEMS IN PSYCHOLOGY.** 3 hrs.
A study of the history of psychology as it has led to the development of systematic study within the field. Prerequisite: 15 hours PY.

502. **INDUSTRIAL PSYCHOLOGY.** 3 hrs.
Application of the basic principles of learning, motivation and perception to typical industrial problems. Prerequisite: 12 hours PY.

503. **ADVANCED GENERAL PSYCHOLOGY.** 3 hrs.
A comprehensive survey of the various major areas of psychology. Open only to senior psychology majors. Prerequisite: 15 hours PY.

### Sociology (SOC)

100. **INTRODUCTION TO SOCIOLOGY.** 3 hrs.
An introduction to the perspective, methods, concepts, and general findings of the sociologist. Includes discussion of historical and conceptual development of sociology.

Courses listed below are open to students who have completed SOC 100 with exceptions as noted.

102. **ANALYSIS OF SOCIAL PROBLEMS.** 3 hrs.
A sociological interpretation of contemporary social problems as they relate to significant trends in complex societies.

106. **THE FAMILY.** 3 hrs.
Analysis of the family as a social institution, its structure and function in contemporary societies, dating, marital interaction, the life cycle, and the socialization process.

110. **INTRODUCTION TO SOCIAL PSYCHOLOGY: SOCIALIZATION.** 3 hrs.
An analysis of the social factors related to personality development. Includes comparative child-rearing practices; process of attitude and value system development; basic learning theories; and the influence of social roles, norms, and groups. Prerequisite: SOC 100 or PY 100.

200. **CULTURAL ANTHROPOLOGY.** 3 hrs.
The basic study of the origin and development of man's ways of life. Special emphasis is placed on the analysis of pre-literate societies.

208. **URBAN SOCIOLOGY.** 3 hrs.
An analysis of the origin and growth of cities; demographic and spatial characteristics of communities; attitude and value systems in urban society; impact of urbanization on institutional structures.

209. **POPULATION AND SOCIETY.** 3 hrs.
Growth and distribution of world population; population characteristics of pre-industrial and industrial nations, rural and urban localities, and religious, educational, and economic sub-groups; cultural explanations of population change.
210. STATISTICS FOR SOCIOLOGICAL RESEARCH. 3 hrs. Elementary statistical techniques applied to sociological data; tables and graphs, central tendency and dispersion, probability and sampling tests of significance, measures of association. PY 111 and MA 120 are equivalent courses for sociology credit.

211. CRIMINAL BEHAVIOR. 3 hrs. An analysis of theories of criminal behavior and criminal control procedures. Emphasis on causation; criminal and chancery laws, and crime control by police and criminal or juvenile courts. Prerequisite: SOC 100 or approval of instructor.

215. MINORITY GROUPS. 3 hrs. Nature of minorities: status differentiation and group structure; institutional trends; intergroup relations. Prerequisite: SOC 100 or approval of instructor.

259. SOCIAL MOVEMENTS. 3 hrs. The nature and origins of social movements, conditions precipitating their development, the functions of ideologies in social movements, the patterns of revolution, counter-movement, and their relations to social change. Prerequisite: SOC 100 or approval of instructor.

300. RESEARCH METHODS. 3 hrs. Techniques and tools utilized in sociological research; emphasis upon logic of proof, theory of measurement, and allied topics. Prerequisite: SOC 100, 210.

325. THE SOCIOLOGY OF EDUCATION. 3 hrs. A sociological approach to the study of education as a social institution; its structure, function and role in contemporary life. Prerequisite: SOC 100 or approval of instructor.

350. SOCIAL STRATIFICATION. 3 hrs. The analysis of social class, social status, and social mobility. Emphasis placed on the study of social power and prestige. Close analysis is given to the differential opportunities and resultant behaviors of the upper, middle, and lower social classes.

375. SOCIAL PSYCHOLOGY: GROUP DYNAMICS. 3 hrs. An analysis of the fundamental principles of group structure. Emphasis is placed upon such topics as development of group solidarity, cohesion, intergroup conflict and cooperation, and the effects of different patterns of leadership. Prerequisite: SOC 100, 110.

380. SOCIAL CONTROL. 3 hrs. An analysis of the nature and methods of social control. Special emphasis placed on the problems of social control in complex and changing social orders.

420. THE SOCIOLOGY OF CORRECTIONS AND REHABILITATION. 3 hrs. An analysis of the social variables involved in restructuring the behavior of the social offender. Special attention is given to the basic problems faced by correctional institutions. Prerequisite: SOC 211.

440. SOCIOLOGY OF RELIGION. 3 hrs. The application of sociological principles to religious institutions focusing primarily on the function, development and change of these institutions. Prerequisite: SOC 100 or approval of instructor.

455. INDUSTRIAL SOCIOLOGY. 3 hrs. Social interaction in the industrial setting. Historical development of production systems, industrial roles and personality; labor-management relations. Prerequisite: SOC 100 or EC 112.

465. DEVELOPMENT OF SOCIOLOGICAL THEORY. 3 hrs. A study of the development of the discipline of sociology in terms of the major trends of sociological theory, past and present, and the major theoretical problem areas of the discipline. Includes study of the nature of sociological theory in relation to other disciplines. Prerequisite: SOC 100 and junior or senior standing.
475. MASS COMMUNICATIONS AND PUBLIC OPINION. 3 hrs.
An examination of the mass media as a social force in modern society. Emphasis is placed on the role of the mass media in forming public opinion and policy. Offered on demand. Prerequisite: SOC 100 or approval of instructor.

485. SOCIAL GERONTOLOGY. 3 hrs.
A sociological analysis of the process of aging, retirement, and the role of the elderly in modern society. Attention is also given to the social and psychological implications of the awareness of approaching death. Offered on demand. Prerequisite: SOC 100 or approval of instructor.

490. SOCIOLOGY OF POVERTY AND DEPRIVATION. 3 hrs.
A sociological analysis of poverty and deprivation as variables in social life. Emphasis is placed on the social and psychological effects of deprivation and on the nature and effectiveness of programs to combat it. Offered on demand. Prerequisite: SOC 100 or approval of instructor.

Graduate Administrative Science Courses (AS)
The University is developing a graduate program leading to the master's degree in administrative sciences. No degree is currently authorized. In order to be eligible for these courses a student must first be admitted to the graduate school; however, the student's eligibility for admission will be based on the aptitude portion of the Graduate Record Examination only, rather than performance in any substantive field of knowledge. Persons taking these courses will receive graduate credit.

Administrative Science Core Curriculum
The following courses are required of all students enrolled in the Administrative Science program.

601. INTRODUCTION TO COMPLEX ORGANIZATIONS 3 hrs.
Survey of the basic theoretical tools necessary to the understanding of complex organizations. Introduces the students to such major facets of organization as the organization as a part of the larger social system, the comparative study of organizations, both cross and intraculturally, some facets of organizational cohesion and structure such as authority and the division of work; organization as it relates to goals and clientele groups; the study of the problems of organizational survival and decay.

602. HUMAN BEHAVIOR IN ORGANIZATION. 3 hrs.
The behavior of individuals and groups in an organizational context. Considers the organization as a continuing social system. Analyzes the problems of motivation and incentives. Looks at the problem of organizational communication and the blockages thereto. In a general way, it deals with the problem of the elections, training, promotion and severance of organizational members.

603. THE ORGANIZATION AND ITS ENVIRONMENT. 3 hrs.
Evaluation of relation of the organization to the world outside its confines. Examines the conditions leading to flexibility and inertia in organizational behavior. Looks at the focus in public organizations on the epicenters of power, the executive, the legislative committees, the media and the generalized public; in private organizations the processes of marketing and "selling" as well as finding goods and services which are in demand.
604. ORGANIZATIONAL PLANNING AND INNOVATION. 3 hrs.
Analysis of various theories of planning and approaches to planning including incremental and holistic planning; the politics of planning; the twin problems of predicting and controlling the environment and the limitations of each. Examines the organizational situations which foster hospitality or resentment at the introduction of new ideas; organizational structure and innovation; the phenomenon of individual and group creativity; the time lag between invention and the application of invention. (Formerly PA 564)

605. ORGANIZATIONAL COORDINATION AND CONTROL. 3 hrs.
Analyzes means of welding complex organizations into purposive wholes. Uses of techniques such as hierarchy; fiscal controls; staff agencies; rewards and motivation; planning, programming, and budgeting (PPB); accounting and statistical review (variances); computer and systems analysis, are considered. Analyzes responsiveness of organizations to controls by the public.

606. DATA GATHERING AND ANALYSIS I. 3 hrs.
Introduction to the basic assumptions and techniques used in social science research. Designed to enable the student to envision various ways in which needed information can be obtained, evaluated and assessed. Introduces the student to probability and statistics, interviewing techniques, scaling, simulations. Basic computer languages and the uses and limitations of the computer as a data gathering mechanism. Only limited mathematical training will be required as a prerequisite for this course.

Courses with 500 numbers listed in political science and economics may be given graduate credit in connection with the Administrative Science Program.
DIVISION OF NATURAL SCIENCES AND MATHEMATICS

The faculty of the Division of Natural Sciences and Mathematics will assist students in the planning of programs to meet various educational, vocational, and professional goals. Students may select programs of study to provide the background for advanced study in mathematics, the sciences, engineering, medicine or dentistry; to obtain a secondary teaching certificate; to prepare for immediate employment in industrial or government laboratories; or to obtain a scientific background for a future career in business, law, or management.

The course sequences in the Division are divided into three major groups:

1. Course sequences in mathematics, biology, chemistry, earth science, and physics that satisfy the minimum natural science and mathematics general education requirements.

2. A core curriculum in natural sciences and mathematics for the student who wishes to obtain a more thorough knowledge in the natural sciences offered in this Division. Although the courses serve as the science core for the B.S. curricula, they may appeal to students who do not concentrate their work in the sciences but who do wish to obtain a greater understanding of the sciences and their relationships to professional objectives than provided by the sequences in Group 1.

3. Advanced courses in mathematics, physics, chemistry, and biology to provide in-depth training in these disciplines.

Undergraduate Degree Programs

A student seeking a Bachelor of Science degree must satisfy the total AOC requirements (see section on Undergraduate Academic Programs) and complete a core curriculum consisting of 9 semester hours of calculus and a two semester sequence in each of two of the basic sciences—biology, chemistry, and physics—preferably in all three. A student may select biology, chemistry, mathematics, or physics as the major subject in his AOC. In addition to the courses in his major, a student will usually complete his AOC through courses in other disciplines in the Division of Natural Sciences and Mathematics or in the Division of Engineering. The Division strongly urges a student to select his remaining number of courses from those offered in the Division of the Humanities and the Division of Social and Behavioral Sciences.
The Division of Natural Sciences and Mathematics offers programs leading to a Bachelor of Arts degree with a major in biology or mathematics.

In addition to courses in the major, a student will usually complete his AOC through courses offered in the Division of the Humanities and the Division of Social and Behavioral Sciences.

Specific programs are found at the beginning of each section of course descriptions. These programs are presented as models. A student may follow one of these approved programs; however, a student is encouraged to select another course pattern if it better serves his objectives. The proposed programs should be discussed with the chairman of the discipline responsible for the largest number of courses. The discipline chairman will assist him in obtaining the necessary approvals.

A student must declare his AOC no later than the end of his sophomore year.

Graduate Degree Programs

The Division of Natural Sciences and Mathematics offers programs leading to the degree of Master of Arts with a major in mathematics and Master of Science with a major in chemistry or physics. (Refer to section on Graduate Programs.) Early in his graduate program, a student must review his proposed program of study with a faculty advisor. A student majoring in mathematics may select either Plan I or Plan II. Students majoring in chemistry and physics must follow Plan I. Special course requirements are stated in the section of the catalog related to course descriptions.

Biology (BY)

Undergraduate Programs

A student may elect a program leading to either a Bachelor of Arts or a Bachelor of Science degree. In most areas of biological interest, a Bachelor of Science degree is deemed more desirable; however, a Bachelor of Arts degree may be preferred in areas of concentration (AOC) relating biology to some of the humanities, social sciences, and economics.

All areas of concentration with a major in biology will include the following courses: (The basic biology courses BY 111, 112, or 113-114 must be taken or exempted but cannot be counted toward a major.) BY 221, 317 or 354, 515 or 219, 532 or 531, two biology seminars (597, 598, 599), and at least 12 additional hours of biology related to the student’s individual goal.
Curricula I-VIII are offered as models of appropriate programs designed to fulfill the University’s degree requirements and achieve diverse goals in the biological sciences with various related areas of emphasis. Any curriculum may be modified to fit individual aims with the approval of the biology faculty.

**Curriculum I — B.A. Degree Appropriate for a Biology Major with an Associated Cluster in Social Sciences.**

<table>
<thead>
<tr>
<th>Semester Hours</th>
<th>General educational requirements (Humanities and Social Sciences)</th>
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<tbody>
<tr>
<td></td>
<td>Basic biology courses</td>
<td>16-18</td>
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<tr>
<td></td>
<td>Biology—BY 278, 371 or 372 and one elective</td>
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<tr>
<td></td>
<td>Chemistry—CH 101, 131</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Earth Science—ES 101, 102, or Physics—PH 101-102</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Mathematics—MA 109 or 111, 118</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Humanities, social sciences, economics or associated cluster</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Electives (Education core if a Class B Secondary Professional Teaching Certificate is desired)</td>
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**Curriculum II — B.S. Degree for Secondary Teachers of Biology and Chemistry.**

<table>
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<th>General education requirements (Humanities and Social Sciences)</th>
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</thead>
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<tr>
<td></td>
<td>Basic biology courses</td>
<td>16-18</td>
</tr>
<tr>
<td></td>
<td>Biology—BY 278, 371 or 372, and one elective</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Chemistry—CH 121-122, 125, 126, 223, 331-332-333, 335-336</td>
<td>19</td>
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<td>Mathematics—MA 125, 149, 150 (Students who are placed in 109 or 111 may substitute 111 and 118 for 149 and 150 with approval of biology faculty)</td>
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<tr>
<td></td>
<td>Physics—PH 109-110</td>
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<td>Education core</td>
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<td>Electives</td>
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**Curriculum III — B.S. Degree, Preparatory for General Graduate Study.**

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<th>General education requirements (Humanities and Social Sciences)</th>
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<tbody>
<tr>
<td></td>
<td>Basic biology courses</td>
<td>16-18</td>
</tr>
<tr>
<td></td>
<td>Biology—BY 278, 371 or 372, and one elective</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Chemistry—CH 121-122, 125, 126, 223, 331-332-333, 335-336, (341 desirable)</td>
<td>19</td>
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<tr>
<td>Course</td>
<td>Semester Hours</td>
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</tr>
<tr>
<td><strong>Mathematics—MA 125, 149, 150</strong> (Students who are placed in 109 or 111 may substitute 111 and 118 for 149 and 150 with approval of biology faculty.)</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td><strong>Physics—PH 109-110</strong></td>
<td>8</td>
<td></td>
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<tr>
<td><strong>Electives</strong></td>
<td>27-35</td>
<td></td>
</tr>
</tbody>
</table>

Curriculum IV — B.S. Degree with Chemistry Cluster, Preparatory for Graduate Study.

- **General education requirements (Humanities and Social Sciences)**: 30-36
- **Basic biology courses**: 16-18
- **Biology—BY 278, 371 or 372, and one elective**: 12
- **Chemistry—CH 121-122, 125, 126, 223, 331-332-333, 335-336, 341, 342**: 24
- **Mathematics—MA 125, 149, 150, 244, or 251, 385**: 15
- **Physics—PH 109-110, 201**: 11
- **Electives**: 12-20

Curriculum V — B.S. Degree with Physics-Chemistry Cluster, Preparatory for Graduate Study.

- **General education requirements (Humanities and Social Sciences)**: 30-36
- **Basic biology courses**: 16-18
- **Biology—BY 278, 371 or 372, and one elective**: 12
- **Chemistry—CH 121-122, 125, 126, 331-332-333, 335-336**: 15
- **Mathematics—MA 125, 149, 150, 244 or 251, 385**: 15
- **Physics—PH 109-110, 201, 202, 203, 301**: 20
- **Electives**: 12-20

Curriculum VI — B.S. Degree, pre-medical, pre-dental, pre-veterinary. (See chemistry section for an alternate pre-medical curriculum).

- **General education requirements (Humanities and Social Sciences)**: 30-36
- **Basic biology courses**: 16-18
- **Biology—BY 469, 542, and one elective**: 12
- **Chemistry—CH 121-122, 125, 126, 223, 331-332-333, 335-336 (341 desirable)**: 19
- **Mathematics—MA 125, 149, 150 (Students who are placed in 109 or 111 may substitute 111 and 118 for 149 and 150 with permission of biology faculty.)**: 9
- **Physics—PH 101-102**: 8
- **Electives**: 26-34
Curriculum VII — Medical Technology and Paramedical Services leading to a B.S. Degree.

(The Medical Technology curriculum is in accord with the requirements with the American Society of Clinical Pathologists.)

General education requirements (Humanities and Social Sciences) ........................................... 30-36
Basic biology courses .................................................. 16-18
Biology—BY 321, 496, 579 .......................................... 12
Chemistry—CH 121-122, 125, 126, 223, 331-332-333, 335-336 .................................................. 19
Mathematics—MA 125, 149, 150 (Students who are placed in 109 or 111 may substitute 111 and 118 for 149 and 150 with permission of biology faculty.) ........ 9
Physics—PH 109-110 .................................................. 8
Internship in an accredited hospital (or electives) .......... 29

Curriculum VIII — B.S. Degree, Preparatory for Graduate Study in Biology—Mathematics (Biometrics).

General education requirements (Humanities and Social Sciences) ........................................... 30-36
Basic biology courses .................................................. 16-18
Biology—BY 278, or 595, 371 or 372, and one elective 12
Chemistry—CH 121-122, 125, 126, 223, 331-332-333, 335-336 .................................................. 19
Mathematics—MA 125, 149, 150, 244, 251, 352 or 353, 385 .................................................. 21
Physics—PH 109-110 .................................................. 8
Electives ................................................................. 14-22

Biology (BY)

111. BOTANY. 4 hrs. (To be discontinued). A study of principles of plant biology which includes all major groups of the plant kingdoms. Includes laboratory.

112. ZOOLOGY. 4 hrs. (To be discontinued). A basic study of animal biology, taxonomy, and reproduction, considering all major groups of the animal kingdom. Includes laboratory.

113. GENERAL BIOLOGY. 4 hrs. A study of the origin, structure, function and evolution of living organisms, as well as their classification interrelationships. Includes laboratory.

114. GENERAL BIOLOGY. 4 hrs. Continuation of BY 113. Includes laboratory. Prerequisite: BY 113.
216. INTEGRATED PRINCIPLES OF LIVING ORGANISMS. 4 hrs.
A non-laboratory course for non-biology students designed to develop some understanding of the structure and function of living organisms. It relates biological, physical, and chemical principles to all levels ranging from the molecular level to the most complex multicellular living organism. Prerequisite: 8 hours chemistry or 8 hours physics, or approval of instructor. Offered upon demand.

219. HEREDITY. 2 hrs.
(Not open to freshman). An introduction to the principles of inheritance and application of these principles to plants and animals, and to the human. Prerequisite: BY 111, 112 or 113-114.

220. HEREDITY LABORATORY. 2 hrs.
Prerequisite or parallel: BY 219.

221. GENERAL MICROBIOLOGY. 4 hrs.
A fundamental course in microbiology which includes the cultivation and observation of micro-organisms and their relation to foods, water, industrial processes, and disease. Includes laboratory. Prerequisite: BY 111, 112, or 113-114, CH 101 or 121.

238. LOCAL FLORA. 2 hrs.
Identification of local flowering plants. Prerequisite: BY 111 or 113-114.

278. INVERTEBRATE ZOOLOGY. 4 hrs.
A phylogenetic consideration of the invertebrate phyla including morphology and ecology. Includes laboratory. Prerequisite: BY 112 or 113-114 or approval of instructor.

Courses listed below are open to students who have completed BY 113-114 or equivalent with exceptions at noted.

317. VERTEBRATE ZOOLOGY. 4 hrs.
A study of the morphology of vertebrate animals with emphasis upon the relationship of organs and systems and their phylogenetic significance. Includes laboratory. (Formerly BY 217)

321. MEDICAL MICROBIOLOGY. 4 hrs.
A study of bacteria in relation to infectious diseases. Includes laboratory. Prerequisite: BY 221.

339. PLANT ANATOMY. 4 hrs.
A study of the ontogeny, differentiation and maturation of the various tissues and organs of angiosperms. Each student solves investigative problems into the growth and development of an angiosperm, using histological techniques. Includes laboratory. Prerequisite: BY 111 or 113-114.

354. VERTEBRATE EMBRYOLOGY. 4 hrs.
The embryology of the vertebrates including gametogenesis, fertilization of the egg, stages of cleavage, and development of organs and organ systems. Includes laboratory.

371. BIOLOGY OF THE LOWER PLANTS. 4 hrs.
Field and laboratory studies of locally common and economically important nonvascular plants. Includes laboratory.

372. BIOLOGY OF THE HIGHER PLANTS. 4 hrs.
Field and laboratory studies of ferns, "fern allies" and seed plants, their habitats, life histories, and relationships. Includes laboratory.

424. IMMUNOLOGY. 4 hrs.
Theory and practice of immunological principles. Includes laboratory. Prerequisite: BY 321.

469. ANIMAL HISTOLOGY. 4 hrs.
The microscopic study of the various tissues and organs of the mammalian body. Includes laboratory. Prerequisite: BY 317, 354.
Courses listed below are open to students who have completed BY 113-114 or equivalent and 6 additional semester hours in biology.

512. GENERAL ECOLOGY. 4 hrs.
The basic principles of ecology, and a survey of major plant and animal communities. Includes laboratory.

515. GENETICS. 4 hrs.
(Credit will not be allowed for both this course and BY 219.) An intensive study of genes, chromosomes and other factors relating to mechanisms of inheritance. Includes laboratory.

531. PLANT PHYSIOLOGY 4 hrs.
An elementary study of physical and chemical processes occurring in plants and the conditions which influence them. Includes laboratory. Prerequisite: 8 semester hours of chemistry and 8 semester hours of physics, or approval of instructor.

532. ANIMAL PHYSIOLOGY 4 hrs.
A fundamental study of physical and chemical processes occurring in animals and conditions which influence them. Includes laboratory. Prerequisite: 8 semester hours of chemistry and 8 semester hours of physics, or approval of instructor.

534. PLANT TAXONOMY 4 hrs.
Principles and practice in the identification and classification of flowering plants. Includes laboratory. Prerequisite: BY 238.

542. CELLULAR BIOLOGY 4 hrs.
A study of basic biological unit cells, including structure and function of cell organelles and their biochemical aspects. Includes laboratory. Prerequisite: CH 232 or approval of instructor.

571. ALGOLOGY 4 hrs.
A study of the life cycles (sexual and asexual reproduction), structure and metabolism of fresh water algae commonly found in surrounding habitats. Laboratory included. Prerequisite: BY 111 or 113-114, 371 or approval of instructor.

575. GENERAL ENTOMOLOGY 4 hrs.
The study of classification, habits and economic importance of insects including their collection, preservation, and identification. Includes laboratory.

578. ADVANCED INVERTEBRATE ZOOLOGY 4 hrs.
Phylogenetic consideration of the invertebrate, including structural, functional, embryological and physiological relationships leading to an understanding of the progressive complexity of animals. Includes laboratory and field trips. Prerequisite: BY 278 or approval of instructor.

579. PARASITOLOGY 4 hrs.
A survey of the parasitic protozoa and helminths found in man, together with a comparison with certain forms found in other animals. Emphasis is placed upon history, geographical distribution, morphology, habitat, life-cycles and methods of reproduction, transmission, pathogenesis and symptomatology, diagnosis, and prevention. Includes laboratory. Prerequisite: CH 101 or 121.

585. LIMNIOLOGY 4 hrs.
A study of fresh-water environments and organisms exemplified by lakes, ponds, and streams in Northern Alabama. Includes laboratory and field trips. Prerequisite: 8 hours of chemistry, 4 hours of physics, BY 221, 279, 371, and approval of instructor.

592. PROJECTS IN BIOLOGY 2 to 4 hrs.
Individual investigations into biological problems under the direct supervision of an instructor. Designed for advanced senior level biology students with a biology grade point average of 2.5 or above. Prerequisite: Approval of instructor.
595. **PRINCIPLES OF NOMENCLATURE** 2 hrs.
Study of the rules of animal and plant classification and the basic principles of taxonomy.

597, 598, 599. **BIOLOGY SEMINAR** 1 hour each
Discussions of biological literature, careers in biology, graduate schools, and specialty schools. Pertinent discussions on current biological topics. Seniors must take a minimum of two.

**Chemistry (CH)**

**Undergraduate Programs**

Requirements for a chemistry major:

1. Satisfactory completion of the University’s 55-61 hour General Education Requirement which includes MA 125, 149, 150, PH 201, 202, 203, or PH 109-110, 201, and CH 121-122, 125, and 126;
2. Completion of one of the approved six AOC curricula below (or a different one, appropriately approved) each of which includes the 21 semester hours of MA 244, CH 223, 331-332-333, 335-336, 341, 342, and 345;
3. And completion of a number of electives which will vary depending on the particular curriculum chosen. German or Russian is recommended for the language requirement.

The 25 hours of science and mathematics included in Requirement 1 are not included in the AOC, while the 21 hours of chemistry and mathematics included in Requirement 2 are included in the AOC.

The chemistry discipline offers courses leading to a B.S. degree with a chemistry major and supports the undergraduate programs of other disciplines. A minimum of 9 semester hours must be completed at the UAH in chemistry courses numbered 300 or above. All other grade and general requirements are equivalent to those established by UAH for all degree programs.

No credit is granted toward a degree program in chemistry for CH 101 or CH 131 or any mathematics course numbered less than MA 125. Any student requiring these courses must understand that the total semester hours of course work taken as an undergraduate may exceed the 128 semester hour guideline for a baccalaureate program.

Six approved curricula, which emphasize chemistry as the major in an area of concentration (AOC), are available. Course patterns, which differ from those listed are possible but require faculty approval. All six include those courses listed above as requirements for a chemistry major and are:
General education requirements (Humanities and Social Sciences) ........................................... 30-36
General education requirements (Science and Mathematics) ..................................................... 25
Chemistry and Mathematics (Requirement 2 above) ...... 21

**Curriculum I — A Pre-Medical Program.**

(See biology section for an alternative pre-medical curriculum.)

Chemistry, one of two electives (CH 337, 343, 346, 401, 491) ........................................... 3
Biology—BY 113-114 and one elective ......................... 12
Science electives .......................................... 12
Humanities and Social Sciences electives ....................... 19-25

**Curriculum II — For Class B Secondary Professional Teaching Certificate.**

This program meets state certification standards in chemistry and in biology, mathematics, or physics as the student may elect. Only economics, political science, sociology, and cultural anthropology (when available) satisfy the 6 hours social sciences requirement in this curriculum.

Chemistry—CH 401 ........................................ 3
Biology—BY 113-114 ........................................ 8
Education core ........................................... 27
Physics or ................................................. 8-9
Biology or ................................................ 12
Mathematics ............................................... 9
Electives ............................................... 0-6

**Curriculum III — A Graduate Preparatory Program.**

This curriculum follows the recommendations of the American Chemical Society for an undergraduate degree in chemistry. It is intended for a student who plans to do graduate work or who desires an industrial position which requires a strong chemical background. German is recommended for the language requirement.

Chemistry—CH 337, 343, 346, 401, 421, 431, one elective, and a senior project ....................... 19
Mathematics—MA 251 ........................................ 3
Physics elective ........................................... 3
Mathematics or Physics elective .............................. 3
Electives ............................................... 18-24
Curriculum IV — A General Education Curriculum with a Chemistry Major.

Deficiencies may exist with respect to graduate school entrance requirements.

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry—CH 337, 343, 346, 401, one elective and a senior project</td>
<td>12</td>
</tr>
<tr>
<td>Science electives</td>
<td>8-10</td>
</tr>
<tr>
<td>Electives</td>
<td>26-28</td>
</tr>
</tbody>
</table>

Curriculum V — A Chemistry-Physics Program Appropriate for Pre-graduate Education.

Chemistry—CH 337, 343, 346, 401, 421, and a senior project ........................ 14

Physics (a) PH 202, 203, 301, one laboratory from 310-312, and one elective, or 13
(b) PH 301, 357, one laboratory from 310-312, and one elective .................. 11

Sequence (a) requires prior completion of PH 109-110, 201, while sequence (b) requires PH 201, 202, 203.

Mathematics—MA 251, 352 or 353, and one elective ................................ 9
Electives                                                                      11-15

Curriculum VI — A Chemistry-Biology Program Appropriate for Pre-graduate Education.

Chemistry—CH 337, 343, 346, 421, one elective and a senior project .............. 12
Biology—BY 113-114                                                             8
Biology electives from 219 or 515, 221, and any 300 level course or above     12
Electives                                                                      14

Graduate Program

A Master of Science degree with a major in chemistry is offered. Additional courses are available.

It is emphasized that graduate courses are conducted at a level which assumes the student possesses a B.S. degree in chemistry as recommended by the American Chemical Society (see Curriculum III). Graduation from an undergraduate program not equivalent to ACS standards does not preclude entrance into the UAH program. The student should realize, however, that if deficiencies exist, the time required to obtain the M.S. degree is correspondingly increased. (See section on Division of Graduate Programs.)
Degree Requirements

General requirements of the Division of Natural Sciences and Mathematics and the Graduate School under Plan 1 must be satisfied.

Specific requirements:

1. 24 semester hours of graduate course work and a thesis.
2. Three of the following: CH 501, 521, 531, 541.
3. A reading examination in German or Russian.

All other general and grade requirements are identical with those discussed in the section on Graduate Programs.

A particular program must be planned in consultation with a member of the chemistry faculty who will be assigned by the discipline chairman as a temporary advisor until such time as a supervisory committee is appointed. This is not usually done until the student selects his thesis topic.

Chemistry (CH)

101. GENERAL CHEMISTRY 4 hrs.
An introduction is presented to the properties of solids, liquids, gases, and solutions, to atomic theory and bonding, and to the physical and chemical properties of the more common elements and their compounds. Laboratory work is designed to complement the lecture material. No credit given for AOC involving chemistry. Prerequisite or parallel: MA 109 or equivalent.

121. INTRODUCTION TO PHYSICAL CHEMISTRY 3 hrs.
Beginning course for science and engineering majors. An introduction is presented to basic physical principles concerning gases, liquids, and solids. Included are discussions on the nature of the chemical bond, kinetics, chemical equilibrium, electrochemistry, and thermochemistry. (CH 125 is not required for students who satisfactorily complete CH 101.) Prerequisite: CH 101 or placement test; MA 109 or equivalent. Parallel: CH 125.

122. INTRODUCTION TO INORGANIC AND ANALYTICAL CHEMISTRY 2 hrs.
A continuation of CH 121. Includes a modern treatment of the chemical properties of the elements and their compounds and a brief introduction to nuclear chemistry. Prerequisite: CH 121.

125. INTRODUCTORY CHEMISTRY LABORATORY 1 hr.
Laboratory work complements the lecture material of CH 121. (CH 125 is not required for students who satisfactorily complete CH 101.) Parallel: CH 121.

126. QUALITATIVE INORGANIC ANALYSIS LABORATORY 1 hr.
A study of the chemical properties of metal and complexions. Involves systematic separation and qualitative detection of the elements. Prerequisite or parallel: CH 122.

131. GENERAL AND ORGANIC CHEMISTRY 4 hrs.
An extension of CH 101 for those students concentrating on the humanities and social sciences. Emphasis is placed on the broad concepts in inorganic and organic chemistry. Not open to students with AOC involving chemistry. Includes laboratory. Prerequisite: CH 101.
223. QUANTITATIVE ANALYSIS 4 hrs.
Provides a background in fundamental quantitative analytical chemistry with an introduction to instrumentation. Data treatment, ionic equilibria, elementary electrochemical, spectrochemical, gravimetric, and volumetric techniques are discussed. Includes laboratories. Prerequisite: CH 126.

331. ELEMENTARY ORGANIC CHEMISTRY 2 hrs.
The chemistry of organic compounds is systematically studied. Discussion includes synthetic methods, theory, and reaction mechanisms. Prerequisite: CH 223 or approval of instructor. Parallel: CH 335.

332. ELEMENTARY ORGANIC CHEMISTRY 2 hrs.
Continuation of CH 331. Prerequisite: CH 331. Parallel: CH 336.

333. ELEMENTARY ORGANIC CHEMISTRY 2 hrs.
Continuation of CH 332. Prerequisite: CH 332.

335. ELEMENTARY ORGANIC CHEMISTRY LABORATORY 1 hr.
Introduces technique of organic chemistry including synthesis, separation, and identification of organic compounds. Parallel: CH 331.

336. ELEMENTARY ORGANIC CHEMISTRY LABORATORY 1 hr.
Continuation of CH 335. Prerequisite: CH 335. Parallel: CH 332.

337. ORGANIC CHEMISTRY LABORATORY 2 hrs.
Prerequisite: CH 336 and approval of instructor.

341. CHEMICAL THERMODYNAMICS 3 hrs.
Introduces the theory of classical thermodynamics and applies it to the chemistry of solids, liquids, gases, and solutions. Prerequisite: CH 223, PH 201. Parallel: MA 150.

342. CHEMICAL DYNAMICS 2 hrs.
Discussion includes kinetic theory of gases, theory and formulation of rate equations, mechanisms of chemical reactions, and applications. Prerequisite: 341.

343. INTRODUCTION TO QUANTUM CHEMISTRY 2 hrs.
An introduction to the quantum mechanical treatment of the chemical bond including discussions on structure, symmetry, spectroscopy, and statistical thermodynamics. Prerequisite: CH 342, MA 244.

345. EXPERIMENTAL PHYSICAL CHEMISTRY 1 hr.
Laboratory investigations into the general area of thermodynamics, kinetics, and spectroscopy. Parallel: CH 342.

346. EXPERIMENTAL PHYSICAL CHEMISTRY 1 hr.
Laboratory investigations into the general area of kinetics and spectroscopy. Prerequisite: CH 345. Parallel: 343.

361. INTRODUCTION TO BIOCHEMISTRY 3 hrs.
An introduction to contemporary molecular biochemistry. Prerequisite: CH 332, 341, BY 112 or 114.

401. INORGANIC CHEMISTRY 3 hrs.
A survey of certain fundamental topics in inorganic chemistry including atomic structure, chemical bonding, periodic relationships, acid-base theories, non-aqueous solvents, and reaction mechanisms. Prerequisite: CH 342.

421. METHODS OF INSTRUMENTAL ANALYSIS 4 hrs.
An introduction to the use of basic instrumentation in electrochemical and chromatographic and spectrophotometric analysis. Laboratory work emphasizes the general utility of operational amplifiers in making chemical measurements and provides an introduction to digital logic. Prerequisite: CH 345.

431. QUALITATIVE ORGANIC ANALYSIS 2 hrs.
Modern chemical and instrumental methods are used in separation, purification, and identification of organic compounds. A laboratory course. Prerequisite: CH 336, 346.
491, 492, 493. INTRODUCTION TO CHEMICAL RESEARCH 1-3 hrs.
Required for Curricula III-VI. Prerequisite: Senior standing and approval of a member of the chemistry faculty. Registration utilizes last digit of course number to designate semester hour credit.

501. ADVANCED INORGANIC CHEMISTRY 3 hrs.
A survey course with emphasis on the structure and reactivity of inorganic compounds. Prerequisite: CH 401.

505. NUCLEAR AND RADIOCHEMISTRY 3 hrs.
Theory and description of chemical phenomena which are related to nuclear properties and processes. Includes radioactive decay and growth, interactions of radiations with matter, decay processes, nuclear models, and types of nuclear reactions. Prerequisite: CH 346 or approval of instructor.

506. NUCLEAR CHEMISTRY LABORATORY 2 hrs.
Theory and use of nucleonics measuring equipment and techniques of nuclear and radiochemistry. Prerequisite or parallel: CH 505.

521. METHODS OF CHEMICAL ANALYSIS 3 hrs.
A literature, seminar course which emphasizes the theory and methodology of various techniques of chemical analysis. Prerequisite: CH 421.

531. PHYSICAL ORGANIC CHEMISTRY 3 hrs.
An introduction to theoretical organic chemistry with emphasis on the study and understanding of organic reactions. Prerequisite: CH 431.

540. HIGH POLYMER CHEMISTRY 3 hrs.
The theory of polymer formation and the structural dependence of polymer properties are discussed. Prerequisite: CH 397, 342.

541. ADVANCED CHEMICAL THERMODYNAMICS 3 hrs.
Prerequisite: CH 346, MA 251.

549. SPECTROSCOPY AND MOLECULAR STRUCTURE 3 hrs.
An intermediate level treatment of the principles of spectroscopy and their application to the determination of molecular structure. Prerequisite: CH 343.

553. INTRODUCTORY QUANTUM MECHANICS 3 hrs.
Same as PH 503. Prerequisite: CH 343, PH 301.

554. INTRODUCTORY QUANTUM MECHANICS 3 hrs.
Same as PH 504. Prerequisite: CH 553.

601. STRUCTURAL METHODS IN INORGANIC CHEMISTRY 3 hrs.
The study of various physical methods applied to the determination of the structure of inorganic compounds. Prerequisite: CH 501.

602. CHEMISTRY OF COORDINATION COMPOUNDS 3 hrs.
Modern bonding theory and stereochemistry of coordination compounds will be presented. Prerequisite: CH 601.

603. CHEMISTRY OF NON-METAL COMPOUNDS 3 hrs.
A study of the chemistry of selected non-metal compounds. Prerequisite: CH 601.

631. ADVANCED ORGANIC CHEMISTRY I 3 hrs.
An advanced course of broad scope covering the principles of organic chemistry in light of modern theory. Includes a treatment of natural products and heterocyclic compounds in addition to the chemistry of the simple alicyclic, cyclic and aromatic compounds. Prerequisite: CH 531.

632. ADVANCED ORGANIC CHEMISTRY II 3 hrs.
A continuation of CH 631. Prerequisite: CH 631.

633. SYNTHETIC ORGANIC CHEMISTRY 3 hrs.
A study of the reactions and principles involved in the synthesis of simple and complex organic compounds. Prerequisite: CH 632.
641. STATISTICAL THERMODYNAMICS 3 hrs.
A discussion of principles leading to the development of Maxwell-Boltzmann, Bose, Einstein, and Fermi-Dirac statistics is presented and thermodynamic properties are calculated from the partition function. Prerequisite: CH 541.

642. ADVANCED CHEMICAL DYNAMICS 3 hrs.
Concepts related to the velocity of chemical reactions in homogeneous and heterogeneous systems are discussed. Included are the absolute rate theory, collision theory, scattering, and the concept of reaction cross sections. Prerequisite: CH 641.

643. QUANTUM CHEMISTRY 3 hrs.
An application of theory to the chemical bond in the spirit of Coulson and Murrell, Kettle, and Tedder. Prerequisite: CH 642.

651. QUANTUM MECHANICS 3 hrs.
Same as PH 751. An advanced treatment of quantum mechanics. Prerequisite: CH 554, PH 505 or 508 or CH 643, PH 607 or equivalent, and PH 701.

652. QUANTUM MECHANICS 3 hrs.
Same as PH 752. An advanced treatment of quantum mechanics. Prerequisite: CH 651.

705. SELECTED TOPICS IN INORGANIC CHEMISTRY 3 hrs.
Prerequisite: CH 603.

735. SELECTED TOPICS IN ORGANIC CHEMISTRY 3 hrs.
Prerequisite: CH 633.

745. SELECTED TOPICS IN PHYSICAL CHEMISTRY 3 hrs.
Prerequisite: CH 643.

780. CHEMISTRY SEMINAR 3 hrs.
Required of all students working toward the M.S. degree.

790. MASTER THESIS 3 hrs.

Earth Science (ES)

101. EARTH SCIENCE I 4 hrs.
Spatial relationships of the earth, moon, and sun that determine the figure of the earth, earth motions, time, seasons, atmospheric and oceanic circulation, weather, and climates. Includes laboratory.

102. EARTH SCIENCE II 4 hrs.
Minerals and rocks; earth history and development of life; interior of the earth; evolution of continents, ocean basins, and mountains; rock weathering and soil forming processes; and shaping of land forms by running water, glacial ice, winds, and waves. Includes laboratory. Prerequisite: ES 101.

Mathematics (MA)

Undergraduate Programs

All areas of concentration (AOC) with a major in mathematics will include the following courses: MA 125, 149, 150, 244, 251, 373, 491 (basic core—21 semester hours); MA 352 or 385 or 498; MA 363 or 533 or 570; MA 492 or 521 or 552 (not required in Curriculum III); 6 hours of electives in MA courses numbered 300 or above. To supplement the mathematics major in the area of concentration, the
student is required to select a cluster of courses that may relate to his mathematics major or provide a background in another area for his specific purpose.

Students majoring in other disciplines may include only MA courses numbered 118 or above in their AOC. Students taking only 6 hours of mathematics to fulfill the general education requirements may take one of the following sequences, depending upon the results of placement tests:

a. MA 109, 118
b. MA 109, 115
c. MA 115, 118
d. MA 118, 125

Curricula I, II, and III are typical programs leading to a B.A. or B.S. degree with a major in mathematics.

Curriculum I — For B.A. Degree with a Major in Mathematics.

<table>
<thead>
<tr>
<th>General education requirements (Humanities and Social Sciences)</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics—MA basic core, MA 352 or 498, 6 hours of MA electives numbered 300 or above, and one of the following sequences:</td>
<td>36</td>
</tr>
<tr>
<td>(a) MA 533 or 363, 521 or 552; or</td>
<td></td>
</tr>
<tr>
<td>(b) MA 492, 570. Recommended to students preparing for graduate study in mathematics.</td>
<td></td>
</tr>
<tr>
<td>One of the following clusters of courses:</td>
<td>21-24</td>
</tr>
<tr>
<td>(a) Psychology — PSY 100, 104, 200, 302, 303, 401, 426. PSY 303 may be replaced by MA 385 or 581.</td>
<td></td>
</tr>
<tr>
<td>(b) Economics — EC 111, 112, 142, 143, and either EC 213, 231, 325 for accounting emphasis, or EC 251, 310, 352 for finance emphasis.</td>
<td></td>
</tr>
<tr>
<td>(c) A cluster of courses containing a minimum of 21 hours in one discipline including at least 6 hours in courses numbered 300 or above.</td>
<td></td>
</tr>
<tr>
<td>(d) A cluster of courses consisting of a minimum of 15 hours in one discipline, and a minimum of 9 hours in another discipline, including at least 9 hours in courses numbered 300 or above.</td>
<td></td>
</tr>
</tbody>
</table>

Courses in (c) and (d) clusters require the prior approval of the student’s mathematics faculty advisor and representatives of all other disciplines involved. Students wishing to pursue graduate work in applied mathematics are recommended to select a cluster in science or engineering (See Curriculum II).
Laboratory science requirement ........................................ 8
Electives (sufficient number to bring the total number of semester hours to a minimum of 128) .................. 25-33

Curriculum II — For B.S. Degree with a Major in Mathematics.

General education requirements (Humanities and Social Sciences) .................................................. 30-36
Mathematics—MA basic core, MA 352 or 498, 6 hours of MA electives numbered 300 or above, and one of the following sequences: ............................................. 36
  (a) MA 533 or 363, 521 or 552; or
  (b) MA 492, 570. Recommended to students preparing for graduate study in mathematics.

One of the following clusters of courses: ................. 21-24
  (a) Biology — BY 111, 112, 221, 515, and one BY elective numbered 300 or above
  (b) Chemistry — CH 121-122, 125, 126, 331-332-333, 335, 341, 342, 343
  (c) Physics — PH 101, 102 or 109, 110, 201, 202, 203, 301, 501
  (d) Operations research — EG 297, 320, 390, 421, and 3 courses from EG 523, 524, 525, 591, MA 581, 582

Laboratory science (must be in a different science or sciences from the cluster selection above) ........ 16
Electives (sufficient number to bring the total number of semester hours to a minimum of 128) ........... 17-26

Curriculum III — B.A. or B.S. Degree with a Major in Mathematics; Meets requirements for a Class B Secondary Professional Teaching Certificate.

General education requirements (Humanities and Social Sciences) .................................................. 30-36
Mathematics — MA basic core, MA 385, 363, and 6 hours of MA electives numbered 300 or above .... 33
Education core .................................................................... 27
Only one of the following clusters of courses: ....... 20-23
  (a) Biology — BY 111, 112, 221, 515, and one BY elective numbered 300 or above

108
(b) Chemistry — CH 121-122, 125, 126, 331-332-333, 335, 341, 342, 343
(c) Physics — PH 101-102 or 109-110, 201, 202, 203, 301, 501
(d) Psychology — PSY 100, 104, 200, 302, 303, 401, 426. PSY 303 may be replaced by MA 385 or 581.
(e) Economics — EC 111, 112, 142, 143, and either EC 213, 231, 325 for accounting emphasis, or EC 251, 310, 352 for finance emphasis.
(f) A cluster of 21 hours in one discipline, including at least 6 hours in courses numbered above 300 and approved by the discipline and the student's mathematics faculty advisor.
(g) A cluster of courses consisting of a minimum of 15 hours in one discipline and a minimum of 9 hours in another discipline, including 9 hours in courses numbered 300 and above and approved by student's mathematics faculty advisor and representatives of all other disciplines involved.

Clusters (a)-(c) lead to a B.S. degree; clusters (d)-(g) lead to a B.A. degree.

Laboratory science (must include 8 hours of a physical science and 4 hours of a biological science or 8 hours of a biological science and 4 hours of a physical science) ........................................ 12

Electives (sufficient number to bring the total number of semester hours to a minimum of 128) .......... 0-6

Should a student feel that certain substitutions from any discipline in any of the clusters in above curricula can produce a program better suited for his needs, he is encouraged to consult his faculty advisor on the feasibility of such changes in his program of study.

Graduate Programs

The University of Alabama in Huntsville offers programs leading to the degree of Master of Arts with a major in mathematics. In addition to fulfilling the Graduate School requirements, the student's program must include MA 642, 671, 754, and 755. All other courses require prior approval of the graduate faculty in mathematics.

After being admitted to the Graduate School (see section on Division of Graduate Programs) a student will be assigned to a faculty advisor who will assist him in establishing an acceptable proposed program of study.
Mathematics (MA)

NOTE: No student with three or more entrance units in mathematics who, by testing or otherwise, is placed in MA 111 or has completed MA 111 or above can receive credit for MA 101 or 109. Only 3 hours credit will be given towards a degree at UAH for MA courses numbered below 111.

091. HIGH SCHOOL ALGEBRA
For students with a deficiency of high school credit in algebra. No Credit

092. HIGH SCHOOL GEOMETRY
For students with a deficiency of high school credit in geometry. No Credit

101. INTRODUCTION TO CONTEMPORARY MATHEMATICS 3 hrs.
Introduction to mathematical reasoning; sets, set operation and relations; the system of whole numbers; numeration systems; Fundamental algorithms, systems of integers and rational numbers; real numbers; elementary number theory.

109. COLLEGE ALGEBRA 3 hrs.
Sets, set operations, the real number system, introduction to complex numbers, polynomials, algebraic expressions, exponents and radicals, equations and inequalities, systems of equations and inequalities, functions, relations and graphs. Prerequisite: One unit of high school algebra and placement tests.

111. INTRODUCTORY COLLEGE MATHEMATICS (no credit given if taken after MA 149) 3 hrs.
Sets, relations and functions, equations, inequalities, elementary matrix operations, sequences, mathematical induction, limit concepts, exponential and logarithmic functions, algebraic structures, complex numbers, brief introduction to linear algebra. Prerequisite: MA 109 or placement tests.

115. ALGEBRA AND TRIGONOMETRY (no credit given if taken after MA 149) 3 hrs.
Polynomial functions, rational functions, graphs, continuity, rational roots, exponential and logarithmic functions, trigonometric functions of angles, polar coordinates, solution of triangles, trigonometric functions of a real variable, inverse trigonometric functions, periodicity and graphs, complex numbers and DeMoivre's theorem, introduction to analytic geometry, slopes, direction cosines and conic sections. Prerequisite: MA 109 or placement tests.

118. INTRODUCTION TO FINITE MATHEMATICS (no credit given if taken after MA 251) 3 hrs.
Elementary logic, sets, partitions and counting, elementary probability, introduction to matrices, vectors and linear programming. Prerequisite: MA 101 or 109 or 115, or placement in MA 115 or higher. Students taking both MA 115 and 118 should take MA 115 first.

125. CALCULUS AND ANALYTIC GEOMETRY 3 hrs.
Introduction to plane analytic geometry, functions, limits, continuity, differentiation of algebraic functions, applications of the derivative, antiderivative. Prerequisite: MA 115 or placement tests.

149. CALCULUS AND ANALYTIC GEOMETRY 3 hrs.
The definite integral, applications of definite integrals, logarithmic and exponential functions, trigonometric functions. Prerequisite: MA 125.

150. CALCULUS AND ANALYTIC GEOMETRY 3 hrs.
Techniques of integration, polar coordinates, the conic sections, vectors in the plane and parametric equations, hyperbolic function, indeterminate forms and improper integrals. Prerequisite: MA 149.

244. INTRODUCTION TO LINEAR ALGEBRA 3 hrs.
Systems of linear equations and matrices; matrix operations; bases and coordinates; dimensions of vector spaces; linear transformations, matrix products, inverses and determinants; similar and symmetric matrices, diagonalization and brief application to spectral theory. Prerequisite: MA 149.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>251.</td>
<td>CALCULUS AND ANALYTIC GEOMETRY</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>Vectors in three space and solid analytic geometry, differential calculus of functions of several variables (limits, continuity, partial derivatives, directional derivatives), multiple integrals, sequences and infinite series. Prerequisite: MA 150.</td>
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<tr>
<td>352.</td>
<td>INTRODUCTION TO DIFFERENTIAL EQUATIONS</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>First order equations; linear equations, series solutions; systems of equations; existence theory, numerical methods and Laplace transform. Prerequisite: MA 244, 251.</td>
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<tr>
<td>353.</td>
<td>APPLIED DIFFERENTIAL EQUATIONS</td>
<td>3 hrs</td>
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<td></td>
<td>First order and simple higher order differential equations, linear differential equations, solution by Laplace transformations, series solutions, and applications. Not open to students majoring in mathematics. (Will be discontinued after Spring term, 1970; see MA 352.) Prerequisite: MA 251.</td>
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<tr>
<td>363.</td>
<td>INTRODUCTION TO HIGHER GEOMETRY</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>Directed geometry, axis theorems, projection and section, duality principles, elements at infinity, synthetical and analytical geometric form; homogeneous, punctual, linear and planar coordinates; transversal theory; affine, homologic, homothetic and bi-rational transformation; harmonic and cross ratio, reciprocal perspective and projectivity, theorems of Pappus, Pascal, and Brianchon. Prerequisite: MA 251.</td>
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<tr>
<td>364.</td>
<td>INTRODUCTION TO HIGHER GEOMETRY</td>
<td>3 hrs</td>
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<td></td>
<td>Division and pencil harmonics, complete quadrilaterals, orthogonal circles; pencils of circles, lines, planes and spheres; poles, polars and polar planes; conjugate points and lines, reciprocal polar transformation, involution, homogeneous division and pencil, inversion, inversors, stereographic projection. Prerequisite: MA 363.</td>
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<tr>
<td>373.</td>
<td>INTRODUCTION TO HIGHER ALGEBRA</td>
<td>3 hrs</td>
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<td></td>
<td>Introductory study of groups, rings, integral domains, fields, vector spaces, matrices, and elementary theory of numbers. Prerequisite: MA 244 or 251.</td>
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<tr>
<td>385.</td>
<td>INTRODUCTION TO PROBABILITY THEORY</td>
<td>3 hrs</td>
</tr>
<tr>
<td></td>
<td>Probability spaces, discrete and continuous random variables, conditional probability, and expectation. Bernoulli, Poisson, and other important random processes, basic distributions. Prerequisite: MA 244 or 251.</td>
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<tr>
<td>491.</td>
<td>INTRODUCTION TO REAL ANALYSIS I</td>
<td>3 hrs</td>
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<td></td>
<td>Elementary set theory, the real number system, convergence of sequences, open and closed sets, the Bolzano-Weierstrass and Heine-Borel theorems, limits and properties of limits, continuous functions and their properties, uniformly continuous functions and their properties, and Taylor's theorem. Prerequisite: MA 244 or 251.</td>
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<tr>
<td>492.</td>
<td>INTRODUCTION TO REAL ANALYSIS II</td>
<td>3 hrs</td>
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<td></td>
<td>Infinite series and convergence, sequences and series of functions, the Weierstrass approximation theorem, equi-continuity, power series and their properties, the Riemann integral and its properties, functions of bounded variation, and the Riemann-Stieltjes integral and its properties. Prerequisite: MA 491.</td>
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<tr>
<td>498.</td>
<td>INTRODUCTION TO THEORY OF DIFFERENTIAL EQUATIONS</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>Complex numbers, functions, series, determinants, linear equations of the first order, linear equations with constant coefficients, the Wronskian, linear equations with variable coefficients, linear independence, reduction of order, power series solutions, regular singular points, Frobenius series solutions, existence and uniqueness, the Lipschitz condition and successive approximations. (Will be discontinued after Spring 1970; see MA 352.) Prerequisite: MA 251.</td>
<td></td>
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<tr>
<td>513.</td>
<td>NUMERICAL ANALYSIS I</td>
<td>3 hrs</td>
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<tr>
<td></td>
<td>Linear and nonlinear equations, interpolation, orthogonal polynomials, numerical differentiation and integration, differential equations. Prerequisite: MA 251. (After Summer 1970, MA 244 and a course in differential equations will be additional prerequisites.)</td>
<td></td>
</tr>
</tbody>
</table>
514. **NUMERICAL ANALYSIS II** 3 hrs.
Continuation of MA 513. Prerequisite: MA 513, MA 244, and a course in differential equations.

521. **INTRODUCTION TO COMPLEX ANALYSIS** 3 hrs.
Complex algebra, analytic functions, Cauchy integral theorem, Taylor and Laurent series, classification of singularities, residue theorem, evaluation of definite integrals, conformal mapping. Prerequisite: MA 491.

523. **SERIES AND SPECIAL FUNCTIONS** 3 hrs.
The gamma function and its properties, probability integral and related functions, exponential integral and related functions, orthogonal polynomials, cylinder functions, spherical harmonics and hypergeometric functions. Prerequisite: MA 521.

526. **PARTIAL DIFFERENTIAL EQUATIONS** 3 hrs.
Ordinary differential equations in several variables, partial differential equations of first order, discrete and continuous eigenvalues, separation of variables, Fourier series, Fourier-Bessel and Fourier-Legendre series, Green’s functions and applications, Fourier integrals, solution of partial differential equations by Fourier transforms. Prerequisite: MA 521.

527. **VECTOR ANALYSIS** 3 hrs.
Vectors, vector algebra, vector equations; scalar, vector, box and triple products; reciprocal bases, oblique systems, moments of vectors, discrete and continuous line vectors; derivatives, relative derivatives, partial derivatives and directional derivatives of vector functions; differential invariants, line and surface integrals, theorems of Gauss and Stokes. Prerequisite: MA 251.

533. **METRIC DIFFERENTIAL GEOMETRY** 3 hrs.
Theory of space curves, the concept of a surface, first and second fundamental forms, foundations of tensor calculus; Gaussian, mean and geodesic curvature. Prerequisite: MA 491.

543. **ELEMENTARY NUMBER THEORY** 3 hrs.
Divisibility, congruences, quadratic reciprocity, number theoretic functions, and diophantine equations. Prerequisite: MA 373.

544. **LINEAR ALGEBRA** 3 hrs.
Vector spaces, linear transformations, matrices, determinants, eigenvalues, similarity, linear functionals, bilinear forms, quadratic forms, orthogonal matrices, unitary matrices, and normal matrices. Prerequisite: MA 373 or 491.

552. **FUNCTIONS OF SEVERAL VARIABLES** 3 hrs.
Real and complex number systems, basic set theory, limits and continuity, differentiation, applications of partial differentiation, Jacobians, implicit function theorem, extremum problems, multiple integrals and line integrals. Prerequisite: MA 491.

570. **METRIC SPACES** 3 hrs.
Sequences, continuous functions, completeness, separability, Lindelof property; equivalence of compactness, countable compactness and sequential compactness. Prerequisite: MA 491.

581. **MATHEMATICAL THEORY OF STATISTICS I** 3 hrs.
Probability and combinatorial methods, discrete and continuous distributions, expected value and moments, sampling, point and interval estimation, test of hypothesis. Prerequisite: MA 251. Normally preceded by MA 385 (MA 385 will be a prerequisite after Winter 1969-70).

582. **MATHEMATICAL THEORY OF STATISTICS II** 3 hrs.
Regression and linear hypotheses, experimental design and analysis of variance, sequential tests of hypotheses. Prerequisite: MA 244, 581.

590. **SELECTED TOPICS IN MATHEMATICS** 3 hrs.
Prerequisite: Approval of the Discipline Chairman.
601. INTRODUCTION TO GRADUATE MATHEMATICS 3 hrs.
The Zermelo-Fraenkel theory of sets; basic logic, axioms of the theory of sets, algebra of sets, relation and functions, order and Zorn's lemma, equivalence classes, real numbers, equipollence of sets, similarity, ordinal numbers and their arithmetic, cardinal numbers and their arithmetic. Prerequisite: MA 491.

624. CELESTIAL MECHANICS I 3 hrs.
Review of analytical mechanics, the equations of motion in a Newtonian gravitational field, the two-body problem, elementary theory of the three-body problem, Euler's problem, elementary perturbation theory, and numerical computations in celestial mechanics. Prerequisite: A course in differential equations.

642. ABSTRACT ALGEBRA 3 hrs.
Elementary set theory, equivalence relations, elementary group theory, subgroups, normal subgroups, factor groups, homomorphisms, inner and outer automorphisms, permutation groups, rings, integral domains, fields and skew fields, Euclidean rings, polynomials, vector spaces, modules, extension fields, roots, and elements of Galois theory. Prerequisite: MA 373.

651. THEORY OF DIFFERENTIAL EQUATIONS 3 hrs.
Elementary integration methods, equations with separated variables, some other special equations, existence theorems (Picard-Lindelof, Cauchy-Peano, real analytic functions), uniqueness theorems (Lipschitz, Nagumo); dependence of solutions on parameters and initial values, linear differential equations, linear independence of solutions, reduction of order, zeros of solutions of second order equations, Sturm boundary value problems and expansion problems. Prerequisites: MA 491 and a course in differential equations.

671. INTRODUCTION TO TOPOLOGY 3 hrs.

685. THEORY OF PROBABILITY I 3 hrs.
Sample spaces, probabilities in discrete spaces, laws of probability. Occupancy problems, matching and guessing, Polya's urn models, stochastic independence. Chebyshev's and Kolmogorov's inequalities. Special distributions, and recurrent events. Generating functions and branching processes. Prerequisite: MA 491 and 492 or 552, or approval of instructor.

686. THEORY OF PROBABILITY II 3 hrs.

720. MATRIX ANALYSIS I 3 hrs.
Matrices and operations on matrices, the Gauss algorithm, linear operators, characteristic and minimal polynomials, functions of matrices, equivalent transformations, elementary divisors, normal forms and matrix equations. Prerequisite: MA 544.

721. MATRIX ANALYSIS II 3 hrs.
Continuation of MA 720. Linear operators in a unitary space, spectral theory, decomposition of operators, quadratic forms, Hermitian forms, Hankel forms, and selected advanced topics. Prerequisite: MA 720.

722. THEORY OF STABILITY 3 hrs.
Liapunov stability, stability of linear equations with constant coefficients, Liapunov stability and instability theorems, Kraskovskii's generalizations, quadratic forms as Liapunov functions, theory of first approximation, uniform properties of the equilibrium, algebraic stability criteria (Hermite, Bilharz, Routh, Hurwitz), geometric stability criteria (Leonhard-Cremer-Michallov, Nyquist, root-locus method) and absolute stability. Prerequisite: MA 651.
724. CELESTIAL MECHANICS II 3 hrs.
Continuation of MA 624. Canonical transformations, perturbation theory, regularization, periodic motions, quasiperiodic motions, stability in celestial mechanics, and selected advanced topics. Prerequisite: MA 624.

727. TENSOR ANALYSIS 3 hrs.
Complete study of curvilinear coordinates; linear vector functions, dyadics, linear vector space, matrices, transformations, the tensor concept, covariant and contravariant tensors, Christoffel's symbols, covariant and intrinsic differentiation, applications to analytical and relativistic mechanics. Prerequisite: MA 527.

742. THEORY OF ALGEBRAIC NUMBERS 3 hrs.
Algebraic fields, integral domains, ideals, development of the unique factorization in ideals, and additional selected topics in algebraic number theory. Prerequisite: MA 642.

743. GROUP THEORY 3 hrs.
A study of groups, subgroups, and normal subgroups, factor groups, homomorphisms, isomorphisms, endomorphisms, automorphisms, normal series, the Jordan-Holder theorem, Sylow theorem, and Abelian groups. Prerequisite: MA 642.

745. ADVANCED ABSTRACT ALGEBRA 3 hrs.
Continuation of MA 642. Topics in the theory of groups, categories and functors, rings, modules, field theory, algebraic extensions, splitting fields, finite fields, and Galois theory. Prerequisite: MA 754.

754. REAL ANALYSIS 3 hrs.
Topological and algebraic structure of the real number system, algebras, Borel sets, outer measure, measurable sets, Lebesque measure, the Sigma algebra of measurable sets, measurable functions, theorems of Riesz, Egorov and Luzin, sequences of measurable functions, the Riemann integral, the Lebesque integral of a bounded function over a set of finite measure, the general Lebesque integral, the theorem of Fatou, convergence in measure, differentiation of monotone functions, bounded variation, absolute continuity, the indefinite Lebesque integral, and applications of measure and integration to differential equations and probability theory. Prerequisite: MA 491 and 552 or 570 or 671.

755. COMPLEX ANALYSIS 3 hrs.
A review of the complex number system and topology of the complex plane, holomorphic functions, integration in the complex plane, Cauchy's integral theorems, elementary functions, singularities, calculus of residues, evaluation of definite integrals, Taylor and Laurent series, the Mittag-Leffler theorem, infinite products, the Weierstrass theorem, and the gamma function. Prerequisite: MA 491. Normally preceded also by MA 521.

756. COMPLEX ANALYSIS II 3 hrs.
Conformal mapping, linear transformations, Riemann's mapping theorem, reflection theorems, mapping of polygons, algebraic functions and their Riemann surfaces, analytic continuation, the general concept of an analytic function, and selected advanced topics. Prerequisite: MA 755.

757. ABSTRACT SPACES 3 hrs.
Metric spaces, metric topology, convergence and completeness, Baire categories, topological spaces, countability, separation, connectedness, compactness, countable compactness, the Bolzano-Weierstrass property, local compactness, the Stone-Weierstrass theorem, equicontinuity, Ascoli's theorem, Banach spaces, completeness, linear operators, linear functionals, the Hahn-Banach theorem, weak topologies, convexity, Hilbert spaces, and orthonormal systems. Prerequisite: MA 754. Normally preceded also by MA 570.

759. ADVANCED THEORY OF DIFFERENTIAL EQUATIONS 3 hrs.
Existence and nature of solutions of ordinary differential equations in the real domain, general theory of linear equations, linear systems, non-oscillation theorems, boundary value problems, existence theorems in the complex domain, series solutions. Prerequisite: MA 754.
761. THEORIES OF INTEGRATION 3 hrs.
Generated rings and algebras, Borel sets, set functions, measures (finite, sigma-finite, totally finite, totally sigma-finite), complete measures and completion, Lebesque measure in Euclidean k-space, outer measure, measurable functions, the Lebesque integral, the Daniell integral, over and under functions, summable functions, convergence, measure induced by the integral, iterated integrals, the Fubini theorem and signed measures. Prerequisite: MA 570 or 671, 754.

766. CALCULUS OF VARIATIONS 3 hrs.
Types of problems in the calculus of variations, a study of necessary conditions and sufficient conditions for the extremum of a definite integral in both parametric and nonparametric representation in the plane, extension to higher dimensions. Prerequisite: MA 552.

770. INTRODUCTION TO ALGEBRAIC TOPOLOGY 3 hrs.
Review of elementary general topology, pathwise connectivity, homotopy, homotopy classes, retracts, degrees of mappings, homotopy groups, introduction to homology theory. Prerequisite: MA 642, 671.

773. GENERAL TOPOLOGY 3 hrs.
A brief review of elementary topology (including separability, second axiom of countability, the Lindelöf property, connectivity, compactness and basic separation axioms), Moore-Smith convergence, product and quotient spaces, types of compactness, advanced separation axioms, and advanced properties of compactness and connectivity. Prerequisite: MA 570, 671.

774. GENERAL TOPOLOGY 3 hrs.
Continuation of MA 773. Metrization, function spaces, compact-open topology, local topological properties, filters, introduction to topological groups, and other selected topics in general topology. Prerequisite: MA 773.

781. ADVANCED THEORY OF STATISTICS I 3 hrs.
Sampling theory, order statistics, asymptotic sampling theory, point and interval estimation, nonparametric estimation. Prerequisite: MA 581, 685.

782. ADVANCED THEORY OF STATISTICS II 3 hrs.
Tests of statistical hypothesis, nonparametric tests, statistical decision theory, Bayes and minimax decision rules. Introduction to multivariate normal distribution and linear models. Prerequisite: MA 781.

783. MULTIVARIATE ANALYSIS 3 hrs.
Multivariate normal distribution multiple correlation, Wishart distribution, distribution of roots of determinantal equations, Hotelling $T^2$ and multivariate analysis of variance, discriminant functions, factor analysis. Prerequisite: MA 544, 781.

784. CORRELATION AND REGRESSION 3 hrs.
Analysis of simple and multiple correlation and regression problems, linear and curvilinear. Analysis of covariance, multivariate analysis. Prerequisite: MA 582.

785. ADVANCED THEORY OF PROBABILITY I 3 hrs.
Probability measure, probability distributions, stochastic independence, modes of convergence, law of large numbers. Prerequisite: MA 685, 754.

786. ADVANCED THEORY OF PROBABILITY II 3 hrs.
Central limit problem, conditional probability, martingales and ergodic theory, Brownian motion. Prerequisite: MA 666, 785.

787. SAMPLING TECHNIQUES 3 hrs.
Simple random, stratified, systematic, cluster, probability, double and multistage samplings. Ratio and regression estimates. Prerequisite: MA 581.

792. SEMINAR TOPICS IN APPLIED MATHEMATICS 1-3 hrs.

794. SEMINAR TOPICS IN ALGEBRA 1-3 hrs.
795. SEMINAR TOPICS IN ANALYSIS  1-3 hrs.
797. SEMINAR TOPICS IN TOPOLOGY   1-3 hrs.
798. SEMINAR TOPICS IN PROBABILITY AND STATISTICS  1-3 hrs.
799. RESEARCH IN MATHEMATICS
Prerequisite: Graduate standing.

Physics (PH)

Undergraduate Programs

The basic course requirements for a B.S. degree with a major in physics are: PH 101-102 or 109-110, 201, 202, 203, 301, 310, 311, 312. Three approved AOC’s are listed. Others may be approved after consultation with the student’s faculty advisor and the Division Director.

Curriculum I—For Working Professionally at the B.S. Level or Preparation for Graduate School.

General education requirements (Humanities and Social Sciences) ........................................ 30-36
Physics—PH 109-110, 201, 202, 203, 301, 311, 312, 373, 386, 2 senior labs at 400 level, 501, 503-504 .......... 40
Mathematics—MA 125, 149, 150, 244, 251, 352 or 353 or 498, 491, 521 ............................................. 24
Chemistry—CH 121-122, 125, 126 ........................................ 7
Electives .......................................................... 21-27

Curriculum II—Natural Science AOC with Emphasis on Physics.

General education requirements (Humanities and Social Sciences) ........................................ 30-36
Physics—PH 104, 105, 109-110, 201, 202, 203, 301, 310, 311 ................................................................. 26
Chemistry—CH 121-122, 125, 126, 331-332-333, 335 ... 14
Mathematics—MA 125, 149, 150, 244, 251, 352 or 353 or 498 ................................................................. 18
Biology—BY 113-114, 219, 317 or 354 ....................... 14
Electives .......................................................... 20-26

Curriculum III—AOC with Physics Major for Class B Secondary Professional Teaching Certificate.

General education requirements (Humanities and Social Sciences) ........................................ 30-36
Physics—PH 104, 109-110, 201, 202, 203, 301, 310, 311, 312, 501 ......................................................... 25
Mathematics—MA 125, 149, 150, 244, 251 ................. 15  
Chemistry—CH 121-122, 125, 126 .......................... 7

With Chemistry Cluster  
Chemistry—CH 223, 331-332-333, 341, 342 or 335-336 . 15  
Education core ............................................. 27  
Electives ...................................................... 3-9

With Mathematics Cluster  
Mathematics—MA 363, 373, 385 or 581 ..................... 9  
Education core ............................................. 27  
Electives ...................................................... 9-15

With Biology Cluster  
Biology—BY 113-114, 219, 221, 317 or 371 or 372,  
532 or 531 ...................................................... 22  
Education core ............................................. 27  
Electives ...................................................... 0-2

Graduate Programs

The physics faculty offers courses leading to the Master of  
Science degree under Plan I. (See section on Division of Graduate  
Programs.) One pre-approved selection of courses is shown here.  
Others may be approved to fit the needs of particular students on  
the advice of the faculty advisor and approval by the Division  
Director.

Physics—PH 503, 504, 505 or 508, 701, 702, 751 and 2  
additional graduate courses.  
PH 792 must be taken at least two terms, but does not  
count toward the necessary 24 hours.

Physics (PH)

101. GENERAL PHYSICS  
4 hrs.  
An introductory course intended for all students. It is a non-calculus based  
course but requires good background in algebra and trigonometry. Intended  
to be phenomenological in nature with emphasis on understanding of basic  
ideas of physics and ability to apply these ideas to specific problems. Subjects  
covered include motion of particles, Newtonian mechanics, relative  
motion, concepts of energy, basic nature of electric and magnetic phenomena,  
optics, quantum nature of matter, and wave phenomena. Includes laboratory.  
PH 101-102 satisfy laboratory science requirement.

102. GENERAL PHYSICS  
4 hrs.  
Continuation of PH 101. Includes laboratory. Prerequisite: PH 101.

104. ASTRONOMY OF THE SOLAR SYSTEM  
2 hrs.  
Includes laboratory. Prerequisite: High school algebra.

105. ASTRONOMY OF THE SOLAR SYSTEM  
2 hrs.  
Continuation of PH 104. Includes laboratory. Prerequisite: PH 104.
109. GENERAL PHYSICS 4 hrs.
Lecture same as 101. Lab replaced by one-hour seminar each week. This will be generally in the area of History of Science. PH 109-110 may not be used to satisfy laboratory science requirement; strongly recommended for science majors who will satisfy lab science with another set of courses.

110. GENERAL PHYSICS 4 hrs.
Continuation of PH 109. Lecture same as PH 102. Lab replaced by one-hour seminar each week. This will be generally in the area of contemporary thoughts in science and social implications. Prerequisite: PH 109.

201. MECHANICS 3 hrs.
Galilean invariance; energy and momentum, non-relativistic particle kinematics and dynamics; harmonic oscillator; Lorentz transformations, relativistic momentum, energy, and dynamics. Prerequisite: PH 102 or 110. Prerequisite or parallel: MA 149.

202. ELECTRICITY AND MAGNETISM 3 hrs.
Basic concepts of electrostatics, electric potential theory, electric fields and currents, fields of moving charge including relativistic treatment, magnetic fields. Prerequisite: PH 201. Prerequisite or parallel: MA 150.

203. WAVES AND OSCILLATIONS 3 hrs.
Introduction to periodic phenomena, free oscillators, forced oscillators, traveling waves, modulation and Fourier analysis, polarization, interference and diffraction. Prerequisite: PH 202. Prerequisite or parallel: MA 244.

The sequence of courses 205, 206, 207, 253, 255 is intended for students who need a calculus based introduction to classical and modern topics in physics but who will probably not take additional physics courses. This sequence is not intended for physics majors, but students taking this sequence can, with special permission, have it or parts of it counted toward a major in physics in lieu of or parts of PH 101-102, 109-110, and one or both of PH 201 and 202.

205. MECHANICS 3 hrs.
A vector treatment of the description of motion, the laws of motion, and the conservation laws are studied and applied to simple problems such as the simple pendulum, the harmonic oscillator, a simplified discussion of planetary motion, and scattering of objects. The basic force laws and empirical approximations are covered—gravitation, electric and magnetic forces, Hooke's law and frictional forces. Prerequisite or parallel: MA 149.

206. SOUND, HEAT AND LIGHT 3 hrs.
The concepts and laws in PH 205 will be extended and applied to waves, sound, heat, and light. Thermodynamic concepts and laws are introduced and related to kinetic theory of gases (microscopic and macroscopic treatment of systems of many particles). Both geometrical and physical (wave) optics are presented. Reflection, refraction, and diffraction phenomena are covered and the mirror, lens, and grating equations are discussed. Prerequisite: PH 205. Prerequisite or parallel: MA 150.

207. ELECTRICITY AND MAGNETISM 3 hrs.
The basic electric and magnetic nature of matter is considered. The sources and effects of electric and magnetic fields are studied, including the laws of Coulomb, Gauss, Amperé, Biot-Savart, and Faraday. A brief treatment of circuits is given, including Kirchoff's laws and Ohm's law. Prerequisite: PH 206. Prerequisite or parallel: MA 244 or 251.

253. MODERN PHYSICS 3 hrs.
Emphasis on basic concepts of modern developments in physics. Introduction to special relativity, atomic structure, structure of periodic table, atomic spectra, nuclear structure. Prerequisite: PH 207.

255. MODERN PHYSICS LABORATORY 1 hr.
Selected experiments to demonstrate concepts of PH 253. Prerequisite or parallel: PH 253.
301. QUANTUM PHYSICS 3 hrs.
Quantum hypothesis, physical quantities, theory of measurement; uncertainty principle, energy levels; photons; particles, de Broglie waves; phenomenological wave mechanics, Schroedinger's wave equation, quantization, hydrogen-like systems, interactions. Prerequisite: PH 203.

302. THERMAL AND STATISTICAL PHYSICS 3 hrs.
Microscopic systems, equilibrium, heat and temperature, irreversibility; probability and statistics; thermal interactions, approach to equilibrium mean energy and pressure of Ideal Gas; microscopic theory, absolute temperature, entropy, canonical distribution, equipartition of energy. Prerequisite: PH 301.

310. LABORATORY 1 hr.
Experimental study of the laws of mechanics based largely on the motion of electrons in electric and magnetic fields. Parallel: PH 203.

311. LABORATORY 1 hr.
Electrical circuits and microwave optics. Parallel: PH 301.

312. INTERMEDIATE LABORATORY III 1 hr.
Selected experiments to demonstrate statistical processes and introductory experiments in modern atomic and nuclear physics. Parallel: PH 501.

357. ELECTRONICS 4 hrs.
Introductory course for all science students. Basic AC and DC circuits, vacuum tube circuits, transistor circuits, power supplies, feedback, operational amplifiers, use of above in laboratory Instruments. Laboratory included. Prerequisite: PH 202 or 207.

373. INTERMEDIATE MECHANICS 3 hrs.
Motion of particle in two or three dimensions, central forces, gravitation, system of particles; rigid body motion; moving coordinate systems; generalized coordinates, Lagrange's equations, Hamilton's equations. Prerequisite: PH 201, MA 251.

386. ELECTRICITY AND MAGNETISM II 3 hrs.
Development of Maxwell's equations for time-varying fields, basic concepts of AC circuit theory, electric fields in matter, magnetic fields in matter, selected discussions on modern applications of electricity and magnetism. Prerequisite: PH 202, MA 251.

412. OPTICS AND SPECTROSCOPY LABORATORY 1 hr.
Experiments in geometrical optics including image formation and aberrations, study of diffraction gratings, plane and concave grating spectrographs, photoelectric and photographic spectroscopy, analysis of spectra. (On demand.)

413. NUCLEAR PHYSICS LABORATORY 1 hr.
Statistics in counting processes, beta-ray continuum, scintillation spectroscopy, coincidence spectroscopy, Møssbauer effect, selected experiments in modern techniques. (On demand.)

414. SOLID STATE PHYSICS LABORATORY 1 hr.
Fundamental solid state experiments including electron paramagnetic resonance, nuclear magnetic resonance, Hall effect, cyclotron resonance, Møssbauer spectroscopy. (On demand.)

415. X-RAY LABORATORY 1 hr.
Powder and single crystal x-ray photography with theory as needed. (On demand.)

416. SENIOR LABORATORY 1 hr.
Selected experiments from PH 412-415; on demand by individual arrangement.

503. INTRODUCTORY QUANTUM MECHANICS AND ATOMIC PHYSICS 3 hrs.
Background of the 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. Prerequisite: PH 301 or 373, 386. Prerequisite or parallel: MA 352.
504. INTRODUCTORY QUANTUM MECHANICS AND ATOMIC PHYSICS 3 hrs.
Continuation of PH 503. Prerequisite: PH 503.

505. NUCLEAR PHYSICS 3 hrs.
Stable nuclei, isotopes, nuclear reaction, nuclidic masses, binding energy,
scattering experiments, nuclear cross sections, spins, energy levels, nuclear
models, elementary particles. Prerequisite: PH 504.

506. INTRODUCTION TO PHYSICS OF THE SOLAR SYSTEM 3 hrs.
Development and discussion of the fundamentals necessary for understand­
ing of the solar system and the major modern trends. Prerequisite: PH 504,
MA 353 or 498.

508. SOLID STATE PHYSICS 3 hrs.
Crystal structure lattice vibrations and phonons, free electron theory, band
theory of solids, electric and magnetic and optical phenomena in solids. Pre­
requisite: PH 504.

521. THERMAL PHYSICS 3 hrs.
An introduction to thermal phenomena, both on a macroscopic and on a
statistical basis, and to the principles and laws governing them. Prerequisite:
PH 386.

531. INTRODUCTION TO PLASMA DYNAMICS 3 hrs.
Plasma kinetic theory, including charged-particle and neutral collision, ioniza­
tion, electronic excitation and recombination, motion of charged particle,
macroscopic equations; transport coefficients, gas discharges, instabilities,
sheath and oscillation electromagnetic waves and radiation. Prerequisite: PH
253 or 301, 386.

541. OPTICS 3 hrs.
Review of geometrical optics, thick lenses, aberrations. Physical optics in­
cluding interference, diffraction, partial coherence, polarization, interaction of
radiation with matter. Prerequisite: PH 386.

607. SELECTED TOPICS IN MATHEMATICAL PHYSICS 3 hrs.
Mathematical methods of physics including special functions such as Bessel,
Legendre, and hypergeometric functions, ordinary and partial differential
equations, Green’s functions, applications of complex variables, vector
spaces, tensor groups theory, integral transforms, integral equations, numeri­
cal methods. Prerequisite: PH 504, MA 521.

609. SELECTED TOPICS IN MATHEMATICAL PHYSICS 3 hrs.
Content to be determined by needs of students. Prerequisite: PH 607.

701. CLASSICAL DYNAMICS 3 hrs.
Variational principles and Lagrangian mechanics, the kinematics and dy­
namics of rigid body motion, and the theory of small oscillations. Emphasis
is on those aspects related to modern physics. Prerequisite: PH 373.

702. CLASSICAL DYNAMICS 3 hrs.
Special relativity, Hamilton’s equations, canonical transformations, Hamilton-
Jacobi theory, and an introduction to the classical theory of fields. Emphasis
is on those aspects related to modern physics. Prerequisite: PH 701.

705. RELATIVITY 3 hrs.
A study of the special and the general theory, with emphasis on a covariant
formulation of electrodynamics. Prerequisite: PH 701.

706. ASTROPHYSICS 3 hrs.

722. KINETIC THEORY AND STATISTICAL MECHANICS 3 hrs.
Review of thermodynamics, kinetic theory, classical statistical mechanics,
canonical and grand canonical ensembles, quantum statistical mechanics,
Bose and Fermi statistics, the partition function. Prerequisite: PH 504, 521.
723. KINETIC THEORY AND STATISTICAL MECHANICS 3 hrs.
Advanced topics in kinetic theory and statistical mechanics. Prerequisite: PH 722.

725. SOLID STATE PHYSICS 3 hrs.
Periodic structures, lattice waves, electron states, static properties of solids, electron-electron interaction, dynamics of electrons, transport properties, optical properties, magnetism, superconductivity. Prerequisite: PH 508, 751.

727. RADIATION THEORY 3 hrs.

731. ELECTROMAGNETIC THEORY 3 hrs.
The electrostatic and magnetostatic fields in vacuum and material matter. Conservation laws. The homogeneous wave equations. Prerequisite: PH 386, 504.

732. ELECTROMAGNETIC THEORY 3 hrs.
The inhomogeneous wave equation and sources. Introduction to special relativity. Radiation from accelerated charges. Hamiltonian formulation of electrodynamics. Prerequisite: PH 731.

741. OPTICS II 3 hrs.
Selected topics from advanced optics including Fresnel and Fraunhoffer diffraction, geometrical theory of aberrations, diffraction theory of aberrations, theory of partial coherence. Prerequisite: PH 541.

751. QUANTUM MECHANICS 3 hrs.
Review of basic principles, general formulation in Hilbert space, angular momentum, steady-state perturbation theory, scattering theory, and applications. Prerequisite: PH 505 or 508, 607 or equivalent, 701.

752. QUANTUM MECHANICS 3 hrs.
Identical particles, symmetry principles, time-dependent perturbation theory, variational principles, formal scattering theory, introduction to relativistic quantum mechanics. Prerequisite: PH 609, 751.

754. SELECTED TOPICS IN QUANTUM MECHANICS 3 hrs.
Offered on demand. Prerequisite: PH 752.

756. SELECTED TOPICS IN QUANTUM MECHANICS 3 hrs.
Continuation of PH 754. Prerequisite: PH 754.

758. SEMINAR IN CONTEMPORARY PHYSICS 3 hrs.
Reports and discussion associated with research topics of current interest. Prerequisite: PH 751.

790. MASTERS THESIS

791. MASTERS RESEARCH No Credit
Research for M.S. degree.

792. PHYSICS SEMINAR No Credit
Students report on journal articles or individual research. Prerequisite: PH 504. Two terms required for M.S. students.
DIVISION OF ENGINEERING

The engineering program has as its primary objective the preparation of qualified students for careers in any one of many engineering practices, for research, and for advanced studies. It stresses a broad education in mathematics, physical sciences, liberal arts, and the fundamentals of engineering.

Instead of several narrow curricula carrying such labels as civil, mechanical, and electrical engineering, the Division of Engineering offers a unified program of undergraduate studies that will serve as an effective foundation for creative participation in most areas of engineering, especially those associated with newly evolving technologies. All engineering students follow a common curriculum through the sophomore year, followed by specialization in the junior and senior years in such areas as:

- Electrical Engineering, with applications in electronics, electrical circuitry, networks, radar, instrumentation, and computers;
- Industrial and Systems Engineering, with applications in operations research, industrial management, and man-machine systems;
- Fluid and Thermal Engineering, with applications in aerodynamics, refrigeration and heat exchange systems, air and water pollution control, propulsion, and hydraulics;
- Engineering Mechanics, with applications to orbits and trajectories of space craft and missiles, industrial machinery, materials, and such diverse engineering structural systems as bridges, aircraft, and satellites.

Degrees and Programs

The Division of Engineering offers programs leading to the degrees of Bachelor of Science in Engineering and Master of Science in Engineering.

When desirable, as evidenced from continuous studies, the Division of Engineering may modify its curricula and specific courses of instruction, alter the requirements for admission or for graduation, and change the degrees to be awarded. Such changes will be applicable to both prospective and matriculated students.

COURSE NUMBERS

The course numbering system of UAH has been coded additionally for engineering courses so that the second digit indicates the engineering discipline.
Undergraduate Program

A student may be awarded the degree of Bachelor of Science in Engineering upon successful completion of all requirements, including a total of 136 semester hours of course work. Each student in the Division of Engineering must assume the responsibility for registering for all required courses in their proper sequence and for fulfilling all requirements for admission and graduation. Failure to do so may extend the time required for graduation.

REQUIREMENTS FOR AN ENGINEERING CLUSTER

Students in other divisions may develop a cluster in engineering. A minimum of 21 semester hours of engineering courses is required. A typical selection would include: EG 200, 241, 262, 271, 303, 313, and 320. Other sequences may be developed to meet the requirements of individual needs.

BACHELOR OF SCIENCE IN ENGINEERING DEGREE PROGRAM

Freshman Year (32 Semester Hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 121, 122, 126</td>
<td>Chemistry</td>
</tr>
<tr>
<td>EH 101, 102</td>
<td>English Composition</td>
</tr>
<tr>
<td>MA 125, 149, 150</td>
<td>Calculus and Analytic Geometry</td>
</tr>
<tr>
<td>PH 205, 206</td>
<td>Technical Physics</td>
</tr>
<tr>
<td>EG 198</td>
<td>Engineering Graphics</td>
</tr>
<tr>
<td>EC 142</td>
<td>Principles of Economics</td>
</tr>
<tr>
<td>EG 195</td>
<td>Freshman Seminar</td>
</tr>
</tbody>
</table>

Sophomore - Junior - Senior Years: (104 Semester Hours)

A. CORE PROGRAM (66 SEMESTER HOURS)

ENGLISH:

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EH 205, 206, 240, or 241</td>
<td>Literature Survey</td>
</tr>
</tbody>
</table>

MATHEMATICS:

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 251</td>
<td>Calculus and Analytic Geometry</td>
</tr>
<tr>
<td>MA 353</td>
<td>Applied Differential Equations</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>PH 207</td>
<td>Technical Physics</td>
</tr>
<tr>
<td>PH 252</td>
<td>Modern Physics</td>
</tr>
<tr>
<td>EG 292</td>
<td>Advanced Engineering Analysis I</td>
</tr>
<tr>
<td>EG 297</td>
<td>Introduction to Digital Computations</td>
</tr>
<tr>
<td>EG 393</td>
<td>Advanced Engineering Analysis II</td>
</tr>
<tr>
<td>EG 200</td>
<td>Fields and Circuits I</td>
</tr>
<tr>
<td>EG 303</td>
<td>Electrical Circuits Lab I</td>
</tr>
<tr>
<td>EG 312</td>
<td>Operational Methods in Engineering</td>
</tr>
<tr>
<td>EG 313</td>
<td>Electrical Circuits II</td>
</tr>
<tr>
<td>EG 320</td>
<td>Industrial Management</td>
</tr>
<tr>
<td>EG 390</td>
<td>Probability and Engineering Statistics</td>
</tr>
<tr>
<td>EG 241</td>
<td>Thermodynamics I</td>
</tr>
<tr>
<td>EG 341</td>
<td>Introduction to Fluid Mechanics</td>
</tr>
<tr>
<td>EG 343</td>
<td>Heat Transfer</td>
</tr>
<tr>
<td>EG 262</td>
<td>Dynamics</td>
</tr>
<tr>
<td>EG 271</td>
<td>Statics</td>
</tr>
<tr>
<td>EG 273</td>
<td>Mechanics of Deformable Bodies</td>
</tr>
<tr>
<td>EG 294</td>
<td>Nature and Properties of Materials</td>
</tr>
<tr>
<td>EG 460</td>
<td>Linear Systems</td>
</tr>
</tbody>
</table>

**B. PROFESSIONAL SPECIALIZATION**

Students are required to take 15 semester hours within one of the four engineering disciplines or, with the approval of the Director of the Division of Engineering, devise other meaningful engineering programs of specialization.
ELECTRICAL ENGINEERING:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG 305</td>
<td>Electronics Lab I</td>
<td>1</td>
</tr>
<tr>
<td>EG 315</td>
<td>Electronics I</td>
<td>3</td>
</tr>
<tr>
<td>EG 404</td>
<td>Electrical Circuits Lab II</td>
<td>1</td>
</tr>
<tr>
<td>EG 406</td>
<td>Electronics Lab II</td>
<td>1</td>
</tr>
<tr>
<td>EG 414</td>
<td>Electrical Circuits III</td>
<td>3</td>
</tr>
<tr>
<td>EG 416</td>
<td>Electronics II</td>
<td>3</td>
</tr>
<tr>
<td>EG 417</td>
<td>Field Theory II</td>
<td>3</td>
</tr>
</tbody>
</table>

INDUSTRIAL AND SYSTEMS ENGINEERING:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG 321</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>EG 421</td>
<td>Engineering Statistics II</td>
<td>3</td>
</tr>
<tr>
<td>EG 427</td>
<td>Management Systems Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EG 524</td>
<td>Introduction to Human Factors Engineer</td>
<td>3</td>
</tr>
<tr>
<td>EG 525</td>
<td>Operations Research I</td>
<td>3</td>
</tr>
</tbody>
</table>

FLUID AND THERMAL ENGINEERING:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG 342</td>
<td>Thermodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>EG 358</td>
<td>Fluid-Thermal Laboratory I</td>
<td>2</td>
</tr>
<tr>
<td>EG 441</td>
<td>Thermo-Fluid Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>EG 442</td>
<td>Thermo-Fluid Mechanics II</td>
<td>3</td>
</tr>
<tr>
<td>EG 458</td>
<td>Fluid-Thermal Laboratory II</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Elective in Fluid and Thermal Engine</td>
<td>3</td>
</tr>
</tbody>
</table>

ENGINEERING MECHANICS:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG 441</td>
<td>Thermo-Fluid Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>EG 463</td>
<td>Applied Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EG 470</td>
<td>Intermediate Mechanics of Solids and Structures</td>
<td>3</td>
</tr>
<tr>
<td>EG 492</td>
<td>Methods and Applications in Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>EG 561</td>
<td>Vibrations of Elastic Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

C. APPROVED TECHNICAL ELECTIVES

Selection of 6 semester hours of technical electives should be made with the assistance of an engineering counselor and should complement but not be in the area of the professional specialization chosen and should clearly support the student's aims and goals. Such elective courses must be numbered 300 or above and have the approval of the Director of the Division of Engineering.
D. ELECTIVES IN HUMANISTIC-SOCIAL STUDIES

Engineering students are required to take 6 semester hours of courses in the humanities: art, literature, history, music, or philosophy, and 6 semester hours of courses in the social sciences: sociology, psychology, political science, geography, or economics.

E. FREE ELECTIVES

In general, for 5 semester hours of free elective credit, the student may choose any course offered by UAH in which the subject matter does not duplicate the same or a lower level of courses in his program.

Graduate Study

The Division of Engineering offers programs leading to the degree of Master of Science in Engineering with specializations in the following areas:

- Electromagnetic Fields
- Network Theory
- Communications and Information Theory
- Digital and Analog Computer Engineering
- Control Sciences
- Human Factors Engineering
- Management Control Sciences
- Operations Research
- Heat and Mass Transfer
- Thermodynamics
- Fluid Mechanics
- Aerodynamics
- Solid Mechanics
- Dynamics and Vibrations

Graduate work in the Division of Engineering is administered jointly by the Graduate School and the Division of Engineering. Applicants desiring to pursue graduate work in engineering should apply for admission to the UAH Graduate Office.

For admission to graduate study in the Division of Engineering, a student is required (1) to have earned a "B" average (2.0 out of a possible 3.0) in all undergraduate work attempted as well as in all engineering courses attempted, (2) to have scored at least 1000 on the aptitude portion of the GRE, and (3) to have received a baccalaureate degree in a curriculum which was accredited by the Engineers' Council for Professional Development at the time the degree was conferred.

Conditional admission may be granted to (1) a student with a bachelors degree from an ECPD-accredited curriculum and a quality point average of between 1.5 and 2.0 in all undergraduate work attempted as well as in all engineering courses attempted, or (2) to other students who have baccalaureate degrees and who are cot-
considered, after an individual examination of quantity and quality of their work, to be properly prepared and capable of successfully pursuing graduate work toward an acceptable graduate objective. Students admitted conditionally are required to maintain a “B” average on their first twelve semester hours of graduate course work (and to remove any other conditions imposed at the time of initial enrollment) in order to be allowed to continue graduate study.

Applicants for admission to graduate study in engineering are required to take the Advanced Engineering portion of the GRE, the results of which will be considered in determining the qualification of the student to pursue successfully a program of graduate study.

A student who is admitted to the University as an Irregular Post Graduate but who has been denied admission to the Graduate School because of his deficiency in quality point average (QPA) and/or GRE score may be reconsidered for graduate admission provided he is otherwise eligible to pursue a particular engineering discipline. In order to be reconsidered he must successfully complete 12 hours of courses numbered 500 or above in engineering, mathematics, physics, or chemistry with a QPA exceeding 2.00 on the work undertaken.

Upon admission to graduate study by the Dean of the Graduate School, the student will be referred to the appropriate discipline chairman. A supervisory committee, which usually is, but does not have to be, the same as the examining committee usually is appointed after the student has completed 12 semester hours.

General Requirements For The Master’s Degree

The degree of Master of Science in Engineering is conferred on those students who satisfy the requirements of the Division of Engineering, and the Graduate School under Plan 1.

Course requirements (in addition to those established by the Graduate School) are:

(1) Average grade on the courses numbered 600 or 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.

(3) Each graduate student, during the first 12 semester hours of his program, will be required to register for Graduate Seminar I, EG 695, and, during a term in which he is actively pursu-
ing thesis study, to register for Graduate Seminar II, EG 795. A total credit of one semester hour in these courses may be applied toward graduation requirements.

(4) All courses are selected by the student with the counsel of his adviser and are subject to approval by the appropriate discipline chairman, the Division Director, and the Graduate School. Additional course work may be required to correct deficiencies in undergraduate subjects.

Special Requirements for the MSE Degree

A minimum of 12 semester hours and a thesis must be satisfactorily completed under the direction of the full-time graduate engineering faculty. Under special circumstances, a part-time faculty member may be appointed as thesis advisor by the Division Director. Each student must satisfactorily complete the following additional minimum requirements:

(a) 6 hours of graduate level courses (600 or above) in the primary engineering discipline.

(b) 6 hours of courses in a second approved engineering discipline, physics, or chemistry.

(c) 6 hours of approved electives. These electives will be chosen in support of the primary area of specialization.

(d) 6 hours of mathematics.

(e) An acceptable thesis.

Engineering (EG)

090. GENERAL ENGINEERING REVIEW. No credit.
A refresher course designed to re-acquaint students with the technical portion of the first two to three years of the basic engineering curriculum. Covers mathematics through calculus, physics, chemistry, electricity, thermodynamics, statics, kinetics, strength of materials, fluids mechanics, and engineering economics. Prepares students for EIT and GRE tests.

091. DIGITAL COMPUTER FUNDAMENTALS I. No credit.
Computer elements; programming; number systems and codes; Boolean Algebra; simplification techniques; counters and registers.

092. DIGITAL COMPUTER FUNDAMENTALS II. No credit.
Minimization techniques; analysis and synthesis of sequential logic circuits; examples of digital circuit design with application to computers. Prerequisite: EG 091 or approval of instructor.

093. PATENT LAW FOR ENGINEERS AND SCIENTISTS. No credit.
A study of patents and the legal protection of inventions, from the viewpoint of the inventor, including rights conferred by patent, requisite for patentability, prosecution of application, interference proceedings, infringement, trade secrets, relative rights of employees and employers, including contracts, shopright, comparison of proprietary rights including design patents, copyrights and trademarks.

129
097. ENGINEERING DRAWING. No credit.
Instruction and practice in the graphical representation of objects, using both mechanical and freehand techniques, with emphasis on the principles involved and their use in design. Topics include: isometric and oblique pictorial views; multiview projection on principal and auxiliary planes; dimensioning; fits and tolerances; detail and assembly working drawings. Prerequisite or parallel: MA 125 or evidence of previous instruction in mechanical drawing.

195. FRESHMAN SEMINAR. No credit.
Required of all Freshmen.

197. INDUSTRIAL ILLUSTRATION. 2 hrs.
Deals with technical illustrations, problems, and techniques for engineering communication and pictorial representation. Problems involving lettering, layouts, shading, pictorial views, exploded views, cut away sections, freehand sketching, auxiliaries, rendering and advertising layout, and perspective. (Credit not applicable toward engineering degree.)

198. ENGINEERING GRAPHICS. 2 hrs.
The graphical solution of problems involving the location and relationship of points, lines, planes, and surfaces of revolution by the Mongean and direct methods. Prerequisite: EG 097 or placement test.

200. FIELDS AND CIRCUITS I. 5 hrs.
A study of electrostatic magnetostatic fields; basic electric and magnetic circuit concepts; classical solutions of the integro-differential equations of simple circuits with lumped parameters, and introduction to sinusoidal steady-state analysis. Prerequisite: PH 207. Prerequisite or parallel: EG 292, MA 353.

241. THERMODYNAMICS I. 3 hrs.

262. DYNAMICS. 3 hrs.
A study of the kinematics of particles, lines, and bodies and kinetics of particles and of rigid bodies with translation, rotation, and plane motion using the method of force-mass-acceleration, work-energy, and impulse-momentum. Prerequisite: EG 271, MA 251.

271. STATICS. 3 hrs.
A study of forces and couples and the resultants of force systems, free-body-diagrams, equilibrium, problems involving friction centroids and moments of inertia. Prerequisite: PH 205. Prerequisite or parallel: MA 251.

273. MECHANICS OF DEFORMABLE BODIES. 3 hrs.
A study of the kinematics and dynamics of continuous media, and mechanical behavior of solids with applications to fundamental problems of extension, torsion, flexure and buckling of bars. Prerequisite: EG 271, MA 251.

292. ADVANCED ENGINEERING ANALYSIS I. 3 hrs.
Introduction to the algebra and geometry of vectors, matrices, vector analysis, vector field theory, and complex variables. Prerequisite: MA 251.

294. NATURE AND PROPERTIES OF MATERIALS. 3 hrs.
An introductory course covering the structure of matter; basic concepts of phase transformations; mechanical electrical, magnetic, and thermal properties; and corrosion. Prerequisite: CH 122, PH 205.

297. INTRODUCTION TO DIGITAL COMPUTATIONS. 3 hrs.
An introduction to problem oriented languages, such as FORTRAN and ALGOL, for describing computational processes. Emphasis will be placed on scientific applications. Practice in solving elementary problems on the University's digital computers is included. Prerequisite: MA 149 or approval of instructor.
303. ELECTRICAL CIRCUITS LAB. I. 1 hr.
Experiments and reports to acquaint the student with basic types of circuit instrumentation and to apply and verify the principles presented in EG 200 and EG 313. Prerequisite or parallel: EG 313.

305. ELECTRONICS LAB. I. 1 hr.
Experiments and reports to acquaint the student with basic types of electronic instrumentation and to apply and verify the principles presented in EG 315. Prerequisite or parallel: EG 315.

312. OPERATIONAL METHODS IN ENGINEERING. 3 hrs.
A study of Fourier and Laplace transforms with emphasis on their physical interpretation and application to problems in electrical and mechanical systems; introduction to system transfer functions. Prerequisite: EG 200, MA 353.

313. ELECTRICAL CIRCUITS II. 3 hrs.
Basic techniques of network analysis; steady-state response of networks to sinusoidal forcing functions; network theorems. Prerequisite: EG 200, MA 353.

315. ELECTRONICS I. 3 hrs.
A study of electronic devices and applicable analysis techniques. Descriptions of solid state and vacuum diodes, triodes, transistors, and multigrid tubes. Graphical and small signal analysis; piecewise linear models. Prerequisite: EG 313.

320. INDUSTRIAL MANAGEMENT. 3 hrs.
A comprehensive introduction to the industrial organization, its structure, environment, functions and systems as well as to industrial engineering, its role and methods.

321. ENGINEERING ECONOMY. 3 hrs.
Deals with economic evaluation of engineering alternatives. Topics include interest, depreciation, time-value of investments, learning curves, and replacement analysis. Prerequisite: EC 142, MA 251.

341. INDUCTION TO FLUID MECHANICS. 3 hrs.
Properties of fluids and the fundamental principles governing fluid motion, including hydrostatics, continuity, conservation of momentum and energy, with applications to one- and two-dimensional flows. Prerequisite: EG 241, 262. Parallel: MA 353.

342. THERMODYNAMICS II. 3 hrs.
Irreversibility, availability, chemical reactions, phase and chemical equilibrium. Basic relationships among properties. Prerequisite: EG 241. Parallel: MA 353.

343. HEAT TRANSFER. 3 hrs.
Study of the basic principles of heat, momentum, and mass transfer; and the application of these principles to problems in conduction, convection and radiation. Prerequisite: EG 241, MA 353.

358. FLUID-THERMAL LABORATORY I. 2 hrs.
Use of technique and instrumentation for determining state and field variables of static and dynamic fluid systems in order to experimentally verify fundamental principles of thermodynamics, fluid mechanics, and transport phenomena. Experiments include determination of thermodynamic and transport properties, verification of gas laws, and the demonstration of conservation principles and similitude. Prerequisite: EG 241. Parallel: EG 341.

390. PROBABILITY AND ENGINEERING STATISTICS 3 hrs.
An introduction to probability theory, hypothesis testing, and one way analysis of variance. Prerequisite or parallel: MA 251.

393. ADVANCED ENGINEERING ANALYSIS II. 3 hrs.
Introduction to the application and solution of partial differential equations. Fourier Analysis, Transform Methods, and Special Function. Prerequisite: MA 353, EG 292.
394. **METEOROLOGY.** 3 hrs.
Factors that govern weather conditions; physical properties and dynamics of the atmosphere; weather forecasting, meteorological factors affecting the design and operation of aircraft; weather research. Prerequisite: Approval of instructor.

404. **ELECTRICAL CIRCUITS LAB. II.** 1 hr.
Experiments, problems, and reports to apply and verify the principles presented in EG 312 and 414. Prerequisite or parallel: EG 414.

406. **ELECTRONICS LAB. II.** 1 hr.
Theory of operation and experiments pertaining to special purpose devices such as the thermistor, tunnel diode, unijunction transistor, photo devices, SCR and thyatron. Also experiments, problems, and reports to apply and verify the principles presented in EG 416. Prerequisite or parallel: EG 416.

411. **ELECTRICAL MACHINERY I.** 3 hrs.
Energy storage and transfer in linear coupled systems; introduction to elementary transducers and rotating machines. Prerequisite: EG 262. Prerequisite or parallel: EG 414.

414. **ELECTRICAL CIRCUITS III.** 3 hrs.
Driving point and transfer functions, frequency response of networks; Bode plots; introduction to filter theory. Prerequisite: EG 297, 303, 312, 313.

416. **ELECTRONICS II.** 3 hrs.
Multistage active circuits; impulse and step function response; frequency response; tuned-coupled stages, feedback and oscillators, switching circuits. Prerequisite: EG 305, 315, 414.

417. **FIELD THEORY II.** 3 hrs.
A study of time varying fields and Maxwell's equation, boundary value problems, the high frequency circuit element, radiation and propagation of electromagnetic waves; introduction to guided waves. Prerequisite or parallel: EG 414.

418. **TRANSISTOR CIRCUITS.** 3 hrs.
Characteristics and equivalent circuit representations of semiconductor devices. Applications of equivalent circuits in the analysis of various transistor applications. Prerequisite: EG 315.

421. **ENGINEERING STATISTICS II.** 3 hrs.
A continuation of EG 390 with emphasis on analysis of variance, regression analysis, correlation, and non-parametric statistics. Prerequisite: EG 390.

427. **MANAGEMENT SYSTEMS ANALYSIS.** 3 hrs.
A systems approach to the study of formal organizations. Presents analytical techniques for making decisions about organizational design. Prerequisite: EG 421.

440. **PHYSICAL PROPERTIES OF FLUIDS.** 3 hrs.
Development and study of theoretical, experimental, and correlation methods for determining and predicting the thermodynamic and transport properties of various fluids. Topics include: critical properties, equations of state; vapor pressure and latent heat, heat capacity; viscosity, thermal conductivity, diffusion coefficients; phase equilibrium; heat and free energy of formation. Prerequisite: EG 341.

441. **THERMO-FLUID MECHANICS I.** 3 hrs.
Study of the physical laws of mass, momentum and energy conservation as applied to compressible and incompressible fluid flows. Emphasis is placed upon those flows in which molecular transport effects may be neglected. Topics include streamfunctions, vorticity, potential flow, adiabatic and isothermal flows, and wave phenomena. Prerequisite: EG 292, 341.
442. THERMO-FLUID MECHANICS II. 3 hrs.
Continuation of EG 441 with emphasis placed upon the study of fluid flows and processes in which molecular transport effects due to viscosity, thermal conductivity, and mass diffusivity are important. Topics include the constitutive equations for Newtonian and non-Newtonian fluids, the Navier-Stokes equations, heat transfer, diffusion, concepts of stability of laminar flows, and an introduction to turbulence. Prerequisite: EG 343, 441.

443. APPLIED HEAT TRANSFER. 3 hrs.
The fundamental principles of thermodynamics and heat transfer are applied to the design of processes involving the transfer of energy by conduction, convection, and radiation. Typical applications include: heat exchangers, thermal and humidity control of spacecraft, and thermal protection systems for reentry vehicles. Prerequisite: EG 343, 441.

444. APPLIED MASS TRANSFER. 3 hrs.
Introduction to the design and analysis of processes and equipment in which mass transfer between phases is the primary objective. Typical operations include: gas absorption, fractional distillation, and liquid-liquid extraction. Typical applications include: chemical and related processes, spacecraft environmental control, and electrochemical processes. Prerequisite: EG 341.

445. APPLIED AERODYNAMICS AND PROPULSION. 3 hrs.
Applications of concepts and principles from fluid mechanics, thermodynamics, statics, and dynamics to the determination of the forces acting on engines and aircraft within the atmosphere, and to the resulting performance under non-oscillatory conditions. Prerequisite: EG 441.

446. APPLIED MECHANICS OF INTERNAL FLOWS. 3 hrs.
Applications of principles of mass, momentum, and energy conservation to the flow of incompressible and compressible fluids in pipes and channels, including wave propagation, and fluid amplification; flow through porous media; film lubrication. Prerequisite: EG 441.

458. FLUID-THERMAL LABORATORY II. 1 hr.
Continuation of EG 358, dealing with more sophisticated techniques and instrumentation, applied to more complex phenomena. Completion of student conceived experiments or project is an essential part of this course. Prerequisite: EG 358. Parallel: EG 441.

460. LINEAR SYSTEMS. 3 hrs.
Study of free and forced vibrations both undamped and damped. Systems with many degrees of freedom formulated and analyzed with matrix methods. Laplace transforms are used to study transient vibrations. Prerequisite: EG 262, 273, 393.

463. APPLIED DYNAMICS. 3 hrs.
Applications of the principles of dynamics to various fields of engineering. Prerequisite: EG 262.

470. INTERMEDIATE MECHANICS OF SOLIDS AND STRUCTURES. 3 hrs.
Fundamentals of solid mechanics with applications to structures. Including inelastic behavior, theory of bars and plates, and stability. Prerequisite: EG 492.

492. METHODS AND APPLICATIONS IN MECHANICS. 3 hrs.
Application of vector analysis, tensor calculus, integral transforms, and other mathematical methods. Prerequisite: EG 262, 273, 393.

496. SELECTED TOPICS IN ENGINEERING.

502. INTRODUCTION TO THE THEORY AND DESIGN OF SWITCHING CIRCUITS. 3 hrs.
Boolean algebra; minimization techniques; number systems and codes; analysis and synthesis of combinational and sequential logic circuits; electronic logic implementations and memory devices; static and dynamic hazards in logic circuits. Prerequisite: EG 416 or approval of instructor.
505. AUTOMATIC CONTROL THEORY. 3 hrs.  
An introduction to the theory common to all feedback control systems.  
Topics include transfer functions, stability criteria, and frequency response.  
Prerequisite: EG 414 or approval of instructor.

506. COMMUNICATION THEORY. 3 hrs.  
The transmission of information, including the effects of networks, modulation systems, noise, and the use of statistics in the analysis of information transmission.  
Prerequisite: EG 414 or approval of instructor.

507. ANTENNAS. 3 hrs.  
Radiation from point sources. Calculation of cylindrical antenna radiation resistance, self-impedance, and radiation characteristic. Study of properties of the loop, helical, biconical, and reflector types of antennas. Prerequisite: EG 417.

508. ULTRA HIGH FREQUENCY ENGINEERING. 3 hrs.  
A study of high frequency transmission line charts, negative-grid triode oscillators and amplifiers at high frequencies, klystron oscillators, magnetron oscillators, rectangular wave-guides and radiating elements. Prerequisite: EG 416, 417.

516. ADVANCED ELECTRONICS. 3 hrs.  
Non-sinusoidal generating and wave shaping circuits, timing circuits, comparators, clipping and clamping networks, multivibrators. Prerequisite: EG 406, 416.

517. PHYSICAL ELECTRONICS. 3 hrs.  
Application of quantum and statistical mechanics to the development of models of electronic devices. Electromagnetic properties of materials including semiconductors. Prerequisite: MA 353, PH 253. Prerequisite or parallel: EG 416.

518. FIELDS AND TRANSMISSION LINES. 3 hrs.  
Transmission of information and power by means of transmission lines, waveguides, and free space; determination of line parameters; fields in waveguides; antennas and wave propagation. Prerequisite: EG 417.

523. STATISTICAL QUALITY CONTROL. 3 hrs.  
A study of statistical theory and techniques used to control the quality of manufactured products. Prerequisite: EG 421.

524. INTRODUCTION TO HUMAN FACTORS ENGINEERING. 3 hrs.  
An introduction to the philosophy, methodology, and techniques of human engineering as related to the optimum design and analysis of man-machine systems. Prerequisite: PY 100, EG 421.

525. OPERATIONS RESEARCH I. 3 hrs.  
An introduction to the philosophy and methodology of operations research. Emphasis is placed upon the development of mathematical models and their use in the optimization of complex systems. Prerequisite: EG 390.

527. DIGITAL SIMULATION. 3 hrs.  
Methods and Procedures for digital computer simulation of complex systems. Both discrete increment and continuous time models are considered. Prerequisite: EG 297, 525.

541. ADVANCED FLUID MECHANICS. 3 hrs.  
(Graduate credit not applicable toward degree requirements for students specializing in any area of Fluid and Thermal Engineering.) Development and use of the integral and differential forms of the equations of continuity, momentum, and energy to ideal fluids, viscous fluids, and compressible fluids. The derivations of thermodynamics equations. Applications to one-, two-, and three-dimensional problems. Prerequisite: EG 441.
545. **GASDYNAMICS.** 3 hrs.
Review of the equations of mass, momentum and energy conservation and the equations of state for ideal and real gases. Topics include normal and oblique shock waves, Prandtl-Meyer fans, acoustic waves, isentropic, isothermal, and general diabatic flows, Fanno and Rayleigh lines, Laval nozzles, exact solutions for flow over wedges and cones, and approximate methods. Prerequisite: EG 441 or 541.

560. **INTERMEDIATE DYNAMICS.** 3 hrs.
Newtonian and Lagrangian methods applied to particles, rigid bodies, and other mechanical systems. Prerequisite: EG 262.

561. **VIBRATIONS OF ELASTIC SYSTEMS.** 3 hrs.
Dynamic response of mechanical systems: transient, oscillatory, and wave motions, flutter, and stability. Prerequisite: EG 460.

568. **DYNAMICS OF FLIGHT.** 3 hrs.
Introduction to the dynamics of flight vehicles. Equations for static and dynamic equilibrium are analyzed and the criteria for stability, controllability, and maneuverability are discussed. Fundamentals of stress and mathematical models using linear differential equations are emphasized. Prerequisite: EG 262, 393.

570. **MECHANICAL BEHAVIOR OF ENGINEERING MATERIALS.** 3 hrs.
A study of the structure, properties and behavior of materials. Particular topics are structural defects and their influence on mechanical properties, point defects, dislocations and lattice imperfections in crystals, plastic deformation of single crystal and polycrystalline alloys, strengthening mechanisms and fracture. Strain rate, time to failure and cyclic life are treated from a microscopic viewpoint. Prerequisite: EG 273, 284, PH 253.

571. **APPLIED MECHANICS OF SOLIDS.** 3 hrs.
Analysis of stresses and strains at a point, the theories of failures, stress concentration factors, thick-walled cylinders, torsion of non-circular members, curved beams, unsymmetrical bending, and shear center. Prerequisite: EG 273.

572. **MATRIX METHODS IN STRUCTURAL MECHANICS.** 3 hrs.
Applications of matrices to the formulation and solution of linear problems in structural mechanics. Analyses of stresses, vibrations and stability of engineering structures. Prerequisite: EG 470.

591. **DIGITAL COMPUTERS AND MACHINE-LANGUAGE PROGRAMMING.** 3 hrs.
Introduction to machine-code programming. Representation of numeric and non-numeric data. Machine arithmetic. Discussion of various ways of organizing machines. Prerequisite: EG 297 or approval of instructor.

601. **TRANSIENTS IN LINEAR SYSTEMS.** 3 hrs.
Formulation and solution by transform methods of the differential equations of linear electrical and mechanical systems. Prerequisite: EG 414.

602. **DIGITAL COMPUTER DESIGN.** 3 hrs.
Digital arithmetic; design of combinational and sequential logic circuits; adders, multipliers, switching matrices, shift registers, counters, comparators. Design of a simple digital computer. Prerequisite: EG 502.

603. **ANALOG COMPUTER TECHNIQUES.** 3 hrs.
Applications of an analog computer to the solution of engineering problems involving linear and non-linear differential equations such as are encountered in vibration analysis, flow problems, automatic control theory, electrical circuit theory, and similar topics. Includes laboratory. Prerequisite: MA 353, EG 312, or 601, and graduate standing or approval of instructor.

604. **INSTRUMENTATION.** 3 hrs.
A study of measurement techniques and conventional and electronic instruments. The construction, theory of operation, and proper use of bridge circuits, voltmeters, ammeters, oscilloscopes, transducers, etc. Prerequisites: EG 315.
605. CONTROL SYSTEM DESIGN. 3 hrs.
Compensation of d-c and a-c control systems by means of feedback, feed­forward, minor loop and cascade techniques. Study of control system com­ponents. Laboratory sessions. Prerequisite: EG 505 or equivalent.

606. STATISTICAL COMMUNICATION THEORY. 3 hrs.
Introduction to generalized harmonic analysis. Includes correlation, convolu­tion, power density spectra, etc. Probability and statistics. Correlation de­tection. Optimum linear filtering and prediction. Prerequisite: EG 506.

607. INFORMATION THEORY. 3 hrs.
Introduction to self-information, entropy, mutual information, and channel capacity. Noiseless encoding and error detecting and correcting codes. Sampling theorem. Continuous channels. Prerequisite: EG 606.

608. ELECTROMAGNETIC FIELD THEORY I. 3 hrs.

609. ELECTROMAGNETIC FIELD THEORY II. 3 hrs.
A continuation of EG 608. Prerequisite: EG 608.

610. SELECTED TOPICS IN ELECTRICAL ENGINEERING.

611. ANTENNA THEORY I. 3 hrs.
The study of antennas and antenna arrays. Radiation patterns and impedance characteristics. Analysis of spheres, cylinders, horns, slots, microwave lenses, traveling-wave, and frequency independent antennas. Prerequisite: EG 609.

612. ANTENNA THEORY II. 3 hrs.
A continuation of EG 611. Prerequisite: EG 611.

614. NETWORK ANALYSIS. 3 hrs.
The analysis of networks using matrix algebra, network topology, and transform methods. Network theorems, filters, and introduction to flow graphs. Prerequisite: EG 414.

615. NETWORK SYNTHESIS. 3 hrs.
Methods of Bott-Duffin, Brune, Cauer, Darlington, Foster, etc. studied. Filter synthesis with Butterworth and Tschebycheff functions. Realizability of net­works. Prerequisite: EG 614.

617. SOLID STATE ELECTRONICS. 3 hrs.
Introduction to solid state theory as pertaining to solid state devices, their design and application in electronic circuits. Prerequisite: EG 517.

618. MICROWAVE TECHNIQUES. 3 hrs.

619. ADVANCED LINEAR CONTROL THEORY. 3 hrs.
Modern techniques for the analysis and design of linear control systems. Matrix formulation, multivariable control systems, state variable concepts. Linear transformations, optimization, statistical design methods, sampled data theory. Prerequisite: EG 605.

620. CONCEPTS OF MANAGEMENT. 3 hrs.
A study of the executive process in cooperative systems. Emphasis upon the leadership role, authority, status, and decision making.

621. STATISTICAL METHODS FOR ENGINEERS. 3 hrs.
Designed to introduce graduate students to the applications of probability and statistics useful in research work. Includes descriptive statistics, the­oretical distribution functions, point and interval estimation, tests of hypothe­ses, linear regression, and analysis of variance. Not open to students who have taken EG 390 or 421. Prerequisite: MA 251 and graduate standing.
624. ADVANCED HUMAN FACTORS ENGINEERING. 3 hrs.
Design, analyses and evaluation of man-machine systems. Included are considerations of work space, environment, anthropometrics and simulation as related to optimization of man-system performance. Prerequisite: EG 524.

625. OPERATIONS RESEARCH II. 3 hrs.
Continuation of EG 525 with the introduction of additional optimization techniques and models. Prerequisite: EG 525.

626. DESIGN AND ANALYSIS OF EXPERIMENTS. 3 hrs.
Covers advanced topics in statistical experiments with emphasis on the design aspects. Topics include confounding, fractional replication, factorial and nested designs. Prerequisite: EG 421 or 621.

627. INTRODUCTION TO SYSTEMS ENGINEERING. 3 hrs.
The analysis and design of special purpose operational, procedural and hardware systems. General theories for the analysis of complex systems from both the Macro- and Micro-viewpoints will be considered. Prerequisite: EG 505, 506, or 525.

628. INDUSTRIAL ORGANIZATIONS. 3 hrs.
Deals with the organizational and human relations aspects of industrial management. Formal and informal organizations, motivation of employees, social behavior in the work situation and executive management functions as they influence the design and implementation of management control systems. Prerequisite: EG 620.

630. INFORMATION AND DATA PROCESSING. 3 hrs.
Introduction to the design of integrated control systems necessary for effective management. Includes the methods of systems design, the basic concepts of computer processing systems, the design of management control procedures and reports, and their application to mechanized and electronic data processing equipment. Prerequisite: EG 297.

631. ENGINEERING RELIABILITY. 3 hrs.
The methodology of reliability prediction including application of discrete and continuous distribution models; reliability estimation; reliability logic diagrams; life testing; and reliability demonstration. Prerequisite: EG 421.

632. STOCHASTIC SYSTEMS. 3 hrs.
Analysis of processes whose outputs are governed by probabilistic laws. Included are Gaussian processes, processes with correlated and uncorrelated variables, Markov processes, and others. Prerequisite: EG 421, 525.

634. VALUE AND DECISION THEORY. 3 hrs.
A mathematical development of the 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 the value of additional information. Prerequisite: EG 525.

635. LINEAR PROGRAMMING. 3 hrs.
The application of linear programming to complex allocation problems. Methods for determining the maximum or minimum or objective functions whose variables are subject to constraints. Topics include simplex method, degeneracy, modified simplex, transportation problems, network flows, and sensitivity analysis. Prerequisite: EG 525.

637. DYNAMIC PROGRAMMING. 3 hrs.
Dynamic programming developed in contrast to more general digital optimization. Search methods such as Fibonacci, grid, gradient will be covered. Prerequisite: EG 297, 525.

639. SELECTED TOPICS IN INDUSTRIAL & SYSTEMS ENGINEERING.

640. COMPRESSIBLE FLUID FLOW. 3 hrs.
A unified treatment of subsonic, transonic and supersonic flows. Included are compressible potential flows: elliptic, parabolic, and hyperbolic equations; characteristics, perturbation theory, similarity rules and hodograph methods. Prerequisite: EG 545.
641. FUNDAMENTALS OF THERMODYNAMICS I. 3 hrs.
Properties of thermodynamic systems: reduced equations of state; degenerate gases, equilibrium, third law. Magnetic and electric phenomena. Prerequisite: EG 342.

642. FUNDAMENTALS OF THERMODYNAMICS II. 3 hrs.
A continuation of EG 641. Prerequisite: EG 641.

643. CONVECTION HEAT TRANSFER. 3 hrs.
Analysis of convection problems; boundary layer theory; laminar and turbulent flow. Boiling, condensation. Prerequisite: EG 343, 541.

645. PROPULSION. 3 hrs.
Aerothermodynamics of rocket propulsion systems; rocket propellants and combustion; heat transfer and cooling problems. Application to ramjets and hybrid systems. Prerequisite: EG 545.

646. HYDRODYNAMICS. 3 hrs.
Study of potential flow in two and three dimensions, Eulerian and Lagrangian formulations, potential and stream functions, vorticity; Laplace's equation, singularities and distributions of singularities, complex potential, conformal mapping. Prerequisite: EG 541 and a course in vector calculus.

647. RADIATION HEAT TRANSFER. 3 hrs.

648. HEAT CONDUCTION IN SOLIDS. 3 hrs.

649. TRANSPORT PHENOMENA. 3 hrs.
Mass, energy, and momentum transport in steady and transient motions in real and rheological substances. Prerequisite: EG 343 or 441 or approval of instructor.

650. CRYOGENICS. 3 hrs.
Study of the thermodynamics of low pressure and low temperature systems: measuring devices, materials, and techniques of handling low temperature, low pressure systems. Prerequisite: EG 342.

651. DIRECT CONVERSION OF ENERGY. 3 hrs.
The analysis and study of systems for the direct conversion of heat to electricity including thermionic, magneto-hydrodynamic, fuel cells, and semiconductor devices. Prerequisite: Approval of Division.

658. DIMENSIONAL ANALYSIS. 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: MA 353.

659. SELECTED TOPICS IN FLUID AND THERMAL ENGINEERING.

660. THEORY OF VIBRATIONS. 3 hrs.

661. ADVANCED DYNAMICS. 3 hrs.
Special theory of relativity, Hamilton's equations, canonical transformations, Hamilton-Jacobi theory. Lagrangian and Hamiltonian formulation for continuous systems. Prerequisite: EG 560, 692.
663. ASTRODYNAMICS. 3 hrs.
Introduction to astronomical coordinates and time systems; the many-body problems and disturbing functions. Study of general perturbation theories, special perturbation methods and application of classical mechanics and Hamilton-Jacobi method to orbital mechanics. Prerequisite: EG 560.

664. SPACE TRAJECTORIES AND GUIDANCE. 3 hrs.
Study of trajectories and missions for space flight, optimal orbit transfer by velocity impulses and powered-flight guidance. Fundamental theories of celestial navigation and interplanetary guidance. Prerequisite: EG 560.

665. AEROELASTICITY. 3 hrs.
Deformation of aircraft structures under static and dynamic loads. The effects of the air loads developed by incompressible flow on static aeroelastic phenomena and flutter are analyzed. Prerequisite: EG 541, 560.

671. MECHANICS OF DEFORMABLE SOLIDS. 3 hrs.
The fundamentals of solid mechanics with applications to important structural problems. Topics include: the concepts and analysis of strain and stress, the constitutive equations of elastic, plastic, and viscoelastic materials, energy and stability concepts and applications to beams and plane problems. Prerequisite: EG 273, 692.

672. REVIEW OF FUNDAMENTALS. 3 hrs.
Formulation of the boundary-value problem of classical elasticity. Application to plane problems, prismatic members and axisymmetric problems. Prerequisite: EG 671.

673. MECHANICS OF CONTINUOUS MEDIA. 3 hrs.
A study of the mechanics of continuous media. Kinematics, dynamics and thermodynamics are developed in generality. Constitutive equations of solids and fluids are formulated and applied to specific problems. Prerequisite: EG 541 or 671.

674. ENERGY PRINCIPLES AND VARIATIONAL METHODS. 3 hrs.
Concept of virtual displacements, principle of minimum potential energy, Castigliano's theorem, Hamilton's principle, and Lagrange's equations. Applications in stress analysis, elastic stability, and dynamics. Prerequisites: EG 671.

675. PHOTOELASTICITY. 3 hrs.

676. INELASTIC BEHAVIOR OF MATERIALS AND STRUCTURES. 3 hrs.
An introduction to the theory of constitutive equations with applications in classical viscoelasticity, thermoeasticity, 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: EG 671.

677. EXPERIMENTAL STRESS ANALYSIS. 3 hrs.
Experimental methods (not including photoelasticity) used 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: EG 571.

678. MECHANICS OF FLEXIBLE BODIES. 3 hrs.
A study of the approximate theories and problems of thin bodies. Theories and solutions for plates and curved rods; effects of transverse shear, large deflections and buckling. Prerequisite: EG 671.
679. LINEAR ANALYSIS OF SHELLS. 3 hrs.
Elastic membrane and bending theory of shells. Solutions for cylindrical,
spherical, conical, and other types of shells by analytical and numerical
methods. Prerequisite: EG 671.

680. SELECTED TOPICS IN ENGINEERING MECHANICS.

692. GRADUATE ENGINEERING ANALYSIS I. 3 hrs.
Introduction to the algebra and geometry of vectors, matrices, vector
analysis, vector field theory, and tensor analysis. Not open to students
who have taken EG 292 and 393. Prerequisite: MA 353.

693. GRADUATE ENGINEERING ANALYSIS II. 3 hrs.
Introduction to Fourier series and Laplace transforms, solution of partial
differential equations by separation of variables. Not open to students
who have taken EG 292 and 393. Prerequisite: MA 353.

695. GRADUATE SEMINAR I.
Preparation and presentation of papers on current topics of research and
general interest in engineering. To be taken no later than the term pre­
ceding registration for the 13th hour of the student's program and no earlier
than the term in which the student is registered for the 7th hour of his
graduate program.

697. SYSTEMS PROGRAMMING AND THE THEORY OF FORMAL LANGUAGES I. 3 hrs.
The technique of constructing systems programs: supervisory programs (mon­
itors), input-output systems, interpreters and compilers for procedure-orient­
ed languages. Syntactic analysis and semantic interpretation of formal
languages. Prerequisite: EG 591 or approval of instructor.

698. SYSTEMS PROGRAMMING AND THE THEORY OF FORMAL LANGUAGES II. 3 hrs.
A continuation of EG 697. Prerequisite: EG 697.

700. SAMPLED DATA CONTROL SYSTEMS. 3 hrs.
Z-transforms, transport lags, z and w plane analysis, finite sampling durations
are among the topics studied. Prerequisite: EG 619.

702. THEORY OF AUTOMATA. 3 hrs.
Unified treatment of finite-state systems. Decomposition theory, group in­
variance, reliability and state assignment. Other models of automata with
applications to coding and programming. Probabilistic automata. Prerequisite:
EG 502.

704. NONLINEAR CONTROL SYSTEMS. 3 hrs.
Classical and modern methods for the analysis and design on nonlinear auto­
matic control system. State variables, phase plane, limit cycles, stability,
describing functions, relay control. Optimal and adaptive control systems.
Prerequisite: EG 619.

705. THEORY OF OPTIMAL CONTROL. 3 hrs.
The general theory of optimal control of dynamic processes. Calculus of
variations, Hamilton-Jacobi theory, Pontryagin's maximum principle, dynamic
programming. Prerequisite: EG 619 or approval of instructor.

706. COMMUNICATION SYSTEMS. 3 hrs.
Analysis of nonlinear communication processes using Hilbert transforms.
Optimum nonlinear and time-varying systems and non-stationary signals.
Phase lock demodulation. Orthogonal multiplexing. Modulation, detection and
series approximation for nonlinear systems. Prerequisite: EG 606.

710. SELECTED TOPICS IN ELECTRICAL ENGINEERING.

715. MICROWAVE FILTER THEORY. 3 hrs.
Microwave filter design. Synthesis of reflection. Coefficient. Tchebyscheff,
Butterworth design. Theory of coupled cavity filters. Prerequisite: EG 609 or
618.
716. PLASMA DYNAMICS I. 3 hrs.
Motion of ions and electrons, Kinetic theory, collisions, ionizations and recombination. BBGKY hierarchy. Interaction of plasma with static and slowly varying fields, gas discharges, instabilities sheath and oscillations. Prerequisite: EG 608 or approval of instructor.

717. PLASMA DYNAMICS II. 3 hrs.

718. ADVANCED TOPICS IN SERVOMECHANISMS. 3 hrs.
Advanced topics in linear, non-linear, sampled data, optimal, etc. control. Prerequisite: Approval of instructor.

719. ADVANCED ELECTROMAGNETIC FIELD THEORY. 3 hrs.
A study in depth of the classical theory of electricity and magnetism. Potential theory, time-varying fields, boundary-value problems, stresses, theory of relativity. Prerequisite: EG 609.

739. SELECTED TOPICS IN INDUSTRIAL AND SYSTEMS ENGINEERING.

741. STATISTICAL THERMODYNAMICS. 3 hrs.

744. HYPERSONIC FLOW THEORY. 3 hrs.
Nonlinear treatment of compressible flow; linearized theory, methods for blunt bodies, best wave theory, numerical methods and hypersonic wind tunnels. Prerequisite: EG 640.

752. MECHANICS OF RAREFIED GASES. 3 hrs.

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: EG 640 or approval of appropriate discipline chairman.

755. THEORY OF FLOW OF VISCOUS FLUIDS I. 3 hrs.
Navier-Stokes equations including several exact solutions and several approximate solutions for both small and large Reynolds numbers. Application to laminar and turbulent flows. Introduction to approximate boundary layer methods. Prerequisite: EG 541.

756. THEORY OF FLOW OF VISCOUS FLUIDS II. 3 hrs.
Theory of convective aerodynamic heating in high speed flow, laminar, and turbulent flows: ablation, transpiration cooling, and mass transfer cooling. Includes aerodynamic heating in hypersonic flow, real gas effects, effect of pressure interactions, vorticity interactions, and heat transfer in rarefied gas flows. Prerequisite: EG 755.

757. TURBULENCE. 3 hrs.
Study of turbulence in gases and liquids; compressive phenomena such as interaction of shocks and boundary layers, and fluid-dynamic heating. Prerequisite: EG 756.

759. SELECTED TOPICS IN FLUID AND THERMAL ENGINEERING.

760. ANALYTICAL METHODS IN NONLINEAR DYNAMICS. 3 hrs.
Development of theory and applications of nonlinear vibration phenomena, transient and steady state response of nonlinear systems. Prerequisite: EG 660, 661.
762. WAVE MOTION OF CONTINUOUS ELASTIC BODIES. 3 hrs.
A study of the dynamics of continuous elastic bodies. The properties of wave motion are considered while studying the motion of an elastic string. Propagation of elastic waves in infinite and semi-infinite bodies, cylinders, rods, and beams. Prerequisite: EG 660.

768. DYNAMICS OF AEROSPACE VEHICLES. 3 hrs.
Advanced problems in aerospace vehicle rigid body dynamics and control are studied. Statistical characteristics of vehicle responses to turbulence, trajectory computations, Euler's equations of motion for spinning vehicles, and other special problems related to satellite stabilization and control are presented. Prerequisite: EG 668.

770. DISCRETE MODELS FOR NONLINEAR CONTINUA. 3 hrs.
Methods for approximating continuous systems by finite systems. Particular attention is given to the finite-element approximation of continuous media. Prerequisite: EG 572, 671.

772. THEORY OF STRUCTURAL STABILITY. 3 hrs.

773. THEORY OF SHELLS. 3 hrs.
The first-approximation theory of thin shells, higher approximations and transverse-shear deformations. This course emphasizes the role of geometrical nonlinearities and current problems of shell instability. Theories are illustrated by selected problems. Prerequisite: EG 678 or 679.

779. SELECTED TOPICS IN ENGINEERING MECHANICS.

795. GRADUATE SEMINAR II. 1 hr.
Preparation and presentation of papers on topics of research interest related to thesis study. Parallel to EG 799.

799. MASTER'S THESIS.
Written dissertation for master's degree. Required of all students working on a master's thesis.
DIVISION OF GRADUATE PROGRAMS

The University of Alabama in Huntsville offers the following graduate degrees:

Master of Arts: Mathematics
Master of Science: Physics, Chemistry
Master of Science in Engineering

Graduate courses in the administrative sciences and education are offered also.

A person who desires to obtain graduate credits without pursuing one of the degree programs may be admitted as an unclassified student providing he meets the qualifications outlined below for regular admission.

Members of the University faculty with rank above that of instructor may not pursue work toward an advanced degree at the University of Alabama in Huntsville.

PLANS FOR MASTER'S DEGREE

All course work is done with the approval of the faculty in which a student proposes to major.

PLAN ONE:

Degree requirements under this plan include completion of 24 or more semester hours of course work and the writing of an acceptable thesis.

The thesis should show evidence of the student's capacity for research, independent thought, and his ability to interpret materials used and to write correct English. The subject must be in the major field and must be approved by a faculty committee of the major field, by the director of the appropriate division, and by the Dean of the Graduate School.

A completed copy of the thesis must be submitted to the major division at least four weeks before the date on which the candidate expects to receive the degree. At least ten days before graduation three copies of the thesis, approved by the thesis committee and the director of the major division, and a receipt for the binding fee ($13.00) must be deposited in the UAH Graduate Office. Theses must comply with the regulations set out in the leaflet Instruction for the Preparation of Theses and Dissertations at the University of Alabama which is available at the UAH Graduate Office. Approval by the Graduate Dean or his designated representative is necessary before graduation.

In exceptional cases, theses may be written in absentia. To obtain such permission, the student, before leaving the University, must select his thesis subject and submit to the director of his
major division a satisfactory outline of his thesis, plus satisfactory
evidence that adequate facilities are available where he plans to
do his work.

PLAN TWO

Degree requirements for the master's degree under this plan in­
clude the completion of 33 or more semester hours of course work.
If the program contains three or more terms of full-time work, the
degree requirements may be met with 30 or more semester hours
of course work. A thesis is not required.

A candidate working under Plan Two may be required to partici­
pate successfully in seminar or problem courses that will give him
an acquaintance with the methods of research and an appreciation
of the place and function of original investigation in the field.

Students majoring in mathematics may follow Plan One or Plan Two; students majoring in all
other master's degree programs must follow Plan One.

Requirements For Admission

Applicants for admission to the Graduate School must hold a
bachelor's degree from the University of Alabama in Huntsville or
from another approved institution. The following minimum require­
ments are acceptable to the Graduate Council; academic units may
require higher averages. (See admission requirements listed under
the academic division concerned.)

ADMISSION:

An applicant must:

1. Have a minimum quality point average of at least 2.0 (A = 3.0)
   overall, or at least 2.0 for the last 60 hours of work, and
2. Score at least 1,000 on the aptitude portion of the Graduate
   Record Examination (GRE). The advanced test of the GRE
   in the applicant's proposed graduate field is also required.
   Information concerning the GRE may be obtained from Edu­
   cational Testing Service (ETS), Princeton, New Jersey. Ap­
   plications may be obtained at the UAH Graduate Office.

CONDITIONAL ADMISSION:

An applicant whose scholastic record does not fully meet the re­
quirements for admission, may, upon recommendation of the ap­
propriate division director and with the approval of the Dean of the
Graduate School, be admitted conditionally provided:

1. His quality point average is at least 1.5 (A = 3.0) overall or
2. His score on the aptitude portion of the GRE is at least 1,000
or
3. His quality point average on the last 60 hours is at least 2.0.
IRREGULAR POST GRADUATE STATUS:  
Persons whose applications to the Graduate School have been denied on the basis of a quality point average and/or GRE score may apply to UAH for admission with irregular post graduate status. (See Admission as an IPG in the undergraduate section of this catalog.) A student admitted in this category may register in courses at UAH providing all prerequisites for the courses have been satisfactorily completed.  

Upon completion of 12 or more semester hours of advanced level courses with an average of B or better in each course, a student may reapply for admission to the Graduate School. Evaluation of this application will include the demonstrated performance in the advanced level courses. In this case, an applicant may be admitted conditionally if acceptance is recommended by the appropriate academic division.  

UAH SENIORS:  
A UAH senior may, with permission of the Associate Dean of the Graduate School in Huntsville, pursue graduate work while completing undergraduate degree requirements if:  

1. Fewer than 13 semester hours remain to be taken.  
2. His overall undergraduate average or his average on the last 60 hours is at least 2.0 (B).  
3. His total course load is less than 12 semester hours.  

Application Procedure  
Applicant must submit:  

1. Completed graduate application form in duplicate.  

In addition he must request that:  

1. Two copies of previous academic records be sent from each institution attended to UAH Graduate Office.  
2. Scores of The Graduate Record Examination (GRE) be sent to UAH Graduate Office from Educational Testing Service (ETS).  
3. Three former professors (or other individuals qualified to judge competence for graduate study) submit to UAH Graduate Office completed “Evaluation of Fitness for Graduate Study Forms.”  

All application materials must be in the UAH Graduate Office no later than dates specified in the UAH Calendar.
Applicants are urged to initiate actions for admission at least six weeks in advance of the registration date for the term to which admission is sought.

Registration

A student must be admitted to the Graduate School and must register on graduate forms in order to receive graduate credit for courses taken. Graduate students can schedule courses for other than graduate credit by so indicating on regular graduate registration forms; these courses will remain as originally designated.

The maximum course load of a graduate student is 10 semester hours per term. Students employed full time (40 or more clock hours per week) can schedule no more than 3 semester hours of graduate work per term. Students employed part time (32 or fewer clock hours per week) can schedule no more than 6 semester hours per term. A letter certifying the employment status must be on file in the UAH Graduate Office.

Identified undergraduate prerequisites or deficiencies must be scheduled early in the graduate program.

The same requirements and procedures of attendance, conduct, withdrawals, examinations, and assigned tasks that apply to undergraduate students must be met by graduate students.

Students working on a thesis must register for thesis.

Scholastic Requirements

The following scholastic requirements are those of the Graduate School; individual academic units may identify additional requirements.

DEGREE REQUIREMENTS:
1. Overall grade average must be B or better on all graduate credit hours undertaken.
2. Grade of B or better must be received on at least 75% of all credit hours undertaken.
3. Credits toward a master's degree are earned only with grades of C or better.
4. At least 50% of the hours required for a master's degree must be completed in courses numbered 600 or above.

TRANSFERRED CREDIT:
A maximum of six semester hours of acceptable graduate credit, earned in any approved graduate institution, may be transferred and counted toward the master's degree. Such credit may not be more than six years old at the time of graduation and is transferable only
if the student was enrolled in a graduate school at the time it was taken and if the overall average at the institution was B or better. Evaluation of credit for transfer will be made on request after the student has completed 12 semester hours of graduate credit at the University of Alabama. Students who have graduate credits from other units of the University of Alabama must complete a minimum of 12 semester hours in the Huntsville Graduate Programs to receive a master's degree from UAH.

TIME LIMIT:

All requirements for the master's degree should be completed in not more than six years. Credit for individual courses completed at the University of Alabama more than six years but less than ten years before the completion of all requirements for the degree may be validated by special examination given by the division concerned. Such an examination will be equivalent to a final examination in the course.

ADMISSION TO CANDIDACY:

Admission to the Graduate School and admission to candidacy for a degree are two separate acts. Application for admission to candidacy for the master's degree should be filed after completing 12 semester hours but before completing 18 semester hours of graduate credit at the University of Alabama in Huntsville. It must be approved at least two months before the degree is conferred. Approval will depend on (a) the quality of the applicant's graduate work prior to the time the application is made. (See Scholastic Requirements); (b) the removal of any special conditions; and (c) the certification of the major division that the student is well qualified to continue work toward the degree. Application forms will be supplied by the UAH Graduate Office.

EXAMINATIONS:

In addition to the regular course examinations, a final comprehensive examination is required of all candidates for the master's degree. This examination may be written, oral, or both. If a thesis is submitted and a written examination is given, there will be an oral examination which may be limited to the thesis. The candidate will be examined on his major subject or subjects and his thesis if he pursues Plan One, and on his field or fields of concentration if he pursues Plan Two. The oral examination is conducted by a committee of at least 3 members, appointed by the Dean of the Graduate School. A written notice of the time and place of the examination is sent by the Dean of the Graduate School to the candidate and to each member of the committee. The examination must be given at least two weeks before the date of graduation, and the results must
be reported promptly to the Dean of the Graduate School on furnished forms. A student may take the final oral or written examination only twice.

APPLICATION FOR DEGREE:
Each candidate for a master's degree must apply for the degree through the UAH Graduate Office during the terms in which all remaining requirements for the degree are to be met but at least two months before it is to be conferred.

PROBATIONARY STATUS:
1. At any time that the overall grade average of a student drops below a B average the student will be placed on probation.
2. A student on probation cannot apply for admission to candidacy for a degree.
3. Probationary status is removed by raising the overall grade average to B or better on all work attempted in all terms up to and including the term in which 12 semester hours are completed following the term in which the student was placed on probation.
4. Failure to remove probation in the manner identified in #3 results in dismissal from the Graduate School.

CONDITIONAL STATUS:
1. Students admitted conditionally who have an overall grade average of B or better for all work attempted up to and including the term in which 12 semester hours are completed assume the status of an unconditionally admitted student.
2. Students admitted conditionally who fail to have an overall grade average of B or better as indicated in #1 above are dismissed from the Graduate School.

SPECIAL REQUIREMENTS:
Special requirements of the Huntsville academic divisions are indicated in the separate division sections.

Students must assume full responsibility for acquainting themselves with all requirements related to a desired program and for carrying them out.

Cooperative Graduate Programs Between The Auburn University And The University Of Alabama
In some designated programs, a student enrolled in either Auburn University or any campus of the University of Alabama may register as a transient student at the other institution with the approval of both Graduate Deans, or their representatives, and the department
or division in which the student wishes to take the work. The amount of course work that may be taken by a student under such an arrangement will be determined by his Advisory Committee with appropriate approvals at the other University.

A student earning a master's degree or a six-year degree at either institution must complete at least one-half of the required course work at the institution granting the degree.

In order for a course to be applicable for credit above the six hours presently transferable toward a master's degree or beyond the master's toward a six-year degree, the course must be approved in advance by the student's major department or division and his Graduate Dean.

The Deans of the Graduate Schools or their representatives will serve as liaison officers in arranging programs for which the additional hours may be transferred and other details.

**Ph.D. Programs**

Close cooperation on Ph.D. programs exists between UAH and Tuscaloosa departments authorized for carrying on doctoral work. Applicants to programs in engineering, mathematics, physics, and chemistry who desire to make maximum utilization of services in Huntsville may submit application materials to the Huntsville office of the Graduate School. Upon being admitted, the student will be advised of the procedures for program planning.

The minimum residence requirements on the Tuscaloosa Campus include:

1. 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
2. 18 semester hours of credits (including research, seminars, dissertation, special problems, or other assignments for which a credit equivalency may be established).
OFFICE OF SPECIAL NON-CREDIT COURSES AND CONFERENCES

UAH offers short courses, conferences, seminars, and institutes in a variety of subjects without degree credit.

The continuing education program provides the most up-to-date information available in many areas to individuals who desire to further their education. Needs of the individual are defined, appropriate programs are developed, and from industry and educational institutions across the country, outstanding scholars are recruited as instructors.

Most of the students involved are employed in the Huntsville area; but, increasingly, students come from industries and governmental agencies outside this community.

Normally, professional people have to rely on publications or more general courses to acquire the newest information in their fields. This involves a considerable time lag. By the use of the aforementioned type of continuing education, UAH is significantly implementing technological and scientific progress.

UAH intends to expand non-credit offerings to upgrade professional and sub-professional workers, to fill critical gaps in adult education, and to foster cultural and utilitarian interests.

Types of Offerings

Typical of the short courses offered during a year through this Division are:

- Management Science
- Cryogenic Engineering
- Decision Mathematics
- Flat Cable Technology
- Systems Program Management
- Real Estate Principles and Practices
- Research and Development Contract Management Seminar
- Digital Computer Software
- Theory and Applications of Semi-Conductors Devices
- Architectural Philosophy and Design Consideration of Modern Digital Computer
- Aerospace and Defense Program Management
- Campus Unrest
- Urban Poverty
- Math for Parents

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The University of Alabama in Huntsville, in conjunction with the Huntsville Chapter of the National Contract Management Association (NCMA), offers courses applicable to a Certificate Program in Contract Management.
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Joseph C. Dowdle, B.E.E., M.E.E., Ph.D.
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John F. Porter, Jr., B.S., M.S., Ph.D.
Dean of Faculty

Philip M. Mason, A.B., M.A.
Director, Office of Public Relations and Development

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Director, Office of Finance

Michael F. LaBouve, B.A., M.A.
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Jean M. Perreault, B.S., M.A., M.A.
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D. J. Kieselbach, B.A.
Director, Office of Special Non-Credit Courses and Conferences

Charley Scott, B.S., M.S.M.E., Ph.D.
Associate Dean of the Graduate School
Director, Division of Graduate Programs

William F. Arendale, B.S., M.S., Ph.D.
Director, Division of Natural Sciences and Mathematics

A. W. Braden, B.A., B.D., Ph.D.
Director, Division of the Humanities

Donald W. Smithburg, B.A., Ph.D.
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Wilhelm K. Kubitza, Diplom-Ingenieur, D.Sc.
Director, Division of Engineering

Rudolph Hermann, Ph.D., Dr. Phil. habil.
Director, Research Institute

Nan G. Hall, B.S.
Registrar

Coordinator of Evening Programs

K. O. Thompson, B.S., B.B.A., B.Aero.E., M.S., Ph.D.
Technical Assistant to the Director, Research Institute

W. P. Watts, B.S., M.B.A.
Administrative Manager, Research Institute
FACULTY

(First date refers to original appointment to the University. Second date, if any, refers to date of appointment to title listed.)

ADAIR, BILLY MARQUARDT, B.S.E.E. (University of Tennessee), M.S.E. (University of Alabama). Part-time Assistant Professor of Engineering, 1969.

ADAMS, CURTIS H., B.S. (Mississippi State University), M.S. Ed. (Henderson State Teachers College), Ph.D. (Mississippi State University). Associate Professor of Biology; Section Head, Life Sciences Section; Chairman, Biology Faculty, 1965, 1969.

ADAMS, DAVID M., B.S., M.S. (Texas A & M University), Ph.D. (Oklahoma State University). Part-time Assistant Professor of Engineering, 1965.

AFZAL, MOHAMMAD, F.S.C., B.S., M.S. (Panjab University), Ph.D. (Kansas State University). Assistant Professor of Economics, 1968.


ANDERSON, ROBERT A., B.A. (David Lipscomb College), M.A. (Mississippi State University), Graduate Study (University of Tennessee). Part-time Instructor in History, 1965.


ARENDALE, WILLIAM F., B.S. (Middle Tennessee State University), M.S., Ph.D. (University of Tennessee). Professor of Chemistry; Director, Division of Natural Sciences and Mathematics, 1964, 1966.

ARENSTORF, RICHARD F., Diploma (University of Gottingen, Germany), Dr. rer. nat. (University of Mainz, Germany). Part-time Professor of Mathematics, 1958, 1964.


ATHA, LARRY C., B.S.M.E., M.S.M.E. (Missouri University-Rolla), Ph.D. (Missouri University, Columbia). Part-time Instructor in Engineering, 1968.

AUDEH, NADEEM F., B.S. (South Dakota State College), M.S., Ph.D. (Iowa State University). Associate Professor of Electrical Engineering, 1964, 1965.

BAIRD, JAMES ADAM, JR., B.S.M.E., M.S.M.H., Ph.D. (University of Alabama). Part-time Assistant Professor of Engineering, 1965.

BALDWIN, MART G., JR., B.S. (Furman University), Ph.D. (University of North Carolina). Part-time Assistant Professor of Chemistry, 1967.


*BARTEE, EDWIN M., B.S., M.S.E. (University of Alabama). Associate Professor of Industrial Engineering, 1959.


BLANTON, ROY W., JR., B.M.E., M.S., Ph.D. (Georgia Institute of Technology). Associate Professor of Mechanical Engineering, 1965, 1967.


BOYER, D. ROYCE, B.M. (Butler University), M.A. (Catholic University of America), D.M.A. (University of Texas at Austin). Assistant Professor of Music, 1956.

BRADEN, ARTHUR WAYNE, A.B. (Transylvania College), B.D. (Lexington Theological Seminary), Ph.D. (University of Southern California). Professor of Philosophy; Director, Division of the Humanities, 1966, 1969.


BRAINERD, JEROME J., B.S., M.S. (University of Notre Dame), Ph.D. (Cornell University). Associate Professor of Aerospace Engineering; Section Head, Fluid and Thermal Sciences; Chairman, Fluid and Thermal Sciences Faculty, 1965, 1968.


BROWN, ROBERT A., B.S. (U. S. Naval Academy), M.S., Ph.D. (Ohio State University). Associate Professor of Industrial Engineering, 1967.

BROWN, ROBERT MARION, A.B., Ph.D. (Vanderbilt University). Assistant Professor of Physics, 1967.

BRYANT, WILLIAM S., B.S., Graduate Study (Ohio State University). Part-time Instructor in Economics, 1964.

BUCHER, GEORGE CURTIS, B.S.M.E. (Washington University), M.S.M.E. (University of Alabama), Ph.D. (Oklahoma State University). Part-time Assistant Professor of Engineering, 1967.


BUTTS, TED M., B.S. (Mississippi State University), M.A., Graduate Study (University of Alabama). Instructor in Education, 1968.

CASTLE, JOHN GRANVILLE, JR., B.A. (University of Buffalo), Ph.D. (Yale University). Professor of Physics, 1969.

CLOUD, GISELA, A.B., M.A., Graduate Study (University of Georgia). Instructor in German, 1966.


COBLE, HAROLD DWAIN, B.S. (Kearney State College), M.S., Ph.D. (University of Nebraska). Assistant Professor of Chemistry, 1966.

COFFIELD, KENNETH E., A.B. (University of Kansas), M.A. (DePaul University), A.M., Ph.D. (University of Missouri). Assistant Professor of Psychology; Chairman, Psychology Faculty, 1966, 1967.


DANIEL, ALFRED C., B.S., M.S. (Georgia Institute of Technology), Ph.D. (University of Alabama). Part-time Assistant Professor of Physics, 1964.


DAVIS, JACK H., B.S., Ph.D. (Clemson University). Assistant Professor of Physics, 1966, 1967.

DAVIS, ROBERT TAYLOR, B.S. (Middle Tennessee State University), M.S. (University of Tennessee). Part-time Instructor in Chemistry, 1966.


DEMPSEY, JOHN P., B.S. (University of Louisville), Graduate Study in Venice, Italy; Indiana University. Assistant Professor of Art, 1965.

DEZENBERG, GEORGE J., B.E.E. (Auburn University), M.S. (University of Arkansas), Ph.D. (Georgia Institute of Technology). Part-time Assistant Professor of Engineering, 1966.

DOANE, GEORGE B., III, B.S.E.E. (Swarthmore College), M.S.E.E. (Yale University), Graduate Study (Auburn University). Part-time Associate Professor of Electrical Engineering, 1956.
DODSON, CHARLES L., B.S. (Emory and Henry College), M.S., Ph.D. (University of Tennessee). Associate Professor of Chemistry; Section Head, Chemistry Section; Chairman, Chemistry Faculty, 1966, 1968.

DOSS, DEVA CHITHA, B.S. (University of Madras), B.S., M.S., Ph.D. (University of Poona). Associate Professor of Mathematics, 1969.


DOZIER, JAMES B., B.S., M.S. (Auburn University), Ph.D. (University of Alabama). Part-time Associate Professor of Physics, 1961, 1967.


EDWARDS, THOMAS R., B.S. (Penn State University), Ph.D. (University of Buffalo). Part-time Assistant Professor of Physics, 1966, 1967.


EMERSON, MERLE THOMAS, B.S. (Whitworth College), M.S. (Washington State University), Ph.D. (University of Washington). Associate Professor of Chemistry, 1968.


ESSENWANGER, OSKAR M., Diplom (Technical University of Danzig, Germany), M.S. (University of Vienna), Dr. rer. nat. (University of Wuerzburg, Germany). Part-time Associate Professor of Earth Sciences, 1961, 1967.

FAN, CHIEN, B.S. (National Taiwan University), M.S., Ph.D. (University of Illinois). Part-time Associate Professor of Mechanical Engineering, 1967.


FINKLESTEIN, ROBERT, B.A. (Temple University), M.S. (Lewell Technological Institute). Part-time Laboratory Instructor in Physics, 1967.


FORTE, ALDO, D.Sc. (University of Havana). Associate Professor of Mathematics, 1966.

FU, TSUN-SEN, B.S., M.S. (Cheng Kung University), Ph.D. (University of Minnesota). Part-time Assistant Professor of Engineering, 1969.


GATZKE, HARRY W., B.S., M.S. (Georgia Institute of Technology). Part-time Instructor in Mathematics, 1968.

GAUSE, RAYMOND L., B.S. (Southwestern State College-Oklahoma), Ph.D. (Oklahoma State University). Part-time Assistant Professor of Engineering, 1967.


GOWINS, GENE E., B.S. (Southeast Missouri State), M.S.T., M.S. (University of Missouri). Part-time Instructor in Mathematics, 1967.

GRAHAM, MRS. JOY, B.S. (Florence State University), M.L.S. (Peabody College). Librarian, Assistant Professor, 1969.


GROHSE, EDWARD W., B.Ch.E., Ch.E. (Cooper Union), Ph.D. (University of Delaware). Professor of Chemical Engineering, 1960.


GUINN, GERALD R., B.M.E. (Auburn University), M.S.M.E. (Purdue University), Ph.D. (University of Alabama). Part-time Assistant Professor of Engineering, 1967.


HAMMILL, MISS MILDRED, B.A. (Union University), M.A. (Baylor University), M.L.S. (Peabody College). Assistant Professor, 1969.


HARTMAN, FREDERICK A., B.S. (University of Cincinnati), Ph.D. (Ohio State University). Part-time Assistant Professor of Chemistry, 1968.


HAUPF, FREDERIC CURT, B.S. (University of Florida), Ph.D. (Harvard University). Assistant Professor of Chemistry, 1969.

HAYMOND, ROBERT E., B.S. (University of South Carolina), M.S. (California Institute of Technology), Ph.D. (University of Oregon). Associate Research Professor of Mathematics, 1967.

HELLER, HERTHA D., Perm. Teachers Certificate (Teachers College for Women, Hanover, Germany), Graduate Study (Vanderbilt University). Temeprary Instructor in German, 1965, 1966, 1967.

HERMANN, RUDOLF, Ph.D. (Leipzig University). Dr. Phil. habil. (Aachen Institute of Technology), Professor of Aerospace Engineering; Director, Research Institute, 1962.


HOLT, CECELIA ANN, B.A. (Florence State College), M.S. (University of Kentucky). Instructor in Mathematics, 1968.

HOOMANI, JAFAR, B.S., M.S., Ph.D. (North Carolina State University). Assistant Professor of Mathematics; Section Head, Mathematics Section; Chairman, Mathematics Faculty, 1968, 1969.


HORNER, JAMES M., B.S., M.A., Ph.D. (University of Alabama). Associate Professor of Mathematics, 1965.


HUNG, FRANK T., B.S. (Taiwan College of Engineering), M.S., Ph.D. (Kansas State University). Part-time Assistant Professor of Engineering, 1968.


IGNATOWSKI, ELIZABETH K., A.B. (Bucknell University), M.S., Ph.D. (Purdue University). Part-time Assistant Professor of Psychology, 1967.


JONES, G. MERRILL, B.S. Ch.E., M.S. Ch.E., Ph.D. (University of Alabama). Part-time Assistant Professor of Engineering, 1966.


KERNER, HELMUT, Masters, Ph.D. (University of Vienna). Part-time Assistant Professor of Engineering, 1968.


KILGO, REESE D., M.A. (University of Alabama), M.Ed. (University of Florida), Ph.D. (University of Texas). Assistant Professor of Education, 1966.


KRAUSE, FRITZ R., M.S., Ph.D. (University of Goettingen). Part-time Assistant Professor of Engineering, 1963.


LEHNIGK, SIEGFRIED H., Diplom, Dr. rer. nat. (University of Braunschweig, Germany). Part-time Professor of Mathematics, 1960, 1968.

LEONARD, DR. RICHARD C., B.S., M.A. (East Carolina College), M.A.T., Ph.D. (University of North Carolina). Assistant Professor of Biology, 1968.


LUX, WILLIAM R., B.A. (University of New Mexico), M.A. (University of Southern California), M.A. (Stanford University), Ph.D. (University of Southern California). Assistant Professor of History, 1969.


MARLOWE, GUY H., JR., B.A. (Samford University), Ph.D. (University of Alabama). Assistant Professor of Psychology, 1967.

MARSHALL, GEORGE LEON, JR., B.S. (University of Tennessee), Graduate Study (Indiana University and University of Alabama in Huntsville). Part-time Instructor in Physics, 1968.


MIRAKHOR, ABBAS, B.A., M.A., Ph.D. (Kansas State University). Assistant Professor of Economics, 1968.

MITCHELL, FERDINAND H., JR., B.S. (University of Florida), M.S. (University of California), Ph.D. (University of Alabama). Part-time Assistant Professor of Physics, 1964, 1967.

MORIN, LORRAINE PAULINE, B.S., M.S. (University of Rhode Island), Ph.D. (Southern Illinois University). Assistant Professor of Biology, 1967.

MORRISON, COLUMBUS E., JR., B.S. (University of Alabama), C.P.A. Part-time Assistant Professor of Accounting, 1958.

MORRISON, KERRY R., B.A., Graduate Study (University of Maryland). Assistant Professor of History, 1969.


NICHOLS, DAVID ELBERT, B.S., M.S. (University of Tennessee), Graduate Study (University of Alabama in Huntsville). Temporary Instructor in Chemistry, 1968.


O'NEAL, ROBERT DAWSON, A.B. (Florida State University), M.A. (University of New Mexico), Ph.D. (Florida State University). Assistant Professor of Spanish, 1967.

OSTERLUND, MERILYN J., B.S. (Florence State College), Graduate Study (University of Alabama). Temporary Instructor in Earth Science, 1967.


PARNELL, THOMAS A., B.S., M.S., Ph.D. (University of North Carolina). Part-time Assistant Professor of Physics, 1968.


PERREAULT, MR. JEAN M., B.S. (Rockhurst College), M.S. (Marquette University), M.L.S. (Wisconsin University). Assistant Professor, 1969.


POLGE, ROBERT J., Ingenieur E.S.E. (Ecole Superieure d’Electricite de Paris), M.S.E.E., Ph.D. (Carnegie Institute of Technology). Professor of Electrical Engineering; Section Head, Electrical Engineering; Chairman, Electrical Engineering Faculty, 1963, 1968.

POPE, RICHARD C., B.A., M.A. (University of Louisville). Assistant Professor of Art, 1966.

PORTER, JOHN F., JR., B.S., M.S. (University of Alabama), Ph.D. (Johns Hopkins University). Associate Professor of Physics; Dean of Faculty, 1968, 1969.


RAMIREZ, GILBERT A., B.S. (University of California at Berkeley), M.S. (University of Washington), Ph.D. (Purdue University). Assistant Professor of Engineering, 1967.


RAO, YEDLA K., B.S., M.S. (Banaras Hindu University), Ph.D. (University of Maryland). Part-time Associate Professor of Economics, 1968.

REEVES, H. CLYDE, A.B., M.A. (University of Kentucky), M.S. (Syracuse University). Professor of Public Administration; Executive Vice-President for Huntsville Affairs, 1963, 1968.


RICHARDSON, GEORGE M., B.S. (Memphis State University), M.S. (Purdue University). Part-time Instructor in Mathematics, 1962.


RILEY, CLYDE, B.S. (University of Rochester), Ph.D. (Florida State University). Associate Professor of Chemistry, 1967, 1968.

ROACH, ROBERT R., B.S. (Kansas State University), M.S. (North Texas State College), Graduate Study (University of Alabama). Instructor in Mathematics, 1966.

ROBERTS, FRANCES C., B.S. (Livingston State College), M.A., Ph.D. (University of Alabama). Professor of History; Chairman, History Faculty, 1953, 1968.

ROGERS, JON G., A.B. (Kansas State Teachers College), M.A. (University of Arkansas), Ph.D. (University of New Mexico). Assistant Professor of Psychology, 1968.

ROWLAND, M. ELOISE, B.S. (Mississippi State College for Women), M.S. (Iowa State College), Ph.D. (University of Tennessee at Memphis). Associate Professor of Biology, 1967.
ROY, UPENDRA, B.S. (B.I.T., Sindri, India), M.S. (Sheffield University, England), D.Sc., Dr. rer. nat. (Max-Planck Institute of Metal Research, Stuttgart, Germany). Assistant Professor of Engineering, 1968.

RUSH, JOHN EDWIN, JR., B.S. (Birmingham-Southern College), Ph.D. (Vanderbilt University). Assistant Professor of Physics; Section Head, Physics Section; Chairman, Physics Faculty, 1967, 1969.

RUSSELL, LYNN DARNELL, B.S.M.E., M.S.M.E. (Mississippi State University), Ph.D. (Rice University). Part-time Assistant Professor of Engineering, 1967.


SALMON, MR. LOUIS J. C., Ingenieur E.S.E. (Ecole Superieure d'Electricite), Ingenieur des Arts et Manufactures (Ecole Centrale des Arts et Manufactures). Visiting Assistant Professor of Engineering, 1969.

SCOTT, CHARLEY, B.S. (Mississippi State University), M.S.M.E. (Georgia Institute of Technology), Ph.D. (Purdue University). Professor of Mechanical Engineering; Associate Dean of the Graduate School, 1963, 1966.


SEWELL, ROBERT B., B.S. (Middle Tennessee State University), M.S. (University of Mississippi). Part-time Laboratory Instructor in Physics, 1965.

SHANNON, ROBERT E., B.S. (Oklahoma State University), M.S. (University of Alabama), Ph.D. (Oklahoma State University). Associate Professor of Industrial Engineering; Section Head, Systems and Computer Sciences; Chairman, Industrial Engineering Faculty, 1965, 1966.


SMALLEY, LARRY L., B.S., M.S., Ph.D. (University of Nebraska). Assistant Professor of Physics, 1967.


SMITHBURG, DONALD W., B.A. (University of Washington), Ph.D. (Harvard University). Professor of Political Science; Director, Division of Social and Behavioral Sciences, 1967, 1969.


SODEK, BENARD ANTON, JR., B.S. (Loyola University of the South), M.S., Ph.D. (Oklahoma State University). Part-time Assistant Professor of Physics, 1967.
SPERLING, HANS J., Diplom, Dr. rer. nat. (University of Marburg, Germany). Part-time Professor of Mathematics, 1960.

SPILMAN, LAVINIA W., B.S. (University of Arkansas), M.S. (Purdue University). Part-time Instructor in Mathematics, 1967.

STEGENGA, MARTIN EUGENE, B.S. (University of Southern Mississippi), Ph.D. (University of Alabama). Part-time Assistant Professor of Mathematics, 1968.


STETTLER, JOHN D., B.S. (Notre Dame), Ph.D. (Massachusetts Institute of Technology). Part-time Associate Professor of Physics, 1965.

STREMSKI, RICHARD, B.S. (Loyola University), M.S., Ph.D. (University of Wisconsin). Assistant Professor of History, 1968.


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