DEGREES

The Georgia Institute of Technology at present offers curricula leading to the following degrees which are shown in the order of the establishment of the school in which the work is given:

**Undergraduate Degrees**

- Bachelor of Mechanical Engineering
- Bachelor of Electrical Engineering
- Bachelor of Civil Engineering
- Bachelor of Textile Engineering
- *Bachelor of Science in Textile Chemistry*
- Bachelor of Science in Textiles
- Bachelor of Chemical Engineering
- Bachelor of Science in Chemistry
- *Bachelor of Architecture*
- Bachelor of Ceramic Engineering
- Bachelor of Aerospace Engineering
- Bachelor of Science in Industrial Management
- Bachelor of Science in Physics
- Bachelor of Industrial Engineering
- Bachelor of Science in Applied Mathematics
- *Bachelor of Science in Building Construction*
- *Bachelor of Science in Industrial Design*
- Bachelor of Engineering Science
- Bachelor of Science in Applied Psychology
- Bachelor of Science in Applied Biology
- Bachelor of Science in General Management
- Bachelor of Science in Behavioral Management
- Bachelor of Science in Management Sciences
- Bachelor of Science in Economics

To graduates who have completed their courses under the Cooperative Plan, the degree is awarded with the designation “Cooperative Plan.”

**Graduate Degrees**

The degree of Master of Science (with or without designation) is offered in all fields shown above (with the exception of those marked*) and also in:

- Engineering Mechanics
- Geophysical Sciences
- Information and Computer Science
- Metallurgy
- Nuclear Engineering
- Nuclear Science
- Operations Research
- Sanitary Engineering
Also offered are the degrees:
  Master of Architecture
  Master of City Planning

The degree of Doctor of Philosophy is offered in:
  Aerospace Engineering
  Chemical Engineering
  Chemistry
  Civil Engineering
  Economics
  Electrical Engineering
  Engineering Mechanics
  Industrial and Systems Engineering
  Industrial Management
  Information and Computer Science
  Mathematics
  Mechanical Engineering
  Nuclear Engineering
  Physics
  Psychology
  Sanitary Engineering
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**Notes:**

- The year 1972 is shown in a 7x7 grid, with each row and column representing a month.
- The year 1973 is shown similarly, with the first month starting in the top row.
- The year 1974 is shown starting in the second month of the year, with the first month overlapping into the grid.
- The layout is consistent with standard calendar grids, showing each month with 7 rows and 7 columns, except for January, which has 6 days in some instances.
TENTATIVE CALENDAR 1972-73*

Summer Quarter 1972
June 19 Registration.
July 4 Holiday.
Aug. 30 End of term.

Fall Quarter 1972
Sept. 14 Registration.
Nov. 23 Begin Thanksgiving recess.
Nov. 26 Last day of Thanksgiving recess.
Dec. 9 End of term.
Dec. 10 Begin Christmas recess.
Jan. 3 Last day of Christmas recess.

Winter Quarter 1973
Jan. 4 Registration.
Mar. 22 End of term.
Mar. 23 Begin Spring recess.
Apr. 1 Last day of Spring recess.

Spring Quarter 1973
Apr. 2 Registration.
June 13 End of term.

Summer Quarter 1973
June 25 Registration.
Sept. 1 End of term.

*An official school calendar is published prior to the beginning of each quarter. Students should refer to this official calendar for changes.
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*Deceased December 13, 1971.
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William C. Nixon, B.S., *Recreation Coordinator*
James R. Greene, *Food Service Director*
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Thomas P. Fletcher, B.S., *Night Manager*
James R. Holder, *Office Manager*
Mary Alice Burke, *Dining Hall Manager*

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**Women Students**

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International Student Advisor

Fraternity Affairs

Garry M. Bledsoe, M.Ed., Assistant Dean of Students—Fraternity Advisor

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Security Department

W. Porter Weaver, Commander
Marcelle Simpson, Senior Clerk

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Robert L. Dodd, Athletic Director

WGST RADIO STATION

Jack Collins, General Manager
GENERAL INFORMATION

The Georgia Institute of Technology, founded in 1885, is a four-year, co-educational institution of higher learning located in the heart of Atlanta, Georgia. Master’s and doctorate programs are also offered in many fields. Nationally prominent for education and research in engineering, science, architecture, and management, Georgia Tech is also famous for its colorful traditions—the Ramblin’ Wreck parade and the school song by the same name, football, and hard-working students who approach play with zest and ingenuity. Georgia Tech alumni support is consistently among the strongest in the nation for public institutions.

The Institute operates on the quarter plan with the fall, winter, and spring quarters normally constituting the academic year. A summer quarter is also offered, and many students accelerate their program by attending four quarters per year. The requirements for a degree may be completed at the end of any quarter.

Because of the heavier workload associated with technological education in this country, the average student takes fourteen (14) quarters to complete the four-academic-year or twelve (12) quarter curricula at Georgia Tech. Many students prefer to attend one or more summer sessions in order to obtain the greatest benefit from their educational program while fulfilling the requirements for graduation in the four-year period. Georgia Tech recommends that students plan to attend a summer session and reduce their academic load.

Undergraduate degrees are offered in Aerospace, Ceramic, Chemical, Civil, Electrical, Industrial & Systems, Mechanical, and Textile Engineering; Engineering Science and Mechanics; Applied Biology; Applied Mathematics; Applied Psychology; Architecture; Building Construction; Industrial Design; Chemistry; Physics; Industrial Management; General Management; Behavioral Management; Management Science; Economics; Textile Chemistry; and Textiles. The curricula in these various fields are listed on the following pages and work submitted for credit must be checked against these basic requirements.

The Georgia Institute of Technology is a member of the Southern Association of Colleges and Schools. As such, it is accredited by this Association.

All of the four-year engineering curricula leading to bachelor’s degrees in engineering and the five-year program leading to a master’s degree in Sanitary Engineering are accredited by the Engineers’ Council for Professional Development, which is the national engineering accrediting agency.

The curriculum leading to the degree Bachelor of Architecture is accredited by the National Architectural Accrediting Board.

The curriculum leading to the B.S. in Chemistry degree is accredited by the American Chemical Society.

The College of Industrial Management is accredited by the American Association of Collegiate Schools of Business.
ADMISSION REQUIREMENTS

For any information regarding admission to Georgia Tech, write to the Director of Admissions, Georgia Tech, Atlanta, Georgia 30332. Both freshmen and transfer students are accepted for all four academic quarters which begin in September, January, March, and June.

It is advisable for candidates to the freshman class to make application not earlier than one year or later than six months prior to the date of the beginning of the quarter for which applying. Transfer students must have all required credentials on file in the Office of Admissions within twenty days of the date of the beginning of the quarter for which applying.

Georgia Tech reserves the right to refuse to accept an application at any time when it appears that students already accepted will fill the Institute to its maximum capacity. The Institute also reserves the right to reject an applicant who is not a resident of the State of Georgia.

The single most important criterion of any decision of acceptance is the probability of the applicant’s completing the requirements for the desired degree. The Institute reserves the right, in every case, to reject any applicant whose overall credentials do not indicate a probability of success, notwithstanding the satisfaction of other requirements. Applicants must comply with such other procedures, including personal interviews and psychological or other tests, as may be necessary to determine the applicant’s general fitness for admission. If an interview is required, the Director of Admissions will notify the applicant of the time and place at which the interview will be conducted.

The decision as to whether an applicant shall be accepted or rejected will be made by the Director of Admissions, subject to the applicant’s right of appeal as provided by the Statutes of the Institute to the Board of Regents of the University System.

FRESHMEN
Course Requirements

Students who are considering Georgia Tech should plan their high school schedules to include the following required courses:

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<td>English 4</td>
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<tr>
<td>Algebra 2</td>
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<tr>
<td>Plane Geometry 1</td>
<td>Plane Geometry 1</td>
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<td>Advanced Algebra ½*</td>
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<td>Science 2</td>
<td>History 1</td>
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</tr>
<tr>
<td>Lab Science 1</td>
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*Elementary functions, mathematical analysis, or analytical geometry are acceptable substitutes. Solid Geometry is NOT an acceptable substitute. An outline of topics is available upon request.
Language is not required for entry to Georgia Tech, but at least two years of a modern language is recommended. Extra courses in mathematics and science are recommended. A course in mechanical drawing and one in typing also prove useful. The total number of high school units completed should be sufficient to insure graduation under local requirements. Students unable to schedule required courses should write to the Director of Admissions for information regarding ways of making up missing high school credits.

The Institute reserves the right to reject the credits from any high school or other institution regardless of its accredited status, where the Institute determines from investigation that the quality of instruction available at such high school or institution is for any reason deficient or unsatisfactory.

**College Board Test Requirements**

All applicants for admission in Engineering, Science, and Mathematics are required to take the Scholastic Aptitude Tests. College Board Achievement Tests are not required. Students who wish to be considered for placement in advanced courses such as English, mathematics, or chemistry should schedule and make score reports available to the Office of Admissions the appropriate Achievement Tests scores.

Dates the tests are offered during the 1972-73 school year are as follows:

- November 4, 1972 (SAT only)
- December 2, 1972
- January 13, 1973
- March 3, 1973
- April 7, 1973 (SAT only)
- May 5, 1973 (Achievement Tests only)
- July 14, 1973

*It is recommended that the Scholastic Aptitude Tests be scheduled in November or December.* No applicant should schedule the SAT later than the March test date.

High school counselors can provide application blanks for the tests, or they can be obtained by writing the College Examination Board, P. O. Box 592, Princeton, New Jersey 08540.

**Criteria for Selection of Students**

Admission is selective, and the following criteria are used in the selection process:

A. *Major*

(1) Graduation from an accredited high school (2) Overall high school grades (3) Results of College Board SAT tests (4) Recommendations of principals, counselors, teachers.
B. Minor

(1) Results of interview if required to establish qualifications of applicant
(2) Results of College Board Achievement Tests (3) Results of additional
tests (4) Honors and advanced course work (5) Trend in academic
performance (6) Type of high school attending (7) Percent of
college-bound students in school attending (8) Residency (9) Relationship
to Georgia Tech alumni (10) Activities and leadership in school and
community (11) Any other factor that applies to an individual situation.

Admission Decision

In order for an admission decision to be made, the following items must be
submitted to complete the application file:

1. Application for Admission—It is recommended that the complete
application be given to the high school and mailed to the Admissions
Office with the transcript. Co-operative student applicants must file an
additional “Application for Co-operative Courses.” No application fee is
required.

2. High School Transcript—It must cover the first three years of high school
with student’s senior year schedule indicated by semesters. A school may
use its own standard transcript form rather than the form provided, if the
substituted form shows the applicant’s rank in class, grading system,
accredited status of the school, and any honors or advanced courses
completed.

3. Scholastic Aptitude Test Results—Applicants should make certain that a
copy of the scores be sent to Georgia Tech from Princeton, New Jersey.
Reproductions of scores received by the high school are also acceptable.

Admission Notification

After the Office of Admissions has received the application for admission, school
transcript, and SAT scores, evaluation and action on an application will be
possible. Approximately one month to five weeks should be allowed for the
College Board to score and report test results to the college. Applications are not
reviewed in any special order, such as alphabetically or by major requested, so it
is most likely that friends or classmates will receive their admission action letter
at different times.

Applicants who indicate a preference for the Co-operative Plan on the
application for admission will be mailed an “Application for Co-operative
Courses.” This must be received before consideration for admission can be given.
Co-operative Plan applicants will not be processed as rapidly as standard
applications.

Applications for financial assistance awarded by Georgia Tech can be
obtained by writing to the Office of Student Financial Aid, and the required
College Scholarship Service forms can be obtained from the high school.
Financial Aid awards are made between March and May.
NROTC Scholarship notifications will be sent as soon as Georgia Tech receives the certified list of candidates from the Department of the Navy. This usually occurs in April.

Failure to file any of the above material, or failure to respond promptly to requests for further information will invariably delay the processing of an application.

Advanced Placement and Honors Programs
Superior students entering Georgia Tech may receive college credit for courses completed in high school if their grades and scores on the advanced placement tests or the achievement tests of the College Board indicate a satisfactory knowledge of college course work. Advanced placement and credit are offered by the Schools of Chemistry, Mathematics and Physics; and Departments of English and Social Sciences on the basis of Advanced Placement Test results of the College Board Advanced Placement Program. Advanced sectioning is possible in the School of Chemistry. An honors program is offered in the School of Mathematics. Participation in the advanced placement and honors programs is voluntary.

Pre-Med—Pre-Dental—Pre-Law Programs
Pre-med, pre-dental, and pre-law programs are all offered at Georgia Tech. None of these are specified as degree programs as such but if a student takes the proper courses from the various Tech curriculums, these objectives can certainly be met.

A major may be declared in almost any engineering or science area for pre-medical or pre-dental, and in almost any engineering or management area for pre-law.

Commonly, if one wants to obtain a pre-med or pre-dental background, a major in Biology is declared. The courses taken routinely in the first three years in Biology include all of the courses listed in Medical School Admissions Requirements, USA and Canada, published by the Association of American Medical Colleges. Other quite logical majors for pre-med and pre-dental are Chemistry, Chemical Engineering, Physics, and Psychology.

A pre-law background may be obtained by majoring in any engineering or science curriculum.

One should check with the graduate school in medicine, dentistry, or law that he hopes to enter for any specific course requirements that might be peculiar to that particular institution.

Early Admission of High School Juniors
Under exceptional circumstances, students may be admitted to the Institute at the end of their junior year. These students must have outstanding records in college preparatory subjects and must have completed all course requirements under a regular admission with the single exception of a fourth year of English.
The student must present all College Board Tests results as regularly required. In addition, the Office of Admissions must receive a letter of recommendation from the high school principal or guidance counselor.

**Joint Enrollment Program for High Schoolers (JEPHS)**

Georgia Tech admits a limited number of gifted students who have finished the eleventh grade and who have academic credentials which would place them in the upper part of Tech's freshman class.

Normally, a student admitted in this category will take all his course work at Tech. The courses taken will include those subject areas which the student needs to fulfill his high school requirements for graduation. High school credit is given for such courses. The student actually graduates with his senior class. All work taken at Georgia Tech is also applicable toward an Institute degree if it is a part of a particular curriculum undertaken by the student at a later date. The student is not morally obligated in any way to stay at Georgia Tech after his senior year of high school (freshman year of college) is completed.

To be eligible to participate in this program, the local school system must have signed the appropriate agreement with the Georgia Institute of Technology. Students should check with the local school officials to determine if their particular system is a participating member. If so, the student should check with the high school counselor regarding specific course, test, and recommendation requirements for JEPHS.

If further information or assistance is required, contact either Dr. James M. Tanner, Co-ordinator, JEPHS Program, Georgia Tech; or the Office of the Director of Admissions at Georgia Tech.

**Acceptance Deposit**

It is mandatory for all admitted applicants to make such deposits (acceptance and/or dormitory) as required on the letter of admission.

**Health Information Record**

Each admitted student will be required to submit a Health Information Record form which will be sent with the notice of acceptance.

Health Information Record forms are mailed to students with the notice of their acceptance for enrollment. These forms are to be completed by the prospective student and his parents or guardians and mailed to the Director of Health in sufficient time to be received prior to the date of initial registration. After review of the Health Information Record, the school physicians shall determine the qualifications for Physical Training. Any student who desires special consideration because of mental or physical disability should have his physician write an explanatory letter to the Director of Health giving full details of the disability and any desired limitations on physical activity. This letter is to be attached to the Health Information Record. Any special examination or
reports needed to determine eligibility for enrollment or assignment are at the expense of the student, not the school.

Readmissions

Georgia Tech students who find it necessary to discontinue enrollment for one or more quarters, with the exception of a summer quarter, must apply for readmission when planning to return to the Institute. An application for readmission may be obtained from the Office of the Registrar and must be completed and returned at least 20 calendar days prior to the beginning of the quarter to which readmission is sought.

TRANSFER STUDENTS

General Regulations

Applicants who have made satisfactory records in scholarship and in conduct at other colleges may be considered for admission with advanced standing. Courses completed in other colleges must have an overall average of "C" or better, and grades must be satisfactory for the last term prior to transferring.

The basic policy regarding the acceptance of courses by transfer is to usually allow credit for courses completed with satisfactory grades in other accredited colleges providing the courses correspond in time and content to courses offered at the Georgia Institute of Technology. It is ordinarily impossible to give an official statement regarding transfer credit unless the student has an interview with the departments or schools concerned at Georgia Tech where credit is anticipated. The student should bring a catalog from all previous colleges plus information on texts used, authors, and chapters covered. Transfer credit from a nonaccredited institution is not normally allowed, and an application from a student attending such a college is discouraged and usually disapproved by the Committee on Admissions. Courses used as credits for a degree must have been completed in a period of ten years, counting from the time the first credits were acquired until the time all requirements for a degree have been met. Courses not falling within this time limit may be validated by examination. Transfer students should realize that credits six or more years old at the time of transferring are in danger of being voided by this regulation.

Transfer students who desire to enter the School of Architecture are generally confronted with a difficult problem due to the highly specialized nature of the curriculum in this school, which starts with the first quarter of the freshman year. The specialized sequence of courses involved usually results in five additional years from the point of transfer to obtain a bachelor's degree in Architecture. These courses are not ordinarily obtainable in another college unless it also has an Architecture School.

Transfer students should be prepared to meet their own expenses, since financial assistance for such students is extremely limited.

Veterans should submit a copy of the form DD214 for their period of service in order to receive credit in physical training and military.
Application Procedures

A student transferring from another college must request the Registrar of all colleges previously attended to send official transcripts to the Director of Admissions for evaluation. A transcript of high school work is ordinarily required to establish the academic background of the applicant.

Transfer students must submit scores from the Scholastic Aptitude Test of the College Entrance Examination Board. Information and applications to schedule the required tests may be obtained from the Educational Testing Service, Box 592, Princeton, New Jersey 08540.

An admission decision is determined and forwarded to the applicant as soon as possible after his file is complete.

Transient Students

A student who has taken work in another college or university may apply for the privilege of temporary registration in Georgia Tech. Such registration is generally for the summer quarter and the student will ordinarily be one who expects to return to the institution in which previously enrolled.

A transient student may be admitted on the receipt of a statement of permission and good standing from the Dean or Registrar of the institution last attended and where the applicant expects to return for further studies.

Special Students

Students in special situations, such as one who holds a bachelor's degree but needs to complete certain undergraduate prerequisite courses in order to be granted full graduate status, may be admitted on receipt of a transcript sent from the institution from which the bachelor's degree was obtained.

Students in this category are not considered as degree candidates but may be required to meet all requirements prescribed for admission to regular student status and meet any additional requirements that may be prescribed by the Institute.

Graduate Students

All correspondence relative to admission to graduate study should be directed to the Dean, Division of Graduate Studies and Research. Necessary application forms may be obtained from this office. These forms, together with letters of recommendation and official transcripts of previous academic work, should be on file in the Office of the Dean at least four weeks before the beginning of the quarter for which the applicant plans to register if he is to be assured consideration for acceptance. The Graduate Bulletin may be obtained on request.

Auditors

Any officially enrolled student who has obtained the approval of his advisor and the departments of instruction concerned may audit courses. However, no credit
is granted for courses scheduled on an auditing basis, and students are not permitted to change to or from an auditing status except through the regular procedures for schedule changes and during the period for changes as published in the college calendar for each given quarter.

All students registered as auditors are required to pay tuition at the regular rate.

Members of the faculty or staff of the Georgia Institute of Technology may sit in on a course providing permission is obtained from the Department concerned and the Registrar.

**ADMISSION OF WOMEN**

By action of the Board of Regents, December 13, 1967, qualified women students were ruled eligible for admission in all programs of study offered at Georgia Tech. The requirements for admission and the regulations governing students apply alike to men and women except that women students will not be required to schedule physical training but will take a health education course to make up the credit hours.

**VETERANS' PROGRAM**

As early as possible, and preferably at least one month before entering Georgia Tech, any student who plans to enroll under any of the Veterans' Administration programs should go in person to the nearest Veterans' Administration Office to make application. The Veterans' Administration will require items such as proof of discharge, marriage license, birth certificates, and other documentation needed to define an individual's eligibility. After the Veterans' Administration has evaluated these documents and your application, they will issue a Certificate of Eligibility. This Certificate of Eligibility will be processed by Georgia Tech on registration day for your first quarter of enrollment. After you have received this Certificate of Eligibility, any questions regarding procedure for enrolling should be directed to the Director of Financial Aid, located in the Administration Building on the Georgia Tech campus.

The veteran planning to further his education under veterans' benefits at the Georgia Institute of Technology should apply for admission as any other student. Eligibility for Veterans' Administration benefits has no direct relationship to the institution. All financial transactions are directly between the student and the Veterans' Administration. The institution serves only as a source of certification and information to the Veterans' Administration.

**THE DUAL DEGREE (3-2 PLAN) IN ENGINEERING EDUCATION**

With more and more engineers occupying positions of leadership in the business, manufacturing, and governmental fields, there has developed a need for a plan of engineering education that will provide a broader base on which to build more courses in liberal arts than is possible under the regular engineering curriculum. Recognizing this need, the Georgia Institute of Technology has arranged a
combined plan with a limited number of outstanding liberal arts colleges in the South to offer to qualified prospective engineers a more complete and well-rounded form of training for the world of today and tomorrow.

Under this plan the student may attend one of these liberal arts colleges for three years and then one of the nine engineering schools of the Georgia Institute of Technology for two years. Upon satisfactory completion of his two years at the school of engineering, he is eligible for the appropriate bachelor's degree from his original college and the bachelor of engineering in his particular field from the Georgia Institute of Technology. In certain cases of highly qualified students, the Georgia Tech degree may be at the master's level.

Colleges and universities associated with the Georgia Institute of Technology in offering the Dual Degree (3-2 Plan) in Engineering Education include The Atlanta University Center (Morehouse, Clark, Morris Brown, and Spelman Colleges), Atlanta, Georgia; Davidson College, Davidson, North Carolina; Middle Tennessee State University, Murfreesboro, Tennessee; Southwestern at Memphis, Memphis, Tennessee; The University of Tennessee at Chattanooga, Chattanooga, Tennessee; The University of Georgia, Athens, Georgia; The University of The South, Sewanee, Tennessee; and West Georgia College, Carrollton, Georgia. Several more four-year colleges of the University System of Georgia will be joining the plan during 1972-73. For further information, write to the Director of Admissions of the particular institution in which interested.

INTERNATIONAL STUDENTS

The number of international students enrolled at Georgia Tech is one of the largest of any engineering and scientific college in the United States.

The applicant must be eligible for admission to a first-rank university in his home country. Average performance is not enough. To be accepted the applicant must be among the best in his class, with high grades made in school subjects and on the examinations given by the Ministry of Education or similar agency where national examinations are available.

In addition to meeting the regular admissions requirements, prospective foreign students must demonstrate proficiency in the English language by taking the Test of English as a Foreign Language (TOEFL).

A special information pamphlet for foreign students is available upon request which contains the application procedures for both undergraduate freshmen and transfers and other basic information helpful to applicants from other countries.

DEFINITION OF LEGAL RESIDENCE

To be considered a legal resident of Georgia for the purpose of registering at an institution of the University System of Georgia, a student must establish the following facts to the satisfaction of the Residence Committee of that institution:

1. A student who is under 21 years of age at the time he seeks to register or re-register at the beginning of any quarter will be accepted as a resident student only upon a showing by him that his supporting parent or
Definition of Legal Residence

1. A guardian has been legally domiciled in Georgia for a period of at least twelve months immediately preceding the date of registration or re-registration.

2. In the event that a legal resident of Georgia is appointed as guardian of a non-resident minor, such minor will not be permitted to register as a resident student until the expiration of one year from the date of appointment, and then only upon proper showing that such appointment was not made to avoid payment of the non-resident fee.

3. If a student is over 21 years of age, he may register as a resident student only upon a showing that he has been domiciled in Georgia for at least twelve months prior to the registration date.

Any period of time during which a person is enrolled as a student in any educational institution in Georgia may not be counted as a part of the twelve months’ domicile and residence herein required when it appears that the student came into the State and remained in the State for the primary purpose of attending a school.

4. A full-time faculty member of the University System, his or her spouse, and minor children may register on the payment of resident fees, even though such faculty member has not been a resident in Georgia for twelve months.

5. If the parents or legal guardian of a minor changes residence to another state following a period of residence in Georgia, the minor may continue to take courses for a period of twelve consecutive months on the payment of resident fees. After the expiration of the twelve months’ period, the student may continue his registration only upon the payment of fees at the non-resident rate.

6. Military personnel and their dependents may become eligible to enroll in institutions of the University System as resident students provided they file with the institution in which they wish to enroll the following:

(a) A statement from the appropriate military official showing that the applicant’s “home of record” is the State of Georgia; and

(b) Evidence that applicant is registered to vote in Georgia; or

(c) Evidence that applicant, if under 18 years of age, is the child of parents who are registered to vote in Georgia; and

(d) Evidence that applicant, or his supporting parent or guardian, filed a Georgia State income tax return during the preceding year.

7. Foreign students who attend institutions of the University System under sponsorship of civic or religious groups located in this state may be enrolled upon the payment of resident fees, provided the number of such
foreign students in any one institution does not exceed the quota approved by the Board of Regents for that institution.

8. All aliens shall be classified as non-resident students; provided, however, that an alien who is living in this country under a visa permitting permanent residence or who has filed with the proper federal immigration authorities a Declaration of Intention to become a citizen of the United States shall have the same privilege of qualifying for resident status for fee purposes as has a citizen of the United States.

9. Teachers in the public schools of Georgia and their dependents may enroll as students in University System institutions on the payment of resident fees, when it appears that such teachers have resided in Georgia for nine months, that they were engaged in teaching during such nine months’ period, and that they have been employed to teach in Georgia during the ensuing school year.

10. If a woman who is a resident of Georgia and who is a student in an institution of the University System marries a non-resident of the State, she may continue to attend the institution on payment of resident fees, provided that her enrollment is continuous.

11. If a woman who is a non-resident of Georgia marries a man who is a resident of Georgia, she will not be eligible to register as a resident student in a University System institution until she has been domiciled in the State of Georgia for a period of twelve months immediately preceding the date of registration.

12. Non-resident graduate students who hold assistantships that require at least one-third time service may register as students in the institution in which they are employed on payment of resident fees.

PLEASE NOTE: In order to avoid delay and inconvenience upon arrival for registration, if there is any question in your mind concerning your residence status, application for clarification should be made immediately or not later than one month prior to the registration date. Applications should be addressed to Residence Committee, Georgia Institute of Technology, Atlanta, Georgia 30332.

**TUITION AND FEES**

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<td><strong>TOTAL</strong></td>
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QUARTERLY—

BOOKS AND SUPPLIES: $50
ROOM RENT: **$92-102-112-132
BOARD: $220-$260
PERSONAL EXPENSES: $150
(clothing, laundry, recreation, etc.)
TOTAL PER QUARTER $680-$760
TOTAL PER YEAR (3 quarters) $2040-$2280
TOTAL PER YEAR (2 quarters) $1360-$1520
For Co-op Students in school $220-$260
2 quarters instead of 3 $112 for Sophomores
$132 for Seniors, Graduate Students,
and Coeds.
ADDITIONAL FRESHMAN EXPENSES:
Slide rule, drawing supplies (In $100
addition to quarterly costs) $100
TOTAL PER YEAR— $2140-$2380
FRESHMEN ONLY $2845-$3085

**Dormitory Room Rent is normally: $92-$102 for Freshmen
$112 for Sophomores
$132 for Seniors, Graduate Students,
and Coeds.

The actual amount depends upon dormitory assignment.
NOTE: (a) The above expenses do not include fraternity, club dues, or
transportation expenses.
(b) Since changes in fees may occur without notice, the student must refer to
information provided on registration day by the Office of the Vice President for
Business and Finance for official amounts on fees and other institutional charges
for each individual quarter.
(c) An extra fee may be charged in special courses.
(d) A deposit of $25.00 (in addition to the $25.00 dormitory room deposit
mentioned on page 34) is required of each accepted applicant for admission to
the fall quarter as required in the letter of admission. Approximately two weeks
following registration, this deposit will be refunded to the student by check
mailed to his campus post office box.
(e) Any student who withdraws during the first quarter of his attendance shall
have his admission deposit deducted before any computation is made of the
refund to which he may be entitled.
Other Fees

Each person receiving a diploma must pay a diploma fee of $8.00 before graduating. A candidate for the doctor's degree must pay a charge of $25.00 for microfilming his dissertation and depositing it with the University Microfilms Service.

Examinations at other than regular examination times will be granted in exceptional cases only and by faculty action. A fee of $2.00 will be charged in all such cases.

A LATE REGISTRATION FEE OF NOT MORE THAN SIXTEEN DOLLARS ($16.00) IS CHARGED AT THE RATE OF TEN DOLLARS ($10.00) FOR THE FIRST DAY AFTER REGULAR REGISTRATION, AND AN ADDITIONAL TWO DOLLARS ($2.00) FOR EACH OF THE NEXT THREE DAYS.

Refund of Fees

Refunds of matriculation, tuition, or dormitory rents for reasons of withdrawal from the Institute or dropping of subjects may be considered only upon written application for refund of fees. The application must be dated and signed by the individual requesting the refund.

A form is available from the Dean of the Graduate Division, Dean of the Undergraduate Division or the Cashier's Office to request the refund. A copy of the withdrawal application or drop slip must accompany the refund application. STUDENT ACTIVITY AND MEDICAL FEES ARE NOT REFUNDABLE. Requests for dormitory rent refunds must be completed at the Housing Office by the individual.

Students who formally withdraw during one week following the scheduled registration date are entitled to a refund of 80% of the fees paid for that quarter.

Students who formally withdraw during the period between one and two weeks after the scheduled registration date are entitled to a refund of 60% of the fees paid for that quarter.

Students who formally withdraw during the period between two and three weeks after the scheduled registration date are entitled to a refund of 40% of the fees paid for that quarter.

Students who formally withdraw during the period between three and four weeks after the scheduled registration date are entitled to a refund of 20% of the fees paid for that quarter.

Students who formally withdraw during the period between four and five weeks after the scheduled registration date will not be entitled to a refund of any part of fees paid for that quarter. All requests for refunds must be received in the Office of the Vice President for Business and Finance within one month following the registration date.

STUDENT MOTOR VEHICLES

Students who are classified as freshmen and are living within the defined campus boundaries are not allowed to own or operate a motor vehicle on the campus. Married freshmen living in campus Married Student Housing shall be exempt
from this restriction. All other exceptions to this regulation will be granted only by special permission by the Dean of Students.

Any student (day, evening, graduate, or co-operative) who operates a vehicle on the campus must register it for CAMPUS operation. CAMPUS registration will allow student parking in designated institutionally owned or controlled areas.

An annual registration fee of $10.00 must be paid to register each vehicle. This fee is applicable regardless of which quarter the vehicle is registered and will cover an entire academic year from September until registration the following September.

Certain categories of students are eligible to register for preferred central campus parking. The annual fee for this privilege is $5.00 in addition to the registration fee.

Freshmen and upperclassmen granted student parking permits are required to observe all parking regulations on the campus. The Georgia Institute of Technology reserves the right to limit in any way the issuance of student parking privileges at the beginning of any quarter.

**ROTC**

The Georgia Tech Reserve Officers' Training Program is on a voluntary basis. Both the four-year and the two-year programs are offered as provided for in the 1964 ROTC Vitalization Act.

Each applicant for formal enrollment in the basic course of the Air Force, Army or Navy ROTC shall be required to execute a Certificate of Loyalty Oath in such form as shall be prescribed by the Secretary of Defense. If a freshman elects to enroll in ROTC, the first course should be scheduled during his first quarter in attendance.

Students who have successfully completed the basic course on a college level (senior division) and who are selected, may pursue the advanced course in the junior and senior years. However, not more than six hours of basic and nine hours of advanced ROTC may be used as elective credit towards a degree.

A student who is qualified for and enrolled in ROTC while at Georgia Tech may be deferred from induction until after his graduation provided he possesses certain qualifications and meets the prescribed requirements.

For further details regarding the Army ROTC, see page 231, the Naval ROTC, see page 252, and for Air ROTC, see page 47.

**Selective Service**

Current academic status will be furnished to the Selective Service System (Local Draft Board) upon written request by the student. A Selective Service Authorization card is provided for this purpose. Once requested, however, all subsequent changes in status are reported automatically until the authorization is retracted by the student.

Current Selective Service Regulations provide for the deferment of full-time undergraduate students until the end of their current academic quarter. Seniors can be deferred until graduation if they have less than one year remaining.
Any questions concerning student deferments should be directed to the Office of the Registrar, Room 104, Administration Building.

HEALTH SERVICES

The Health Service is located in the Joseph Brown Whitehead Memorial Infirmary, located on Fifth Street adjoining Rose Bowl Field. The Infirmary contains the offices of the medical staff, examination and treatment rooms, clinical laboratory, X-ray and physiotherapy departments, plus wards and rooms for seventy patients.

The staff consists of several full time physicians, visiting consultants in Internal Medicine, Psychiatry and Radiology, with the necessary supplement of registered nurses and medical technicians. On the consulting staff are many physicians and dentists representing all medical and dental specialities, whose services are available upon request.

Infirmary policy is determined by a committee composed of the Dean of Students, the Assistant Athletic Director, the Vice President for Academic Affairs, the Athletic Association physician, the Director of Health, and a student appointed by the Student Council.

The facilities of the Health Service, financed by student fees, are available to all students. However, only those who have paid a health fee for the current quarter are eligible for free treatment. Co-op students on their work quarter and students registered for less than 6 credit hours are not charged a health fee and are not entitled to free treatment at the Infirmary, but may be treated on a "fee-for-service" basis.

For those eligible, the Health Service provides unlimited free Infirmary office treatment by the Infirmary Staff for any illness or injury that occurs after enrollment at Georgia Tech. This includes such medical care, minor surgery, X-rays and Staff conducted laboratory examinations, and physical therapy as deemed necessary and provided by the full-time school physicians. Hospitalization in the school Infirmary with Staff nursing care, drugs, Staff laboratory, X-rays, and physical therapy is provided free, except for a charge of one dollar for each meal served, and one dollar per day to cover laundry expenses. If the illness or injury is of such complexity or severity that consultation with a specialist or treatment with another hospital is deemed advisable, arrangements can be made by the school physicians for such care. (See later paragraphs for financial aspects.)

All students who are sick or injured are expected to report to the Infirmary for treatment. If the student does not desire treatment by one of the school employed physicians, he may arrange for another physician to care for him at the Infirmary. The Health Service will assume no responsibility, financial or otherwise, for treatment rendered by nonstaff physicians.

Medical care is available at the Infirmary 24 hours a day when school is in session, but not between quarters. Clinic hours are 7 A.M. to 6 P.M.—Monday thru Friday, 8 A.M. to Noon—Saturday, and 3 P.M. to 6 P.M.—Sunday.
Emergency visits are possible at any hours of the day or night. Students are expected to make their clinic visits during their free periods or before classes begin in the morning.

School regulations prohibit any student staying in his room, in a dormitory or fraternity house, with a contagious disease. If the school physicians feel that the illness of the student is contagious or is severe enough to justify absence from classes, the student will be admitted to the Infirmary and remain until such time as he is able to return to classes with safety. The Health Service does not provide any care for students in the home, nor do the physicians make house calls.

Free service is limited to Staff care in the Infirmary, and, with certain limitations, for those injuries specified in the following paragraph. Unless otherwise indicated herein, free service does not include surgery, specialist treatment, orthopedic appliances, special nurses, or off-campus hospitalization. The Health Service will assume no financial responsibility for the treatment of diseases or injury existing at the time of or prior to enrollment. The Health Service provides no dental care except for repair of teeth injured in P.T. class, provided such injury is reported within one hour of the injury and is verified by the instructor. It does not pay for eye refraction or for glasses. Only if glasses are broken in P.T. class while wearing protective goggles, will the glasses be replaced by the Health Service. It is recommended that all students who must wear glasses keep an extra pair on hand with a copy of their prescription. The Health Service will not pay for broken or lost contact lenses under any circumstances.

The Health Service will provide financial assistance for medical care rendered by physicians outside the Infirmary only for:

1. On-campus injuries sustained in the classroom, laboratory and physical training, or
2. Injuries sustained while participating in regularly scheduled intramural activities.

The Health Service will provide full financial coverage for medical care for those injuries sustained in the classroom, laboratory, and physical training classes. For intramural injuries, the financial responsibility of the Health Service for any one injury will be limited to $200 for the physician’s fees, and if treatment in a hospital outside the Infirmary is required, $10 per day for room and board up to 14 days, plus $100 toward other hospital charges. In all cases, the Health Service will assume this financial responsibility only if such service is deemed necessary and authorized in writing by one of the school physicians.

Health and Accident Insurance written especially for Georgia Tech to supplement the service provided by the School Infirmary is offered to all students at the beginning of each quarter. Excellent coverage for physical and mental illness, on a twelve month basis, is provided at a most reasonable premium. Full details will be mailed to all prospective students in late August so that coverage will be provided at registration at the beginning of each quarter.

All students are required to have immunization against tetanus (toxoid), smallpox, and polio, prior to enrollment. Boosters for tetanus, smallpox, and
polio will be given as needed. Tech does not require typhoid vaccine, but advises it for those who intend to do water-skiing, skin diving, or other fresh water sports.

Health Information Record and Consent-for-Treatment forms are mailed to students with the notice of their acceptance for enrollment. These forms are to be completed by the prospective student and his parents or guardians and mailed to the Director of Health in sufficient time to be received prior to the date of initial registration. After review of the Health Information Record, the school physicians shall determine the qualifications for Physical Training. Any student who desires special consideration because of mental or physical disability should have his physician write an explanatory letter to the Director of Health giving full details of the disability and any desired limitations on physical activity. This letter is to be attached to the Health Information Record. Any special examinations or reports needed to determine eligibility for enrollment or assignment are at the expense of the student, not the school.

The Director of Health, as representative of the Institute, reserves the right to exclude students with certain infirmities or disabilities which he feels may be detrimental either to the individual or the other students. He also reserves the right to require certain treatment of students in order to qualify for enrollment or to remain in school.

**DORMITORY HOUSING**

It is the policy of the Institute to require all single freshmen, men and women, who do not reside with their parents, near relatives, or bona fide guardians, to live in the dormitories. Freshmen are given *first priority* in making dormitory assignments.

The priority for making dormitory assignments is as follows:

<table>
<thead>
<tr>
<th>Area I</th>
<th>Area II</th>
<th>Area III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Priority—Freshman</td>
<td>1st Priority—Senior</td>
<td>1st Priority—Graduate</td>
</tr>
<tr>
<td>2nd Priority—Sophomore</td>
<td>2nd Priority—Junior</td>
<td>2nd Priority—Senior</td>
</tr>
<tr>
<td>3rd Priority—Junior</td>
<td>3rd Priority—Sophomore</td>
<td>3rd Priority—Junior</td>
</tr>
<tr>
<td>4th Priority—Senior</td>
<td></td>
<td>4th Priority—Sophomore</td>
</tr>
</tbody>
</table>

*Transfer students* will be placed according to class status, as above. (Class status should not be taken for granted, as this is determined after credits have been evaluated by the Registrar's Office.) Sophomore classification requires 51 acceptable credit hours; Junior 101; and Senior 151.

Area I dormitories consist of Brown, Cloudman, Glenn, Harris, Harrison, Howell, Smith, Techwood, and Towers. While students in the Co-operative Plan are housed primarily in Techwood, regular students are also given assignments there. Harris is an experimental dormitory consisting of suites. Assignments to this dormitory are made by a special student and staff selection process; freshmen are excluded.

Area II dormitories consist of Field, Hanson, Hopkins, Matheson, and Perry. Field is reserved for seniors and juniors.
Area III dormitories include two new buildings for graduate students; Armstrong, Caldwell, Folk, and Hefner for juniors and seniors; and Fulmer and a new building for women (see Coed Dormitory Accommodations described on page 35).

Each Georgia Tech dormitory or complex is staffed with a faculty or staff member and a mature graduate student or an advanced upperclassman as Resident Advisor, who is assisted by a Senior Counselor and a staff of upperclass student counselors who advise and counsel student residents.

In each dormitory or dormitory area a Dormitory Council is elected by the residents. The Dormitory Councils provide programs of social, recreational, and leadership activities.

The dormitories provide housing for 3,700 students. In the Area I dormitories most of the rooms accommodate two students. A few four-man rooms which consist of two connecting rooms are used for an overflow of students. These rooms accommodate two students per four-man room when space permits.

In the Area II dormitories all of the rooms are double occupancy with telephone capabilities in some rooms.

In the Area III dormitories all rooms are double occupancy and air-conditioned. Telephone capabilities are provided in some dormitory rooms in this area.

All rooms are equipped with beds, study desks, dressers, clothes lockers, bookcases, chairs, mirrors, and wastebaskets. The student should provide himself with blankets, bedspreads, sheets (36” x 76” fitted for Area I, and 39” x 82” for Area II, and 36” x 80” for Area III - top and bottom fitted sheets as per these sizes are available in the Bookstore), pillow and pillowcases, towels and a good study lamp.

Linen service is available on an optional basis. Two sheets, one pillowcase and two bath towels are provided each week. Detailed information concerning this service will be mailed along with the room assignment.

Dormitory regulations prohibit the installation and use of such electrical appliances as exceed a 2.5 amp power rating. All appliances should be approved by the Underwriters Laboratory (and be so tagged). Maximum cord length from the appliance to the receptacle should be six feet. No portable heaters (electric or gas) should be used. Refrigerators that do not exceed an overall dimension of 36” x 24” x 32” or the power rating are allowed in all dormitories except Brown and Techwood. Televisions are permitted in Areas II and III only.

Dormitory Applications from beginning freshmen and transfer students for fall quarter should be sent to the Office of the Vice President for Business and Finance by May 1 after receiving the Notification of Acceptance and Dormitory Application from the Registrar. When Notification of Acceptance to fall quarter is received after May 1, the Dormitory Application must be mailed to the Office of the Vice President for Business and Finance within two (2) weeks. New students entering for quarters other than fall quarter must submit the Dormitory Application with the $25.00 room deposit to the Office of the Vice President for Business and Finance within two (2) weeks after receiving the Notification of Acceptance and Dormitory Application from the Registrar.
Applicants are encouraged to indicate their roommate requests, if they have a preference, and it is usually possible to grant such requests provided the applicants request each other. However, one’s application is for an accommodation in the dormitories and not for a specific room or roommate. With roommate requests, the applicant having the lower priority establishes the priority for both applicants.

A $25.00 Room Deposit (in addition to the admission deposit mentioned on page 27) must be submitted with the dormitory application. No application for dormitory housing will be honored without the required deposit, except from students from countries with restrictive monetary policies. (In such cases, the international student should send his application to the Housing Office with a request for delay of payment.) Upon payment of the deposit, the Housing Office will promptly return to the applicant a receipt along with helpful preliminary instructions. The deposit is not applicable to dormitory rent. It may be refunded at such time as the student leaves the dormitories, provided he checks out properly, returns his room key, has no room damage for which he is responsible and has observed policies concerning room cancellations and withdrawals from the dormitories. The refund must be applied for; it is not refunded automatically.

ASSIGNMENTS: Dormitory Room Assignments are not mailed until approximately forty (40) days prior to the first day of classes of the quarter applied for. Those applying after the beginning of this 40-day period will receive a room assignment as available and be held responsible for acceptance. If it is too late to mail the assignment, it may be secured at the Dormitory Housing Office upon arrival at Tech.

Requests for assignment changes between dormitories are not made beyond the second day before registration. However, room changes may be made within the dormitory, to which assigned, provided the change has been approved by the Resident Advisor of that dormitory and then officially arranged in the Housing Office before the change is made. Room change is scheduled during the first week after registration.

The Dormitory Housing Office will send instructions as to shipment of baggage, arrival dates, and other information with the room assignment.

CANCELLATIONS: If, for any reason, the Dormitory Application, or an assignment to a room, is to be cancelled, the cancellation must be recorded in the Dormitory Housing Office at least thirty (30) days prior to registration day, or the deposit is forfeited. Exceptions to this policy are as follows:

(a) Beginning freshmen and transfer students for fall quarter have until May 1 to submit the Dormitory Application with the $25.00 room deposit. After the room deposit is made, no refund is applicable except for an Act of Providence.

(b) Beginning freshmen and transfer students admitted for fall quarter after May 1 are to send the Dormitory Application to the Office of the Vice President for Business and Finance within two (2) weeks after receiving the Notification of Acceptance. No refund is applicable after the deposit is made.

(c) New students entering for quarters other than fall quarter must cancel
their application or assignment 30 days prior to the first day of registration or the deposit is forfeited.

DORMITORY RENT is as follows: (A $2.00 Dormitory Activity Fee is included in the rent.) Room rent is subject to change at the end of any quarter.

<table>
<thead>
<tr>
<th>Area</th>
<th>Room Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area I</td>
<td>$92.00-$102.00</td>
</tr>
<tr>
<td>Area II</td>
<td>$112.00</td>
</tr>
<tr>
<td>Area III</td>
<td>$132.00</td>
</tr>
</tbody>
</table>

DORMITORY RENT is payable as follows:

(a) On or before the last day of scheduled registration, for assignments made before the beginning of a quarter, unless otherwise indicated on assignment notice.

(b) Within two (2) days from date the room is assigned (when assignment is made after the beginning of a quarter).

A penalty fee will be charged for failure to pay rent on or before the last date due. The penalty fee will be five dollars ($5.00) for the first day following the date due, and one dollar ($1.00) for each of the next three days, the total not to exceed eight dollars ($8.00).

Students who fail to pay their room rent, including penalty fees, according to the conditions in above paragraphs (a) and (b), will be reported to the Dean of Students for appropriate action, four days after the deadline stated in the notice of assignment.

WITHDRAWALS: Residents once having paid rent, will receive no refund of room rent should they decide to move from the dormitories during any given quarter, UNLESS disenrolling from school in good standing.

Any student who withdraws from school and is in good academic and disciplinary standing should receive a dormitory rent refund in accordance with the Institution tuition refund policy.

Any student who moves from a dormitory to an apartment, fraternity house, private home, or is removed from the dormitory for disciplinary reasons, or leaves the Institute without proper notification should not receive a room rent refund and should forfeit his room deposit.

COED DORMITORY ACCOMMODATIONS: Fulmer and a new dormitory, located in Area III, the new dormitory complex between Sixth and Eighth Streets, house a total of 196 women. All rooms are double occupancy with individual room controls to the central air conditioning and heating. Telephone capabilities are provided in some rooms. Each floor has a study room. The Women's Dormitory Director resides in the dormitory complex. Freshmen women (except Atlanta area) are given first priority in dormitory housing.

APARTMENTS

The school has 300 apartments for married students. The apartments range in size from efficiency to three-bedroom units. Detailed information and an apartment application blank will be supplied upon request to the Housing Office, Georgia Tech, Atlanta, Georgia 30332. It is not necessary to be accepted
as a student before application is made. As apartments are vacated they are reassigned according to the date of application and priority.

**FOOD SERVICE**

Georgia Tech has three food service facilities conveniently located on the campus. In the Student Center are a cafeteria, a table service dining room, and a snack bar.

For those students living on the east side of the campus, Brittain Dining Hall provides full meal service. Bradley Dining Hall, located in the Administration Building, provides a snack bar and a cafeteria serving breakfast and lunch.

**GEORGIA TECH PLACEMENT CENTER**

The Georgia Institute of Technology operates a centralized placement operation serving all degree candidates for career employment. The four principal services available to students and employers are (1) campus interviews (2) a weekly bulletin published to students listing position vacancies (3) an open resume file for employer selection of candidates and (4) communication information for more than 3,000 prospective employers. In addition, the Placement Center staff conducts orientation and employment seminars to aid students in their employment search. Summer and part-time position openings are also made known to the students through the Placement Center. Formal campus interview periods are October and November, and January through April but can be arranged at anytime with at least two weeks notice. Employers wishing to establish interview dates, list position vacancies or review resumes may call (404) 894-2550 or visit the Placement Center at 891 Hemphill Avenue, N.W.

**OTHER INFORMATION**

*Class Attendance:* There are no formal regulations regarding class attendance at the Georgia Institute of Technology. The resources of the Institute are provided for the intellectual growth and development of the students who attend. A schedule of courses is provided for the students and faculty to facilitate an orderly arrangement of the program of instruction. The fact that classes are scheduled is evidence that attendance is important and students should, therefore, maintain regular attendance if they are to attain maximum success in the pursuit of their studies.

*Examinations and Grade Reports:* Final examinations are scheduled during the last week in each quarter and reports of the student's academic progress are issued after the close of the quarter.

*Constitution and History Examinations:* A Georgia law, amended March 4, 1953, requires all students to pass examinations on United States and Georgia history and the United States and Georgia constitutions or pass comparable courses before graduation. Courses which may be substituted for the United States and Georgia constitutions examination are Pol. 151 or Pol. 351; courses which may be substituted for the United States and Georgia history examination are: Hist. 101, Hist. 102, Hist. 301, or Hist. 302.
Limitations on Credit for ROTC Courses: Six (6) quarter hours in basic ROTC courses and nine (9) quarter hours in advanced ROTC courses are the maximum credits allowed toward meeting the requirements for any degree.

Grading System:

A—excellent (4 quality points)
B—good (3 quality points)
C—satisfactory (2 quality points)
D—passing (1 quality point)
F—failure, must be repeated if in a required course (no quality points)
S—satisfactory completion of a course taken under Pass-Fail or of a course in which no other letter grade may be assigned (not included in calculation of scholastic average)
U—unsatisfactory completion of a course taken under Pass-Fail, must be repeated if in a required course (not included in calculation of scholastic average)
V—audited, no credit (no academic achievement implied)

A grade of D is passing in a single subject but a general average of C is required for graduation.

More detailed information regarding the academic regulations of the Institute is contained in the handbook of student rules and regulations which is available to all students in the Office of the Dean of Students.

CURRICULA

A tabulation of the work required for degrees in the curricula offered by the Georgia Institute of Technology is given in alphabetical order in the following pages.

At least 36 credit hours of humanities and social sciences must be included in all curricula leading to an undergraduate degree.

Engineering College—all students enrolled in curricula of the Engineering College must take at least 36 hours of humanities and social sciences distributed as follows:

At least 18 hours of humanities (including at least 3 hours of literature) selected from the following subjects:


Modern Language:*  
German: 301, 302, 303, 401, 402, 403, 421, 422, 423, 491, 492, 493.  
Russian: 301, 302, 303.  
French: 301, 302, 303, 401, 402, 403, 497, 498, 499.  
Linguistics: 201, 202, 203, 401, 402, 403.

*Up to 9 hours of beginning modern language may be included, provided that 9 additional hours of literature studies in the same language are also completed.
Music: 201, 203.
At least 18 hours of social sciences (including at least 3 hours of history) selected from the following subjects:
Modern Language:
German: 201, 202, 203.
French: 201, 202, 203.
Russian: 201, 202, 203.
Spanish: 201, 202, 203, 304, 305.
Linguistics: 201, 202, 203, 401, 402, 403.
Psychology: 300, 303, 304, 400, 402, 410, 423, 480.
Econ: 201, 202, 203, 204, 486, 487, 489, 495.
Socio-technology:
C.E.: 470.
N.E.: 420.
Pol: 474, 475.
Soc: 476.
Econ: 489, 495.

Freshman Engineering Electives–any of the following courses are acceptable for credit as freshman engineering electives in all curricula in engineering:
E.Gr. 108 Introduction to Spatial Structures for Computer Simulation
E.Gr. 171 Introduction to Visual Communication and Engineering Design II
A.E. 110 Introduction to Engineering
Cer.E. 110 Introduction to Ceramic Engineering
Ch.E. 110 Elements of Chemical Engineering Design
C.P. 110 Introduction to City Planning
C.E. 110 Introduction to Civil Engineering
E.E. 110 Computer Programming and Graphics
E.E. 111 Electrical Engineering Fundamentals
ESM 110 Introduction to Engineering
ISyE 110 Basic Concepts in Industrial and Systems Engineering
M.E. 110 Creative Decisions and Design
General College and Industrial Management College—all students enrolled in curricula of either the General College or the Industrial Management College must take at least 36 hours of humanities and social sciences distributed as follows:

At least 18 hours of humanities selected from the following subjects:


Modern Language:

German: 101, 102, 103, 105, 106, 301, 302, 303, 401, 402, 403, 421, 422, 423, 491, 492, 493.

Russian: 101, 102, 103, 301, 302, 303.

Spanish: 101, 102, 103, 301, 302, 303, 306, 401, 402, 403, 404, 407, 408, 409, 410, 494, 495, 496.

French: 101, 102, 103, 301, 302, 303, 401, 402, 403, 497, 498, 499.

Linguistics: 201, 202, 203, 301, 302, 303, 401, 402, 403, 421.

Music: 201, 203.


At least 18 hours of social sciences selected from the following subjects:

Social Science:


Modern Language:

German: 201, 202, 203.

French: 201, 202, 203.

Spanish: 201, 202, 203, 304, 305.

Linguistics: 201, 202, 203, 301, 302, 303, 401, 402, 403, 421.

Psychology: 300, 303, 304, 400, 402, 410, 423, 480.

Economics: 201, 202, 203, 204, 486, 487.
SCHOOL OF AEROSPACE ENGINEERING
(Daniel Guggenheim School of Aeronautics)
(Established in 1930)


General Information

The mission of the School of Aerospace Engineering is the preparation of graduates for a career in flight vehicle engineering and related applied research. The curriculum is specifically designed to develop proficiency for research, analysis and design in the three disciplines of fluid flow, structures and vehicle performance. The background developed in these disciplines is applicable to vehicles within the complete flight spectrum—underwater, atmospheric and space flight.

Chemistry, mathematics, physics and the humanities are emphasized in the first two years of the curriculum. The disciplines in Aerospace Engineering and the related engineering sciences are covered in the third and fourth years. Basic principles and theories are stressed in recognition of the sophistication and rapid changes associated with modern engineering technology. The curriculum prepares the graduate for either an engineering position, usually in the aerospace industry, or for additional education at the graduate level, usually with specialization in one of the disciplines in Aerospace Engineering. Electives are offered during the last two years of the curriculum so that a student's program of study can be tailored for his objectives and abilities.

The School offers graduate work leading to both the Master of Science and the Doctor of Philosophy degrees.

*Deceased December 27, 1971.
### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.Gr.</td>
<td>170</td>
<td>Visual Communication and Engr. Design I</td>
<td>2-3-3</td>
<td>or 2-3-3</td>
<td>......</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Elective*</td>
<td>- - 3</td>
<td>or - - 3</td>
<td>......</td>
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<tr>
<td>Chem.</td>
<td>104-5</td>
<td>Inorganic Chemistry</td>
<td>4-3-5</td>
<td>4-3-5</td>
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</tr>
<tr>
<td>Hum./S.S./M.L.**</td>
<td>104-5</td>
<td>Humanities/Social Sciences/Modern Language</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>6-0-6</td>
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<tr>
<td>Math.</td>
<td>107-8-9</td>
<td>Calculus I, II, III</td>
<td>5-0-5</td>
<td>5-0-5</td>
<td>5-0-5</td>
</tr>
<tr>
<td>Phys.</td>
<td>227</td>
<td>Physics</td>
<td>......</td>
<td>......</td>
<td>4-3-5</td>
</tr>
<tr>
<td>Electives***</td>
<td></td>
<td></td>
<td>2-0-2</td>
<td>2-0-2</td>
<td>2-0-2</td>
</tr>
<tr>
<td>P.T.</td>
<td>101</td>
<td>Swimming</td>
<td>0-4-1</td>
<td>......</td>
<td>......</td>
</tr>
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<td>P.T.****</td>
<td>101</td>
<td>Physical Training</td>
<td>0-4-1</td>
<td>0-4-1</td>
<td>0-4-1</td>
</tr>
<tr>
<td>Gen.</td>
<td>101</td>
<td>Orientation</td>
<td>1-0-0</td>
<td>......</td>
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<tr>
<td></td>
<td></td>
<td><strong>Totals</strong></td>
<td></td>
<td><strong>17-10-19</strong></td>
<td><strong>16-10-19</strong></td>
</tr>
</tbody>
</table>

### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.</td>
<td>290</td>
<td>Structures I</td>
<td>......</td>
<td>......</td>
<td>4-3-5</td>
</tr>
<tr>
<td>ESM</td>
<td>205</td>
<td>Statics</td>
<td>3-0-3</td>
<td>......</td>
<td>......</td>
</tr>
<tr>
<td>ESM</td>
<td>309-10</td>
<td>Dynamics I, II</td>
<td>......</td>
<td>3-0-3</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Hum./S.S./M.L.**</td>
<td>104-5</td>
<td>Humanities/Social Sciences/Modern Language</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>......</td>
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<tr>
<td>Math.</td>
<td>207</td>
<td>Calculus IV</td>
<td>5-0-5</td>
<td>......</td>
<td>......</td>
</tr>
<tr>
<td>Math.</td>
<td>208</td>
<td>Calculus and Linear Algebra</td>
<td>......</td>
<td>5-0-5</td>
<td>......</td>
</tr>
<tr>
<td>Math.</td>
<td>209</td>
<td>Ordinary Differential Equations</td>
<td>......</td>
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<td>5-0-5</td>
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<tr>
<td>M.E.</td>
<td>322</td>
<td>Thermodynamics</td>
<td>......</td>
<td>......</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Phys.</td>
<td>228-29</td>
<td>Physics</td>
<td>4-3-5</td>
<td>4-3-5</td>
<td>......</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Totals</strong></td>
<td></td>
<td><strong>15-3-16</strong></td>
<td><strong>15-3-16</strong></td>
</tr>
</tbody>
</table>

*See page 38 of the catalog for engineering electives.
**Eighteen credit hours in Humanities and 18 credit hours in Social Sciences are required for graduation. To satisfy these requirements, Humanities and Social Sciences courses must be selected from the Engineering College listings on page 37 of the General Catalog.
***These free elective courses may be taken at any time during a student's course of study. However, if six credit hours of basic ROTC are elected, ROTC must be scheduled the first quarter the student is enrolled. For further details see page 29 of the catalog.
****The student may elect any two of the physical training courses listed under Department of Physical Training in the General Catalog.
### Junior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E. 361-2-3</td>
<td>Fluid Mechanics I, II, III</td>
<td>4-3-5</td>
<td>4-3-5</td>
<td>4-3-5</td>
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<tr>
<td>A.E. 391-2-3</td>
<td>Structures II, III, IV</td>
<td>4-3-5</td>
<td>4-3-5</td>
<td>4-3-5</td>
</tr>
<tr>
<td>E.E. 325</td>
<td>Electric Circuits and Fields</td>
<td>2-3-3</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>E.E. 326</td>
<td>Elementary Electronics</td>
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<td>2-3-3</td>
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</tr>
<tr>
<td>ESM 421</td>
<td>Mechanical Vibrations</td>
<td>-------</td>
<td>-------</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Hum./S.S./M.L.*</td>
<td>Humanities/Social Sciences/ Modern Language</td>
<td>3-0-3</td>
<td>3-0-3</td>
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</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td>13-9-16</td>
<td>13-9-16</td>
<td>14-6-16</td>
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</table>

### Senior Year

<table>
<thead>
<tr>
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<th>Subject</th>
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<th>2nd Q.</th>
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<tbody>
<tr>
<td>A.E. 443</td>
<td>Aerospace Engineering Design Project</td>
<td>-------</td>
<td>-------</td>
<td>3-9-6</td>
</tr>
<tr>
<td>A.E. 456</td>
<td>Vibration and Flutter</td>
<td>3-0-3</td>
<td>-------</td>
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</tr>
<tr>
<td>A.E. 458</td>
<td>Stability and Control</td>
<td>-------</td>
<td>5-0-5</td>
<td>-------</td>
</tr>
<tr>
<td>A.E. 460</td>
<td>Fluid Mechanics IV</td>
<td>4-3-5</td>
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</tr>
<tr>
<td>A.E. 480</td>
<td>Jet Propulsion</td>
<td>-------</td>
<td>5-0-5</td>
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</tr>
<tr>
<td>Hum./S.S./M.L.*</td>
<td>Humanities/Social Sciences/ Modern Language</td>
<td>3-0-3</td>
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<tr>
<td>Math. 412</td>
<td>Advanced Engineering Math</td>
<td>3-0-3</td>
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<tr>
<td>Electives**</td>
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<td>3-0-3</td>
<td>6-0-6</td>
</tr>
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<td><strong>Totals</strong></td>
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<td>16-0-16</td>
<td>12-9-15</td>
</tr>
</tbody>
</table>

*Eighteen credit hours in Humanities and 18 credit hours in Social Sciences are required for graduation. To satisfy these requirements, Humanities and Social Sciences courses must be selected from the Engineering College listings on page 37 of the General Catalog. **Free electives. Not more than 9 credit hours of advanced ROTC may be applied toward the requirements for a degree.
Courses of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

A.E. 110. Introduction to Engineering
2-3-3. Prerequisite: None.

As a road map to engineering, this course emphasizes creative imagination, rather than mathematics, as the tool most important to the engineer, especially to the designer. The course deals with the tie between biology and engineering, demonstrating that the study of natural structures, form, systems, and process can assist the engineer in formulating better solutions to his problems.

A.E. 290. Structures I
4-3-5. Prerequisites: Math 208 and ESM 205; 2.0 overall average and a 2.0 average in Math and in Physics.

Introduction to the elements of structural mechanics which are basic in the design of aircraft and missile structures. Emphasis on the use of the concepts of strain and stress in problems involving trusses and beams with application to wing type structures. Relation of design decisions to phenomenological failure theories.

Text: To be selected.

A.E. 361. Fluid Mechanics I
4-3-5. Prerequisite: Math. 209 and M.E. 322; 2.0 overall average and a 2.0 average in Math and in Physics.

The atmosphere, properties of fluids, classifications of flows, flow parameters, and one-dimensional flows including Bernoulli equation, stagnation conditions, sonic speed, isentropic flows, normal shocks, and duct flows with friction and heat addition.

Text: To be selected.

A.E. 362. Fluid Mechanics II
4-3-5. Prerequisites: A.E. 361.

The development of the physical equations for continuum flows followed by applications to laminar and turbulent boundary layers for incompressible and compressible flow.

Text: Kuethe and Schetzer, *Foundations of Aerodynamics*.

A.E. 363. Fluid Mechanics III
4-3-5. Prerequisites: A.E. 362.

Two-dimensional incompressible flow theory, superpositioning of flows, and conformal transformations, with applications to flow around bodies and to airfoil theory.

Text: Kuethe and Schetzer, *Foundations of Aerodynamics*.

A.E. 391. Structures II
4-3-5. Prerequisites: Math. 209 and A.E. 290.

Discussion of inertia loads and load factors. Analysis of three-dimensional trusses, thin-walled beams, beams with taper and unsymmetrical bending. Introduction to theory of elasticity and application to selected two-dimensional problems.

Text: To be selected.

A.E. 392. Structures III
4-3-5. Prerequisites: A.E. 391.

Principle of virtual work and introduction to energy principles. Applications to truss, beam and frame problems with linear and nonlinear elasticity and including shear deformation and temperature effects. Principle of superposition, flexibility and influence coefficients, reciprocal theorem, Betti's Law. Introduction to stability analysis with application to simple models and to columns. Plastic bending of beams and effects of impact loading.

Text: To be selected.

A.E. 393. Structures IV
4-3-5. Prerequisites: A.E. 392.


Text: To be selected.
A.E. 401-2-3. Aeronautical Research
I,II,III
0-9-3. Prerequisites: Third quarter junior or senior standing and approval of A.E.
School Director.

A clearly stated program prepared by
the student describing in detail the nature,
purpose and scope of the proposed
problem, carrying the endorsement of the
sponsoring A.E. staff member, must be
submitted to the A.E. School Director for
approval. Library, experimental, or theo-
retical work will be considered.

A.E. 410. Thermal Stresses
3-0-3. Prerequisites: A.E. 393 or consent
of instructor.

Origin of thermal stress; external
constraints; determination of tempera-
tures—the heat transfer problem; funda-
mental equations of uncoupled isotropic
thermoelasticity; some solutions of typical
thermoelastic problems; properties of
materials at high temperatures; problems
in creep analysis.
Text: Gatewood, Thermal Stresses.

A.E. 428. Experimental Methods
1-6-3. Prerequisites: A.E. 460.

The methods, equipment, and instru-
mentation used in experimental aerospace
engineering. The technique of recording
and interpreting experimental data from
selected laboratory tests is emphasized.

A.E. 439. Advanced Structures
3-0-3. Prerequisites: A.E. 393 or consent
of instructor.

Detailed study of beam columns, shear
webs with cut-outs; shear lag, bending in
the plastic range; miscellaneous thin metal
structural problems.
Text: Peery, Aircraft Structures; Niles and
Newell, Airplane Structures, Vol. II.

A.E. 443. Aerospace Engineering
Design Project
3-9-6. Prerequisite: Last quarter senior
standing or consent of instructor.

Preliminary design or case study of a
contemporary aerospace system such as a
complete flight vehicle, a jet propulsion
system or a flight vehicle structural
system. The laboratory periods will be
used for the design and/or design analyses
while the lecture periods will be used to
introduce the related engineering analysis,
experimental results, empiricism, and
technical literature and to maintain
organization, interchange ideas, and report
progress.

A.E. 456. Vibration and Flutter
3-0-3. Prerequisites: A.E. 363, ESM 421;
and Math. 412 or concurrently.

Structural dynamics of one-dimen-
sional systems utilizing normal coordi-
nates. Fundamental analyses of static
aeroelastic phenomena and various types
of flutter. Formulation of the generalized
equations of motion for complete aero-
elastic systems and a description of the
techniques used for this solution.
Text: Scanlon and Rosenbaum, Aircraft
Vibration and Flutter.

A.E. 458. Stability and Control
5-0-5. Prerequisites: A.E. 460 and ESM
421.

Principles of static lateral and longitudi-
nal stability and studies of the equations
and methods used in the analysis of
dynamic stability and controls. Applica-
tions to airplane and missile systems are
emphasized.

A.E. 460. Fluid Mechanics IV
4-3-5. Prerequisites: A.E. 363.

Finite wing theory in incompressible
flow, two-dimensional subsonic and super-
sonic compressible flows, airfoils and
finite wings in compressible flow, super-
sonic flow around bodies of revolution,
and an introduction to transonics and
hypersonics.
Text: Kuethe and Schetzer, Foundations
of Aerodynamics.

A.E. 473. Introduction to Propeller
and Rotor Theory
3-0-3. Prerequisites: A.E. 460 or concur-
rently or consent of instructor.
A study of the theory and equations used in the design of propellers and helicopter rotors.

**A.E. 480. Jet Propulsion**  
5-0-5. Prerequisite: A.E. 460.  
The theory and principles of jet propulsion including the mechanics and thermodynamics of combustion and reacting one-dimensional flows, theory of engine diffusers and exhaust nozzles, fundamental principles of jet propulsion, and cycle analysis and performance characteristics of gas turbine, turbo-prop, turbo-fan, turbo-jet, ram-jet, and rocket engines.  

**Graduate Courses Offered**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
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</thead>
<tbody>
<tr>
<td>A.E. 604,5,6</td>
<td>Special Problems in Aerospace Engineering</td>
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<tr>
<td>A.E. 607*</td>
<td>Thermodynamics</td>
<td>4-0-4</td>
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<tr>
<td>A.E. 608*</td>
<td>Combustion I</td>
<td>3-0-3</td>
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<tr>
<td>A.E. 609*</td>
<td>Combustion II</td>
<td>3-0-3</td>
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<tr>
<td>A.E. 621</td>
<td>Elements of Viscous Fluid Theory</td>
<td>3-0-3</td>
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<tr>
<td>A.E. 622</td>
<td>Elements of Compressible Flow Theory</td>
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<tr>
<td>A.E. 630</td>
<td>Theoretical Elasticity</td>
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<tr>
<td>A.E. 631</td>
<td>Advanced Structural Analysis I</td>
<td>3-0-3</td>
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<tr>
<td>A.E. 632</td>
<td>Advanced Structural Analysis II</td>
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<td>A.E. 634</td>
<td>Advanced Structural Analysis IV</td>
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<td>A.E. 635</td>
<td>Advanced Structural Analysis V</td>
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<tr>
<td>A.E. 636</td>
<td>Aerospace Structures Laboratory</td>
<td>1-6-3</td>
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<tr>
<td>A.E. 640</td>
<td>Molecular Gas Dynamics</td>
<td>3-0-3</td>
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<td>A.E. 641</td>
<td>Rarefied Gas Dynamics I</td>
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<td>A.E. 645</td>
<td>High Temperature Gas Dynamics I</td>
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<tr>
<td>A.E. 646</td>
<td>High Temperature Gas Dynamics II</td>
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<td>A.E. 650</td>
<td>Advanced Potential Flow I</td>
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<td>A.E. 651</td>
<td>Structural Dynamics I</td>
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<tr>
<td>A.E. 654**</td>
<td>Systems Design Methodology</td>
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<td>A.E. 655,6**</td>
<td>Complex Systems Design</td>
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<td>Thermal Effects in Structures I</td>
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<td>A.E. 661</td>
<td>Thermal Effects in Structures II</td>
<td>3-0-3</td>
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<td>A.E. 662</td>
<td>Thermal Effects in Structures III</td>
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<tr>
<td>A.E. 670</td>
<td>Meteorology and Atmospheric Dynamics</td>
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<tr>
<td>A.E. 671</td>
<td>Turbulence and Atmospheric Dynamics</td>
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<td>Aerodynamics of the Helicopter I</td>
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<td>Aerodynamics of the Helicopter II</td>
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<td>Rocket Propulsion Principles II</td>
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<td>Engineering Acoustics I</td>
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<tr>
<td>A.E. 695***</td>
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<td>Master’s Thesis</td>
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<td>Aerospace Seminar</td>
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<td>A.E. 704, 5, 6</td>
<td>Special Problems in Aerospace Engineering</td>
<td>Credit to be arranged</td>
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<td>A.E. 712****</td>
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<td>A.E. 713****</td>
<td>Magnetogasdynamics III</td>
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<td>A.E. 714****</td>
<td>Methods of Experimental Magnetogasdynamics</td>
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<td>A.E. 719</td>
<td>Hypersonic Flow Theory</td>
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<td>A.E. 750</td>
<td>Advanced Potential Flow II</td>
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<td>Structural Dynamics II</td>
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<td>A.E. 752</td>
<td>Applied Aeroelasticity I</td>
<td>3-0-3</td>
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<tr>
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<td>Applied Aeroelasticity II</td>
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<tr>
<td>A.E. 754</td>
<td>Experimental Aeroelasticity</td>
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<tr>
<td>A.E. 756</td>
<td>Special Topics in Aeroelasticity I</td>
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<tr>
<td>A.E. 757</td>
<td>Special Topics in Aeroelasticity II</td>
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<td>A.E. 780,1****</td>
<td>Space Power and Energy Conversion</td>
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<td>A.E. 782****</td>
<td>Space Nuclear Propulsion</td>
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<td>A.E. 799</td>
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<td>A.E. 800</td>
<td>Doctor’s Thesis</td>
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</table>

*Also taught as M.E. 607, 608, and 609, respectively.
**Also taught as E.E. 654, 655, 656 and M.E. 654, 655, 656.
***Also taught as ESM 694 and 695, respectively.
****Also taught as M.E. 711, 712, 713, and 714, respectively.
*****Also taught as N.E. 780, 781, and 782, respectively.
Air Force Aerospace Studies / 47

DEPARTMENT OF AIR FORCE AEROSPACE STUDIES
(Established in 1950)

Professor of Air Force Aerospace Studies—Colonel William T. Preston; Assistant Professors—Major Thomas A. Barrett, Major John C. Cardosi, Major Dee G. Sullins, Jr.; Capt. Dallas D. Morgan; Staff—Master Sergeant Cecil C. Culbreth, Staff Sergeant Kenneth R. Clinkingbeard, Staff Sergeant Albert F. Cron, Jr., Technical Sergeant Lindel R. Thompson; Secretary—Mrs. Elizabeth W. Cerulli.

Air Force Reserve Officer Training Corps
The Department of Air Force Aerospace Studies was established in 1950 to select and prepare students to serve as officers in the Regular and Reserve components of the United States Air Force. AFROTC training is divided into two phases. The first two years constitute the General Military Course (GMC); the last two years the Professional Officer Course (POC). Students with prior active military service or previous officer training in high school or college may receive a waiver and credit for portions of the GMC. Co-operative students can be accommodated in both the GMC and POC.

Four-Year Program
A formal application is not required from students entering the 4-year program. Students enroll in Air Force ROTC courses in the same manner in which they register for other undergraduate college courses. Enrollment in the GMC is normally for freshmen and sophomores. Students enrolled in the GMC incur no military obligation. Students must compete for entry into the POC which is usually taken during the last two years of college. Selection is based upon the results of an Air Force medical examination, the scores achieved on the Air Force Officer Qualifying Test, and an interview by a board of Air Force officers. Selectees must be free from academic probation, or any institutional status denoting academic deficiency. Students accepted for the POC become members of the Air Force Reserve and receive a $100 per month tax-free subsistence allowance. Upon request, Selective Service Student Deferments are available for full time students enrolled in the GMC.

Two-Year Program
The 2-year program and the last two years of the 4-year program are identical in academic content. To be eligible for the 2-year program, students must have two academic years remaining at the undergraduate, graduate level, or both levels combined at the time of enrollment. Entry into the 2-year program is also on a competitive basis. Students still must qualify on the Air Force Officer Qualifying Test, the Air Force medical exam, and be selected by a board of Air Force officers. In addition, candidates must successfully complete a 6-week Field Training Course at an Air Force base during the summer preceding their enrollment. They are then ready to enter the POC upon their return to campus.
Air Force ROTC College Scholarship Program

AFROTC College Scholarships are available to qualified cadets in the two- and the four-year programs. These scholarships cover tuition, matriculation, health service, student activities fee, and an allowance for books. Scholarship cadets also receive a $100 per month tax-free subsistence allowance. Initial selection for scholarships to sophomores, juniors, and seniors is made on campus by a board composed of institutional officials and Air Force officers. Final selection is made by a central selection board at the Air Force ROTC Headquarters. Cadets are selected on the basis of:

1. Scores achieved on the Air Force Officers Qualifying Test.
2. Grade point average of at least 2.0 on a 4.0 (A) scale.
3. The rating from an interview board composed of institutional officials and Air Force officers.

Additionally, the academic major and potential active duty career field of each cadet is considered relative to the needs of the Air Force. Receiving an AFROTC Scholarship does not result in any additional active duty service commitment. High school seniors may also compete for a four year scholarship by applying directly to Headquarters, Air Force ROTC (ARTO-OTTA), Maxwell AFB, AL 36112, not later than mid November of their senior year.

Flight Instruction Program

The Flight Instruction Program provides up to 35 hours of flight training and the necessary ground school required by the Federal Aviation Administration for primary flying schools. The main purpose of this program is to determine aptitude and interest in training as an Air Force pilot after commissioning. This program may lead to a private pilot’s certificate. Flight instruction is provided by a civilian flying school which is approved and certified by the Federal Aviation Administration. This program is only open to male POC category I-P cadets who are physically and mentally qualified and who desire to be pilots.

Leadership Laboratory

Leadership Laboratory is that portion of the AFROTC on-campus curriculum that centers on the cadet corps. This activity is largely cadet planned and directed under the supervision of the department head. The function of the laboratory is to provide leadership training experiences which will improve a cadet’s ability to perform later as an USAF officer. These experiences range from participating in basic military drill and ceremonies to instructing, correcting, and evaluating other cadets. It culminates in organizing, directing, and managing the entire cadet corps.

Field Training

Cadets in the four-year program normally attend a four-week Field Training session between their sophomore and junior years; except co-ops who normally
attend Field Training after graduation. Special cases are handled on an individual basis. Candidates for the 2-year program must attend a special six-week Field Training prior to beginning the POC. Cadets will receive pay, compensation for travel expenses, and are furnished food, housing, uniforms, and medical care while attending Field Training, which is conducted at regularly established Air Force bases. The major areas of training at these Air Bases include junior officer, aircraft, aircrew, and career orientation, survival training, base functions, Air Force environment and physical training. The six-week camps, in addition, cover the content of the General Military Course and 60 hours of Leadership Laboratory.

Summary of Qualifications and Requirements

I. General Qualifications
   1. Be a citizen of the United States
   2. Be of sound physical condition
   3. Be of sound moral character
   4. Be at least 14 years of age

II. Additional Qualifications for Admission to the Professional Officer Course (POC):
   1. For the 4-year cadet, complete the General Military Course
   2. For the 2-year applicant, complete the 6-week Field Training Course
   3. Qualify on the Air Force Officer Qualifying Test (AFOQT)
   4. Qualify on the Air Force medical evaluation
   5. Be interviewed and selected by a board of Air Force officers
   6. Enlist in the Air Force Reserve prior to entry into the POC

III. Commission Requirements:
   1. If applying for the 2-year program, attend the 6-week Field Training Course and, upon satisfactory completion, participate in 3 hours of classroom instruction and an average of 1 hour of Corps Training each week for 2 years (i.e. completion of the Professional Officer Course)
   2. If in the 4-year program, participate in 1 hour of classroom and 1 hour of Corps Training each week for 2 years, prior to entry and completion of the Professional Officer Course
   3. Earn at least a baccalaureate degree
   4. Agree to accept, if offered, a commission in the United States Air Force
   5. Remain medically, morally, and otherwise qualified for a commission

IV. How to Apply:
   1. Students applying for the 4-year program register for the Air Force ROTC in the same manner and at the same time as they-register for other undergraduate college courses.
   2. Students interested in applying for the 2-year program must be enrolled at Georgia Tech and apply to the Professor of Air Force Aerospace
Studies. Application must be made early in the academic year and not later than registration week of Winter Quarter which precedes Field Training. The student must have two academic years of study remaining after completion of the six-week Field Training.

3. Transfer students should contact this department directly at the same time they apply to the registrar for entry to Georgia Tech. This will allow processing time to determine student eligibility.

V. Complete physical requirements are too lengthy and technical to be listed here. The following are simply some of the more important:

Requirements for Air Force Commission:

1. At least 20/400 bilateral vision without glasses, correctable to 20/30 in one eye and 20/40 in the other
2. Normal hearing
3. Blood pressure: Systolic, between 100 and 139
   Diastolic between 60 and 89
4. Normal heartbeat, free of murmurs
5. Height between 64 and 80 inches for men and 60 and 72 inches for women.
6. Weight normal for height and age
7. No history of asthma since 12th birthday
8. No limiting physical infirmity
9. Good dental health

Additional Requirements for pilot or navigator (male only):

1. Pilots: 20/20 bilateral near and far vision without glasses
   Navigators: 20/70 bilateral far vision correctable with glasses to 20/20 and 20/20 bilateral near vision uncorrected
2. Normal color vision
3. Normal hearing
4. Not over 76 inches in height; at least 64 inches
5. No history of hay fever or sinusitis since twelfth birthday
6. At least eight serviceable, opposed teeth in both upper and lower jaws

UNIFORMS AND AIR FORCE TEXTS

The Air Force ROTC uniform is identical to the regulation Air Force uniform except for insignia. Air Force ROTC cadets are required to wear the uniform during Corps Training periods. Newly entering students in the Air Force ROTC are issued required uniforms and most of their textbooks from AFROTC supply. A deposit of $25.00 is required for course enrollment. The uniform remains the property of the Air Force and is returned to supply when the course is dropped, the student transfers to another institution, or upon completion of the General Military Course. The full $25.00 deposit, less cost of lost or damaged items of uniform, will be refunded to the student when he returns the uniform.
A cadet entering the Professional Officer Course is required to purchase a new uniform through Georgia Institute of Technology. The cost of the Professional Officer Course uniform is approximately $108.00. A Professional Officer Course cadet will receive a partial reimbursement for the uniform upon completion of the course or upon disenrollment without prejudice. In addition he will be allowed to retain the uniform.

**Academic Credit**

Academic credit is granted for the completion of Air Force ROTC courses as indicated in the sections that follow, however, not more than 6 hours in General Military Courses and not more than 9 hours in Professional Officer Courses may be applied toward a degree.

<table>
<thead>
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<th>Course</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
<th>Credit Hrs.</th>
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<td>1</td>
<td>1</td>
<td>3</td>
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<tr>
<td>2nd year</td>
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<tr>
<td>Professional Officer Course:</td>
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<tr>
<td>1st year</td>
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<td>Total</td>
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**Courses of Instruction**

NOTE: 3-1-3 means 3 hours class, 1 hour laboratory, 3 hours credit.

**GENERAL MILITARY COURSE**

This two-year course examines the role of the U.S. military forces in the contemporary world with particular attention to the United States Air Force, its organization, and mission. The functions of strategic offensive, defensive, general purpose, and aerospace support forces are covered. The roles of these forces are related to national defense policy, national policy, general and limited war, alliances and the strategies and policies of the Soviet Union and China. Deviation from normal course sequence may be waived by the Department Head.

**AEROSPACE STUDIES I**

- United States Military Forces in the Contemporary World
  - A.S. 151. The United States Aerospace Organization and Strategic Offensive Forces
    - 1-1-1.
      - A study of the United States Air Force doctrine, mission and organization; the strategic offensive forces are covered with emphasis on mission and employment.
  - A.S. 152. The United States Aerospace Strategic Defensive and General Purpose Forces
    - 1-1-1.
      - A study of the United States strategic defensive and general purpose forces;
emphasis on their mission and employment and the control over employment of nuclear weapons.

A.S. 153. The United States Aerospace Support and General Purpose Forces

1-1-1.

A study of the mission, resources and operation of tactical air forces with special attention to limited war; review of Army, Navy and Marine general purpose forces and aerospace support forces.

AEROSPACE STUDIES II — United States Military Forces in the Contemporary World

A.S. 251. Modern Warfare and the United States Department of Defense

1-1-1.

This course is designed to familiarize the student with the nature and principles of modern warfare. Emphasis will be placed on analysis of the instruments of national power, with special attention being given to the military instrument. Also included is a look at the organization of the United States Department of Defense, to include the roles and missions of the several military departments.

A.S. 252. Comparative Military Policies and Capabilities

1-1-1.

The objective of this course is to provide the student a comparative look at both the military capabilities and policies of the United States, the Soviet Union and Red China. Current examples of general and limited war strategies of all three nations will be considered. In addition, the security alliances to which the above nations are aligned will be surveyed.


1-1-1.

This course will provide the student with a detailed study of the various aspects of how United States defense policy is determined. Included will be a study of the roles in defense policymaking of the President and the Executive Branch agencies, the National Security Council, the Joint Chiefs of Staff, and the Legislative Branch. Particular attention will be given to the relationship between foreign policy and defense policy.

PROFESSIONAL OFFICER COURSE

This two-year course concentrates on three main themes: Aerospace Power and Space Operations, the concepts and practices of leadership, and the concepts and practices of management, especially as related to the U.S. Air Force.

AEROSPACE STUDIES III — The Growth and Development of Aerospace Power

A.S. 311. Development of Air Power

3-1-3.

A survey of the development of air power in the United States. Major emphasis is placed on the development of doctrine, technology, organization and employment of this nation's air arm between 1903 and 1961. Within this study, attention is devoted to developing the communicative skills needed by junior officers.

A.S. 312. Contemporary Aerospace Power

3-1-3.

A survey of contemporary air power including: strategies and military programs in the contemporary nuclear age, employment of aerospace forces, and the future of manned aircraft. Within this study, attention is devoted to developing the communicative skills needed by the junior officer.

A.S. 313. Astronautics and Space Operations

3-1-3.

An examination of the national space effort and its evolution; characteristics of the spatial environment; types of orbits
and trajectories; space vehicle systems, and concepts of space operations and their application to future aerospace power. Within this study, attention is devoted to developing the communicative skills needed by the junior officer.

AEROSPACE STUDIES IV – THE PROFESSIONAL OFFICER

A.S. 411. Air Force Leadership
3-1-3.
A study of the need for Air Force leadership, human relations, and discipline in the military services. Command positions in leadership laboratory.

A.S. 412. Command-Staff Relationships
3-1-3.
A study of the variables affecting leadership, problem solving, and the principles and concepts of the commander and his staff. Introduction to Air Force management and the military justice system.

A.S. 413. Air Force Management and the Junior Officer
3-1-3.
SCHOOL OF ARCHITECTURE*
(Established in 1908)


General Information

The School of Architecture was established as a degree granting department of the Institute in 1908 and now offers the following courses of study—(1) the five-year curricula in Architecture with options in Architectural Design or Structural Design both leading to the degree Bachelor of Architecture, (2) a four-year curriculum in Building Construction leading to the degree Bachelor of Science in Building Construction and (3) a four-year curriculum in Industrial Design leading to the degree Bachelor of Science in Industrial Design. In addition, the graduate program in Architecture** leads to the degree Master of Architecture, and the graduate program in City Planning** leads to the degree Master of City Planning.

In addition, the following graduate studies are offered: a one-year program leading to the degree Master of Architecture; a joint two-year program with emphasis on Urban Design leading to the simultaneous award of the degrees Master of Architecture and Master of City Planning; a one-year program in City Planning studies leading to the degree Master of Science without designation; the regular two-year program leading to the degree Master of City Planning; and the

*Please see the note on page 68 concerning the possible curricula revision before the academic year 1972-73.

**For the complete details of the graduate programs in Architecture and City Planning, consult the Graduate Bulletin.
joint two-year programs leading to the simultaneous award of the degrees Master of City Planning and Master of Civil Engineering (Transportation Engineering), or Master of Landscape Architecture at the University of Georgia.

Except for those courses listed as electives on page 38 of this catalog, instruction is available only to majors in the School of Architecture.

Architecture

The original objective and first aim of the School is to prepare students for the profession of Architecture. The scope of the field is of such breadth in current practice that need is felt not only for men who are strong in design but for others whose interests will be closely integrated with design in structural and mechanical techniques. The training in Architecture is uniform for the first four years with two areas of specialization, Architectural Design and Structural Design, strongly emphasized in the final year. The central core of the curriculum in Architecture is the study of design, with related exercises and drawing, graphics, visual composition, and model building. The student is given an opportunity in these courses to develop his creative as well as his analytical powers by finding solutions to programs employing the requirements of contemporary buildings and paralleling the conditions to be encountered in later practice. Instruction is generally in the form of guidance and suggestion on the part of the instructor to each student individually, accompanied by group discussions, lectures, and demonstrations. Solutions are submitted as drawings or models for review and judgment by a jury of teachers, practicing architects, and such designers or specialists as the occasion may require.

Closely allied to design and, insofar as possible, integrated with it are the courses in construction which, in turn, are dependent on the basic requirements of mathematics, physics, and mechanics. Courses in the history and theory of architecture supply a fuller understanding of our architectural heritage and its meaning and impact on contemporary problems. Work of technical importance is offered in building materials, mechanical plant (plumbing, heating, air-conditioning and electrical installations), office, and field practice.

The National Architectural Accrediting Board has officially accredited the five-year course leading to the degree Bachelor of Architecture at the Georgia Institute of Technology.

The National Council of Architectural Registration Boards and the Georgia State Board for the Examination, Qualification and Registration of Architects, recognize the Bachelor of Architecture degree at the Georgia Institute of Technology as adequate preparation for practice, with the exception of experience requirements. After three years internship in the office of a registered architect, Bachelor of Architecture graduates may apply for examination and registration as licensed architects.

All work executed in classes administered by the School becomes the property of the School and will be retained, or returned at the discretion of the faculty.
The faculty reserves the right to refuse for credit any project executed outside the precincts of the School of Architecture, or otherwise executed without proper coordination with the instructor.

Standards for Advancement

All students entering the School of Architecture are required during the first term of residence to take interest and aptitude tests with the Office of Guidance and Testing.

Curriculum in Architecture

In order for students to obtain the greatest benefit from courses offered concurrently in the curriculum, progress will be noted at several intervals as follows:

a) Averages in drawing and design will be checked at the end of each year-group of three courses (151-52-53; 251-52-53, etc.). A student will not be permitted to enter a more advanced group until his record in the previous group equals 2.0 or better.

b) Admission to the third year of Architecture will be based on faculty approval plus the completion of all required and prerequisite courses, both academic and departmental, in the first two years of the curriculum. A point average in design of 2.0 and an overall average not less than 1.9 are required. The student on entering the third year must be prepared to schedule his primary subjects concurrently (Arch. 322, 351, 361, ESM 346).

c) Admission to the fifth year of Architecture will be based on faculty approval plus the completion of all required and prerequisite courses, both academic and departmental, in the first four years of the curriculum. A point average of 2.0, both overall and in design courses is required. The student must be prepared to schedule his primary subjects concurrently (Arch. 551 or 554, 561 and C.E. 400);

d) Admission to the thesis in Architecture requires faculty approval and a minimum average of 2.0 in Arch. 551-52 (Option I) or 554-55 (Option II).

e) To qualify for graduation each student must present an affidavit confirming at least three months' practical experience in the office of a registered architect or approved construction company.

Curriculum in Building Construction

a) Requirements for the first two years are identical with those for architectural students, except for the substitutions noted.

b) Admission to the third year of Building Construction will be based on faculty approval plus the completion of all required and prerequisite
courses, both academic and departmental, in the first two years of the curriculum. An overall average not less than 1.9 is required. The student must be prepared to schedule his primary subjects concurrently (Arch. 322, 337, ESM 346).

c) To become a candidate for a degree, the student must present an affidavit confirming at least three months' practical experience with an approved construction or materials concern.

Curriculum in Industrial Design

a) Requirements for the first four quarters are identical with those for architectural students, except for the substitutions noted.

b) Averages in Industrial Design will be checked at the end of each year-group of courses (I.D. 202-3, I.D. 301-2-3, etc.). A student will not be permitted to enter a more advanced group until his record in the previous group equals 2.0 or better.

ARCHITECTURE

Freshman Year

(Uniform for Architecture, Building Construction and Industrial Design)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<th>3rd Q.</th>
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</table>

Totals 15-16-19 15-16-19 15-16-19

NOTE: Under Quarters, 3-3-4 means 3 hours class, 3 hours lab., 4 hours credit.
*Chemistry is required in place of M.L. for the curricula in Building Construction and Industrial Design.
**These free elective courses may be taken at any time during a student's course of study. If these six credit hours are satisfied by selecting basic ROTC, it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.
## Sophomore Year

<table>
<thead>
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<td>Phys. 211-12-13</td>
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## Junior Year

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<td>Arch. 372-73</td>
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## Senior Year

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<td>E.E. 315</td>
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<td>11-24-19</td>
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*Electives: 8 hours must be chosen from the restricted list of the School of Architecture, Group I or Group II corresponding to option; 12 hours must be chosen from the list of general electives approved by the School of Architecture; 9 hours may be used as free electives. If advanced military is elected, only 9 hours will be credited toward a degree.
### Fifth Year (Option I–Architectural Design)

<table>
<thead>
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<th>Course No.</th>
<th>Subject</th>
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### Fifth Year (Option II–Structural Design)

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*Electives: 8 hours must be chosen from the restricted list of the School of Architecture, Group I or Group II corresponding to option; 12 hours must be chosen from the list of general electives approved by the School of Architecture; 9 hours may be used as free electives. If advanced military is elected, only 9 hours will be credited toward a degree.

### Building Construction

As one of the major industries in the country, construction needs men who are trained in the fields of materials, products, manufacture, sales, and general contracting. The Building Construction curriculum at Georgia Tech is designed to supply graduates for these varied building activities who, with the architect and engineer, help to coordinate all building projects. The course parallels the curriculum in Architecture for the first two years, then specializes in technical studies in construction, materials, personnel, and management problems. The degree, Bachelor of Science in Building Construction, is awarded on the completion of four years of study.
## Freshman and Sophomore Years—See Architecture.

### Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>No.</th>
<th>Subject</th>
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<tr>
<td>Arch.</td>
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<td>Building Materials</td>
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<td>Arch.</td>
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**Totals** | 19-0-19 | 16-6-18 | 18-6-20 |

### Senior Year

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<td>325</td>
<td>Survey of Bus. Law</td>
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<td>Mgt.</td>
<td>443</td>
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<td>3-0-3</td>
<td>6-0-6</td>
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</table>

**Totals** | 18-0-18 | 15-9-18 | 18-0-18 |

*Electives: 15 hours must be chosen from the approved list of the School of Architecture; 9 hours may be used as free electives. If advanced military is elected, only 9 hours will be credited toward a degree.
Industrial Design

Industrial Design deals with the development of those products of industry with which man, in utilizing them, has direct visual physical relationship, such as utensils, appliances, equipment, and furnishings for the home, industry, commercial, and public places.

The specialized curriculum in Industrial Design begins with the second term of the sophomore year. It is comprised of two design series which are taken concurrently.

The Industrial Design series deals with the nature of objects, the design processes, the different fields of design, and the types and groups of objects. In this series the student deals with the actual design and execution of text models as well as with the theoretical aspect of design for mass-production.

The Material and Technique series covers the relationship of design to various industrial materials and processes. In this series the student designs and executes objects, but is limited in each assignment to specific materials and/or processes.

The degree, Bachelor of Science in Industrial Design, is awarded on the completion of four years of study.

Freshman Year—See Architecture.

Sophomore Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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<tr>
<td>Arch. 251</td>
<td>Arch. Design</td>
<td>0-15-5</td>
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<tr>
<td>Arch. 254-55</td>
<td>Color Theory</td>
<td>......</td>
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<tr>
<td>I.D. 202-3</td>
<td>Design</td>
<td>......</td>
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<tr>
<td>I.D. 215-16</td>
<td>Material and Technique</td>
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<td>10-15-15</td>
<td>10-18-16</td>
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*Electives: 17 hours must be chosen from the approved list of the School of Architecture. 9 hours may be used as free electives. If advanced military is elected, only 9 hours will be credited toward a degree.
**Junior Year**

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<tr>
<th>Course No.</th>
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<tr>
<td>Arch. 354-55</td>
<td>Arch. Rendering</td>
<td>0-3-1</td>
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<td>Arch. 337-38-39</td>
<td>Arch. History</td>
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<td>I.D. 314-15-16</td>
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<td>General Metallurgy</td>
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<tr>
<td>I.E. 311</td>
<td>Manufacturing Processes</td>
<td>.......</td>
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**Senior Year**

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<td>1-15-6</td>
<td>1-18-7</td>
<td>1-21-8</td>
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<td>Legal and Ethical Phases of Engineering</td>
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*Electives: 17 hours must be chosen from the approved list of the School of Architecture. 9 hours may be used as free electives. If advanced military is elected, only 9 hours will be credited toward a degree.

**ELECTIVES**

General Electives: See humanities list on page 37 plus the following: Engl. 315, 320; ICS 151; I.D. 215, 216; Mgt. 316, 325, 340, 443; Math. 207, 208, 209, 236.

Restricted Electives: Group I: Arch. 254, 255, 335, 336, 354, 355, 384, 416, 435, 436, 444, 465, 466, 484, 485, 486, 510, 511, 512, 513, 514, 522, 530, 540, 541, 584. Group II: Arch. 540, 541, 584; C.E. 201 or 206, 211, 460; ICS 151; I.E. 460; M.E. 353.
Courses of Instruction: Architecture

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

Arch. 151, 152, 153. Architectural Drawing
0-9-3.

Introductory studies in drawing and the principles of visual expression; includes one laboratory period per week in creative drawing.


Arch. 162, 163. Orientation
1-0-0.

An introduction to the field of architecture and design; a requirement for all students in the School of Architecture.


Arch. 171, 172, 173. Graphics
1-3-2.

Lectures and laboratory exercises in descriptive geometry; shades and shadows; perspective.


Arch. 251, 252, 253. Design
0-15-5. Prerequisites: Arch. 153, 163, 173.

Basic composition, architectural problems and presentation methods; includes one laboratory period per week in creative drawing.

Arch. 254, 255. Color Theory
1-3-2. Prerequisite: Arch. 251 or Sophomore standing.

Lecture and laboratory experiments on the properties of color and its use in design.

Arch. 271 Introduction to Building Structures
3-0-3. Prerequisite: Math. 109.

A discussion of building frames and components and their relation to architecture.

Arch. 310, 311, 312. Freehand Drawing
0-3-1.

For non-architects and architects who lack credit when transferring from other schools or institutions. Creative drawing from compositions by students.

Arch. 322, 323, 324. Building Materials
2-0-2. Prerequisite: Arch. 253 or consent.

A study of materials of construction, their properties and use in modern construction, with special attention to their effect upon architectural design.


Arch. 335, 336. Art History
2-0-2. Prerequisite: Arch. 253 or consent.

A history of the development from primitive to modern times of the useful objects, artifacts, and inventions of man (tools, utensils, furniture, weapons, etc.) as distinguished from the usual categories of painting, sculpture, and architecture; with an analysis of present-day principles and processes.

Arch. 337, 338, 339. Architectural History
2-0-2. Prerequisite: Arch. 252 or consent.

A survey course in architectural history for non-architectural students. In non-technical language it covers architectural development from ancient times to the present. Lectures, supplemented by slide projection, notes, and reading assignments.


Arch. 351, 352, 353. Design
0-15-5. Prerequisites: Arch. 253 and admission to the third year curriculum.

Elementary problems in architectural design and presentation methods; includes
one laboratory period per week in creative drawing.

Text for 351: Burbank and Shaftel, *House Construction Details*.

**Arch. 354, 355. Architectural Rendering**

0-3-1. Prerequisite: Arch. 251.

Rendering of architectural subjects in various media.

**Arch. 361, 362, 363. History and Theory**

3-0-3. Prerequisite: Admission to the third year curriculum or consent.

History of architecture in ancient Egypt and Mesopotamia, Greece, and Rome; Medieval Europe; the Renaissance in continental Europe.


**Arch. 371, 372, 373. Structures**

3-0-3. Prerequisites: ESM 343 and admission to the third year curriculum.

Introduction to methods of construction, proportioning, and qualitative explanation of behavior; theory and design of ordinary timber structures; theory and design of metal structures (Part I).


**Arch. 381, 382. Design and Graphic Presentation**

1-12-4. Prerequisite: Senior standing.

A basic course in drawing and design for students preparing for the Master's program in City Planning. Not open to architectural students.

**Arch. 384. Acoustics of the Built Environment**

2-0-2. Prerequisite: Physics 213.

The basic principles of and the design approach to the acoustics of buildings and their surroundings.

**Arch. 410. Freehand Drawing**

0-6-2.

For non-architects, and architects electing additional work in creative drawing.

**Arch. 411. Freehand Drawing**

0-3-1.

For non-architects, and architects electing additional work in creative drawing.

**Arch. 412. Freehand Drawing**

0-6-2.

For non-architects, and architects electing additional work in creative drawing.

**Arch. 416. Introduction to Landscape Architecture**

2-0-2. Prerequisites: Arch. 451 and Arch. 461.

A brief history of landscape architecture followed by a study of the principles of landscape design as applied to contemporary problems.

**Arch. 435, 436. Art History**

2-0-2. Prerequisite: Junior standing.

A survey course in the history of artistic manifestations from primitive times to our own day.

Text: Janson, *History of Art*.

**Arch. 444. Housing Seminar**

2-0-2. Prerequisite: Junior standing.

Lecture and discussion broadly covering the housing field and the home building industry, housing needs, housing markets and financing, standards of design and construction, the Government and housing.

**Arch. 451, 452, 453. Design**

0-18-6. Prerequisites: Arch. 353 and advancement standard.

Intermediate problems in architectural design and presentation methods; includes
Arch. 461, 462, 463. History and Theory
3-0-3. Prerequisites: Arch. 363 and advancement standard.

Renaissance architecture in England and America; the 19th and 20th centuries; history of town and city planning in Europe and America.


Arch. 465, 466. Art History
2-0-2. Prerequisite: Junior standing.

A history of Pre-Columbian and Oriental art and architecture.

Arch. 471. Structures
3-0-3. Prerequisite: Arch. 373.

Theory and design of metal structures (Part II).


Arch. 484 (Psy. 484) Psychology and Environmental Design I
3-3-4. Prerequisite: Permission of instructor.

Arch. 485 (Psy. 485) Psychology and Environmental Design II
3-3-4. Prerequisite: Arch. 484 and permission of instructor.

Arch. 486 (Psy. 486) Special Problems in Psychological Aspects of Environmental Design
Prerequisites: Arch. 484, 485 and permission of instructor. Credit to be arranged.

Arch. 510, 511, 512. Freehand Drawing: Advanced
0-3-1. Prerequisite: Arch. 453.

Freehand drawing of varied subjects and in various media.

Arch. 513, 514. Freehand Drawing: Advanced
0-3-1, 0-6-2. Prerequisite: Arch. 453.

Freehand drawing from live models.

Arch. 522. Structural Design: Integration
3-3-4. Prerequisites: Arch. 373 and C.E. 400 or consent.

This course brings together the information obtained in previous courses in Structural Design and presents the subject matter as an integrated whole.

Arch. 530. Art History
2-0-2. Prerequisite: Arch. 339, 462, or consent.

A survey of 19th and 20th century art in Europe and the United States.


Arch. 540, 541. Research
0-6-2, 0-9-3, or 1-9-4.

A clearly stated program by the student describing in detail the nature, purpose, and extent of the proposed problem must be submitted for approval. The major portion of the work will be conducted in library, drafting room, or shop.

Arch. 551, 552, 553. Design

Group I. Advanced problems in architectural design with emphasis on the solution of complex building programs and site planning, terminating in an independent major problem submitted as a thesis for the degree Bachelor of Architecture (Option I).

Arch. 554, 555, 556. Design

Group II. Advanced Problems in architectural design with emphasis on structural solutions, computations, and
details; terminating in an independent problem submitted as a thesis for the degree Bachelor of Architecture (Option II).

Arch. 561, 562, 563. Seminar
2-0-2. Prerequisites: Arch. 453, 463.
Preparation of thesis programs and research; lectures and discussions of current problems in architectural design and architectural education.

Arch. 581, 582, 583. Professional Practice
3-0-3. Prerequisites: Arch. 453, 463 or senior standing.
Conduct of architectural practice, office organization, competitions, contracts, legal and ethical problems; specification writing; estimating and supervision of construction.

Arch. 584. Cost Analysis
2-3-3. Prerequisite: Senior standing.
Principles and methods of cost analysis in the construction industry. Methods of compiling and analyzing material, labor, and equipment production costs. Exercises in office and field management procedures.

Courses of Instruction: Industrial Design
NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

I.D. 202. Design
1-12-5. Prerequisite: Arch. 251. Concurrent with I.D. 215.
Introduction to Industrial Design. Theory and practical exercises in ideation and design procedure.

I.D. 203. Design
The basic attributes of objects. Study of factors which determine the characteristics of an object.

I.D. 215. Material and Technique
1-3-2. Prerequisite: Arch. 153 or consent.
The standard joints and hand-operated machines. Exercises, execution, and development of joints.

I.D. 216. Material and Technique
1-3-2. Prerequisite: I.D. 215 or consent.

I.D. 301. Design
1-12-5. Prerequisite: I.D. 203. Concurrent with I.D. 314.
Design of structural objects.

I.D. 302. Design
1-12-5. Prerequisite: I.D. 301. Concurrent with I.D. 315.
Design analysis of a mass produced object.

I.D. 303. Design
Design and execution of an object, based on studies in the previous course.

I.D. 314. Material and Technique
1-3-2. Prerequisite: I.D. 216.
Casting and fabricating techniques—plaster, plastic-casting, blowing, sand casting, ceramics, paper, rubber. Design of objects for the various techniques.
Texts: Bolz, Manufacturing Processes and Their Influence on Design; DuMond, Fabricated Materials and Parts.

I.D. 315. Material and Technique
1-3-2. Prerequisite: I.D. 314.
The industrial pre-formed materials—
extrusion, rolled and drawn profiles, mouldings.

Design of objects for the various techniques.


**I.D. 316. Material and Technique**

1-3-2. Prerequisite: I.D. 315.

Semi-automatic and mass-production techniques—forging, stamping, heading, screw machining, wire forming.

Design of objects for various techniques.


**I.D. 401. Design**


Graduate Courses Offered

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Arch. 601, 602, 603</td>
<td>Architectural Design: Special Problems</td>
<td>2-21-9</td>
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<tr>
<td>Arch. 607</td>
<td>Membrane Structures in Architecture</td>
<td>3-3-4</td>
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<td>Arch. 608</td>
<td>Pre-stressed Concrete Structures in Architecture</td>
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<td>Arch. 624</td>
<td>Advanced Structural Theory and Design</td>
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<td>Arch. 625</td>
<td>Advanced Building Construction</td>
<td>2-3-3</td>
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<td>Arch. 634, 635, 636</td>
<td>Special Problems in Architectural History</td>
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<td>Arch. 704, 705</td>
<td>Special Problems in Structure</td>
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<td>Arch. 706</td>
<td>Special Problems in Design</td>
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<td>Arch. 741</td>
<td>Urban Design Survey, Analysis, and Implementation Methods</td>
<td>2-3-3</td>
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<td>Arch. 742</td>
<td>Urban Design Research</td>
<td>1-6-3</td>
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<td>Arch. 751, 752, 753</td>
<td>Urban Design Problems I, II, III</td>
<td>2-21-9</td>
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<td>Arch. 761</td>
<td>Origin and Evolution of Cities</td>
<td>3-0-3</td>
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<td>Arch. 762</td>
<td>Theories and Principles of Urban Design</td>
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<td>Special Studies in Urban Problems</td>
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<td>C.P. 401, 402, 403</td>
<td>Urban Planning Communication I, II, III</td>
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<td>C.P. 600</td>
<td>Urban Community Planning</td>
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<td>C.P. 601</td>
<td>Land Use Planning</td>
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<td>C.P. 602, 603</td>
<td>Planning Legislation and Regulation</td>
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<tr>
<td>C.P. 605</td>
<td>Housing and Urban Renewal</td>
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Design of products enclosing engineering components.

**I.D. 402. Design**

1-18-7. Prerequisite: I.D. 401.

Ecology of products. Complex inter-relationship of products to space and time.

**I.D. 403. Design**

1-21-8. Prerequisite: I.D. 402.

Design and execution of a product based on studies in the preceding course.

**I.D. 414. Material and Technique**

1-3-2. Prerequisite: I.D. 316.

The mass-production techniques—die casting, impact extrusion, compression—transfer—molding.

Design of objects for various techniques.
GRADUATE COURSES

(Complete details about graduate courses in Architecture and City Planning are contained in the Graduate Bulletin, which is available upon request.)

Note*

The curricula contained in this catalog for Architecture, Building Construction, and Industrial Design are subject to revision before the opening of the academic year 1972-73. The five-year curriculum in Architecture is expected to be replaced by a four-year undergraduate program awarding the degree Bachelor of Science (undesignated) plus a two-year graduate program with several options awarding the professional degree Master of Architecture. For further information please address your inquiry to the School of Architecture, Georgia Institute of Technology, Atlanta, Georgia 30332.
SCHOOL OF BIOLOGY
(Established in 1960)

Acting Director—Edward L. Fincher; Professor Emeritus—Hugh A. Wyckoff; Professors—Robert H. Fetner, Thomas W. Kethley, Walter L. Bloom; Adjunct Professor—David W. Menzel; Associate Professors—Allen B. Eschenbrenner, John J. Heise, Alfred W. Hoadley, Hong S. Min, N. W. Walls, Edward K. Yeargers; Assistant Professors—John R. Strange; Instructors—Ann M. Colley, John B. Hamilton, Sharon V. Radford; Principal Secretary—Mrs. Corinne K. Cown.

General Information
The purpose of the School of Biology is to provide competence in this basic science to students of the Institute. There are unique opportunities for biological instruction and research in an environment of science and technological excellence. The curriculum draws heavily from the other sciences and engineering programs to prepare students for professional careers in biology. Completion of the curriculum also prepares students who wish to continue their studies in graduate programs or in medicine.

The Bachelor of Science in Applied Biology provides an adequate number of elective hours for the development of a program of study to meet individual student interest and career objectives.

Optional programs are available under revised curricula for the B.S. in Applied Biology and provide combined studies of biology and mechanics or of biology and electronics. Curricula for the B.S. in Applied Biology (Biomechanics Option) and for the B.S. in Applied Biology (Electronics Option) are shown below.

The school offers a program leading to the Master of Science degree. The members of the faculty are actively engaged in such research areas as: cell physiology, molecular biology, radiation biology, bacterial physiology, physiology, cytology, and biophysics.
### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>No.</th>
<th>Subject</th>
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**NOTE:** Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.

*Choice of: (1) two quarters of one of the following: American History, Political Science, Philosophy and History of Science, or Sociology; and the third quarter selected from one of the three remaining areas; or (2) three quarters of M.L. in either German, French, or Spanish. Three quarters of either M.L. or S.S. are required.

**These free elective courses may be taken at any time during a student's course of study. However, if six credit hours of basic ROTC are elected, then it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>No.</th>
<th>Subject</th>
<th>1st Q.</th>
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<th>3rd Q.</th>
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*Three quarters of either M.L. or S.S. are required.
### Junior Year

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*Not more than 9 hours of electives in the junior and senior years may be advanced ROTC. The remaining electives must be chosen in conference with a staff advisor to provide a sequence or group of courses which is interrelated to a specific field of interest.

### Senior Year

<table>
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*Not more than 9 hours of electives in the junior and senior years may be advanced ROTC. The remaining electives must be chosen in conference with a staff advisor to provide a sequence or group of courses which is interrelated to a specific field of interest.

NOTE: Of the 48 hours of electives, 25 hours must be departmentally approved courses in biology, mathematics, physics, chemistry, or engineering.
# B.S. in Applied Biology
## (Biomechanics Option)

### Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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**Totals** 16-7-17 15-7-17 15-7-17

*NOTE:* Under Quarter, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.  
*Choice of: (1) two quarters of one of the following: American History, Political Science, Philosophy and History of Science, or Sociology; and the third quarter selected from one of the three remaining areas; or (2) three quarters of M.L. in either German, French, or Spanish. Three quarters of either M.L. or S.S. are required.

### Sophomore Year

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**Totals** 15-9-18 15-3-16 13-9-16

*Three quarters of either M.L. or S.S. are required.*
### Junior Year

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*Three quarters of either M.L. or S.S. required.

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<td>7-6-16</td>
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*Up to 6 hours of basic ROTC, and a maximum of 9 hours of advanced ROTC, may be used for elective credit. The remaining electives must be chosen in conference with a staff advisor to provide a sequence or group of courses interrelated to a specific field of interest. **NOTE:** Of the 24 hours of electives, 6 hours must be selected from courses in Engineering Science and Mechanics.
### Freshman Year

<table>
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<th>Course No.</th>
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**Totals** 18-7-19 17-7-19 17-7-19

**NOTE:** Under Quarter, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.

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<tr>
<td>Bio. 210-11-12</td>
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**Totals** 14-6-16 15-6-17 15-6-17

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<td>Bio. 334</td>
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*Three quarters of either M.L. or S.S. required.
**Not more than 9 hours of electives in the junior and senior years may be advanced ROTC.

### Senior Year

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<tr>
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<th>Subject</th>
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*Not more than 9 hours of electives in the junior and senior years may be advanced ROTC.
The remaining electives must be chosen in conference with a staff advisor to provide a sequence or group of courses interrelated to a specific field of interest.
NOTE: Of the 29 hours of electives, 6 hours must be selected from electrical engineering courses (Recommended: E.E. 335, 477).

### Courses of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

**Bio. 101. Orientation to Biology**
1-0-1. Prerequisite: None.

An orientation to the broad spectrum of subdisciplines encompassed by the term "biology" and to the biology program at Georgia Tech. Survey of the nature of biology, contemporary research in biology, and the types of career opportunities available to graduates.

**Bio. 110-11-12. Introduction to Biology I, II, III**

3-3-4, 3-3-4, 3-3-4. Prerequisite: None.

A three quarter lecture and laboratory
study of the principles of biology for students interested in one year of laboratory science. The chemical basis of life is defined and life processes studied at the cellular and organism levels. Basic principles of genetics, physiology, metabolism, taxonomy, and evolution in plants and animals are discussed. Non-credit for biology majors.

Text: Keeton, *Biological Science."

**Bio. 210-11-12. Principles of Biology**

5-3-6, 5-3-6, 5-3-6. Prerequisites: Chem. 112; the biology courses to be taken in sequence.

These three courses constitute an intensive, three quarter introduction to the principles of biology and are intended for biology majors and students who have a strong interest in the subject of biology. Chemical as well as descriptive considerations are emphasized in the study of the physiology, anatomy, and genetics of individual cells. The cellular aspects of biology are then integrated into a study of the physiology, development, anatomy, and behavior of intact organisms, both plant and animal. Finally, a study is made of the ecology of populations of organisms, including the principles of biological evolution.

Text: Villee-Dethier, *Biological Principles and Processes*; supplemented by selected specialized texts.

**Bio. 310. General Microbiology**

3-6-5. Prerequisites: Bio. 212; Chem. 341.

Study of bacteria and other micro-organisms.

Text: Pelczar and Reid, *Microbiology*. 

**Bio. 311. Anatomy and Physiology**

3-0-3. Prerequisites: Junior standing or consent of instructor.

A study of the anatomy of the human body and fundamental mechanisms of human physiology designed for the advanced student in fields interdisciplinary with the life sciences. Credit available for biology majors.

Text: To be selected.

**Bio. 316. Industrial Hygiene**

3-0-3. Prerequisite: None.

Problems of health in industry; industrial poisons, occupational hazards and diseases, industrial fatigue, ventilation, and accident prevention.

Text: References.

**Bio. 333. Biostatistics**

3-3-4. Prerequisites: Math. 109; Bio. 212.

An introduction to statistical methods and their use in the preparation and interpretation of biological experiments.

Texts: Croxton, *Elementary Statistics with Emphasis in Medical and Biological Sciences*; Goldstein, *Biostatistics*.

**Bio. 334. Genetics**

3-3-4. Prerequisites: Bio. 212 or consent of instructor.

An introduction to the principles of heredity.

Text: To be selected.

**Bio. 341. Comparative Anatomy**

3-6-5. Prerequisite: Bio. 211.

Study of the comparative anatomy of the vertebrates with laboratory dissection of several vertebrate forms.

Text: To be selected.

**Bio. 407. Advanced Microbiology**

3-4-4. Prerequisites: Bio. 310, Chem. 341.

Advanced discussion and laboratory procedures in bacteriology and general microbiology.

Text: To be selected.

**Bio. 413. Air and Water Pollution**

3-0-3. Prerequisite: None.

An introduction to the technical and legal problems of air and water pollution by industry and its control, for those engineers working in industry.

Text: References.
Bio. 415. Introductory Radiation Biology
3-3-4. Prerequisite: Consent of instructor.

A general survey of biological systems and their responses to various kinds of radiations.

Bio. 429. Biological Principles of Radiobiology
3-3-4. Prerequisite: None.

A survey of the biological principles necessary as a prerequisite for the study of radiobiology. Non-credit for biology majors.
Text: Selected references.

Bio. 431. Cytology
3-6-5. Prerequisite: Bio. 212.

Modern aspects of the morphologic, functional and cytochemical organization of the cell. Preparative techniques and principles for observations in light, phase and electron microscopy.

Bio. 435, 436. Applied Biology
3-0-3. Prerequisite: Consent of instructor.

Selected topics in modern biology.
Text: References.

Bio. 443, 444, 445. General Physiology
3-6-5, 3-6-5, 3-6-5. Prerequisites: Bio. 310, Chem. 342.

The chemical, physical and biological responses and functions of living systems. The study of cellular biochemistry and metabolism, tissue and organ function, interrelationship of organ systems and the response of the whole organism to its environment.
Texts: Giese, Cell Physiology; other texts to be selected.

Bio. 450. Seminar
2-0-2. Prerequisite: Senior status.

Student and staff presentations of reports on laboratory or literature searches.
Text: References.

Bio. 460, 461, 462. Special Problems

Hours to be arranged. Prerequisite: Bio. 212.

A course for the study of special laboratory problems in biology, to be given any quarter with credits (not to exceed 6) to be arranged.
Text: References.

3-3-4. Prerequisites: Senior standing.

An introduction to microbiology and its applications to water and wastes. The scope and role of microbiology in environmental engineering. Specific emphasis upon the relationships of protozoa, algae, bacteria and viruses to water-borne disease, the treatment of wastes and the deterioration of aquatic habitats.

Bio. 478. Physical Biology
4-0-4. Prerequisites: Physics 227, Chem. 342; or consent of instructor.

This course emphasizes the use of modern physics and biochemistry in explaining the structure and function of biological systems at the atomic and molecular levels. The approach is mainly mathematical; quantum mechanics will be introduced as needed.
Texts: Setlow and Pollard, Molecular Biophysics; Hanna, Quantum Mechanics in Chemistry.
### Graduate Courses Offered

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Bio. 630</td>
<td>Biological Effects of Radiation</td>
<td>3-3-4</td>
</tr>
<tr>
<td>Bio. 632</td>
<td>Design of Experiments in Quantitative Biology</td>
<td>3-3-4</td>
</tr>
<tr>
<td>Bio. 633</td>
<td>Selected Topics in Radiobiology</td>
<td>3-3-4</td>
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<tr>
<td>Bio. 634</td>
<td>Selected Topics in Experimental Cell Biology</td>
<td>3-3-4</td>
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<td>Bio. 635</td>
<td>Air Pollution Biology</td>
<td>3-0-3</td>
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<tr>
<td>Bio. 640</td>
<td>Instrumental Methods in Biology</td>
<td>3-6-5</td>
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<tr>
<td>Bio. 641</td>
<td>Electron Microscopy Laboratory</td>
<td>0-6-2</td>
</tr>
<tr>
<td>Bio. 704,5,6</td>
<td>Special Problems</td>
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</tbody>
</table>

(Complete details about these courses are contained in the *Graduate Bulletin*, which is available upon request.)
SCHOOL OF CERAMIC ENGINEERING
(Established 1924)

Director—Lane Mitchell; Professors—A. T. Chapman, Willis E. Moody, Joseph L. Pentecost; Associate Professor—James F. Benzel; Associate Professor Emeritus—W. C. Hansard; Assistant Professor—Joe K. Cochran, Jr.; Special Lecturers—James Neiheisel, R. A. Young; Principal Secretary—Thelma C. Saggus; Secretary—Barbara B. Beavin; Senior Laboratory Mechanic—Thomas Mackrovitch.

General Information

The School of Ceramic Engineering offers a four-year curriculum leading to the Bachelor's degree and graduate work leading to the Master of Science degree in Ceramic Engineering. To prepare the bachelor’s degree candidate to enter successfully any division of ceramic engineering, he is given a broad and basic training in the fundamental and engineering courses as well as in the necessary cultural courses. While classroom, laboratory, and library work are coordinated to combine theoretical and practical knowledge, the student's periodic contacts with the nonmetallic mineral and clayworking industries of the State are designed to enlarge his practical viewpoint.

The School is vitally concerned with the future development of the ceramic and mineral industries in the South and is using its facilities to aid their development. Through research, the use of Georgia minerals has been extended so that almost every ceramic industry may find the greater proportion of its raw materials within the state boundaries. Demonstration of a stable market and the many industrial advantages of Georgia are also encouraging the establishment of new industries.

To introduce non-majors to the field's contributions to contemporary civilization, the School offers survey courses in Ceramics. Many contributions to ceramic science and industry of national and world-wide implications have emanated from this School, which plans to continue its present fundamental research.
### Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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<tbody>
<tr>
<td>Chem. 104-5</td>
<td>General Chemistry</td>
<td>4-3-5</td>
<td>4-3-5</td>
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<tr>
<td>E.Gr. 170</td>
<td>Visual Communication and Engr. Design I</td>
<td>2-3-3 or 2-3-3</td>
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<tr>
<td>Math. 107-8-9</td>
<td>Calculus I, II, III</td>
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<td>4-3-5</td>
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<tr>
<td>P.T. 101-2-3</td>
<td>Physical Training</td>
<td>0-4-1</td>
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<tr>
<td>Hum./S.S./M.L.</td>
<td>Humanities/Social Sciences/Modern Language</td>
<td>3-0-3</td>
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<tr>
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<tr>
<td>Gen. 101</td>
<td>Orientation</td>
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</table>

**Totals** | 17-10-19 | 16-10-19 | 14-7-16 |

*NOTE: Under quarter, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.*

### Sophomore Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Cer.E. 204</td>
<td>Ceramic Data Handling</td>
<td>.......</td>
<td>.......</td>
<td>2-3-3</td>
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<tr>
<td>Cer.E. 208</td>
<td>Ceramic Survey</td>
<td>.......</td>
<td>.......</td>
<td>2-0-2</td>
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<tr>
<td>ESM 205</td>
<td>Statics</td>
<td>3-0-3</td>
<td>.......</td>
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<tr>
<td>ESM 309</td>
<td>Applied Mechanics</td>
<td>.......</td>
<td>3-0-3</td>
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<tr>
<td>Math. 207</td>
<td>Calculus IV</td>
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<tr>
<td>Math. 208</td>
<td>Calculus and Linear Algebra</td>
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<tr>
<td>Phys. 228-9</td>
<td>Physics</td>
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</table>

**Totals** | 15-3-16 | 15-3-16 | 13-3-14 |

*See page 38 of the catalog for engineering electives.
**These free elective courses may be taken at any time during a student’s course of study. However, these six credit hours may be satisfied by selecting basic ROTC. If basic ROTC is elected by the student, then it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.
### Junior Year

<table>
<thead>
<tr>
<th>Course No.</th>
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<tr>
<td>Cer.E. 305</td>
<td>Phase Equilibria for Ceramists</td>
<td>......</td>
<td>3-0-3</td>
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<tr>
<td>Cer.E. 310</td>
<td>Principal Materials of Ceramics</td>
<td>2-3-3</td>
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<tr>
<td>Cer.E. 311</td>
<td>Processing and Forming</td>
<td>3-3-4</td>
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<tr>
<td>Cer.E. 315</td>
<td>Solid State Ceramics</td>
<td>......</td>
<td>......</td>
<td>3-0-3</td>
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<tr>
<td>Cer.E. 318</td>
<td>Pyrometry and Instruments</td>
<td>......</td>
<td>1-3-2</td>
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<tr>
<td>Cer.E. 320</td>
<td>Glass</td>
<td>......</td>
<td>2-3-3</td>
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<td>Chem. 209</td>
<td>Chemical Principles</td>
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<td>Chem. 331-332</td>
<td>Physical Chemistry</td>
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<td>Chem. 339</td>
<td>Physical Chemistry Laboratory</td>
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<td>Mechanics of Deformable Bodies</td>
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<td>Geol. 325</td>
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<td>17-9-20</td>
<td>15-9-18</td>
<td>14-9-17</td>
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### Senior Year

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<tr>
<td>Cer.E. 420</td>
<td>Microscopy</td>
<td>......</td>
<td>2-6-4</td>
<td>......</td>
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<tr>
<td>Cer.E. 418</td>
<td>Drying and Psychrometry</td>
<td>2-0-2</td>
<td>......</td>
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<tr>
<td>Cer.E. 419</td>
<td>Firing and Combustion</td>
<td>......</td>
<td>2-3-3</td>
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<tr>
<td>Cer.E. 422-28-29</td>
<td>Thesis</td>
<td>1-0-1</td>
<td>0-3-1</td>
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<tr>
<td>Cer.E. 425-26</td>
<td>Physical Ceramics</td>
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<td>3-3-4</td>
<td>2-0-2</td>
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<tr>
<td>Cer.E. 431-32-34</td>
<td>Design and Construction</td>
<td>1-3-2</td>
<td>0-6-2</td>
<td>0-3-1</td>
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<tr>
<td>Cer.E. 441</td>
<td>Glaze and Enamel Coating</td>
<td>2-3-3</td>
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<tr>
<td>Chem. 333</td>
<td>Physical Chemistry</td>
<td>3-0-3</td>
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<td>E.E. 325</td>
<td>Electrical Circuits and Fields</td>
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<td>2-3-3</td>
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<td>Met. 401</td>
<td>Engineering Materials</td>
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<td>Hum./S.S./M.L. 30-3</td>
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Recommended Electives*

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<tr>
<th>Course No.</th>
<th>Subject</th>
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<tr>
<td>Cer.E. 209</td>
<td>Ceramic Survey Laboratory</td>
<td>0-3-1</td>
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<tr>
<td>Cer.E. 406-7-8</td>
<td>Seminar</td>
<td>2-0-2</td>
</tr>
<tr>
<td>Cer.E. 421</td>
<td>Cements</td>
<td>2-3-3</td>
</tr>
<tr>
<td>Cer.E. 450</td>
<td>Engineering Materials in Nuclear Engineering</td>
<td>2-3-3</td>
</tr>
<tr>
<td>C.E. 206</td>
<td>Elementary Surveying</td>
<td>2-3-3</td>
</tr>
</tbody>
</table>

Any course for which student has prerequisites in geology, chemistry, physics, industrial engineering, industrial management, mathematics, psychology, or English.

*Check quarterly schedule of course offerings to determine if offered. Ordinarily a request for a course by eight or more students will be honored. Also, check prerequisites required.

Courses of Instruction

NOTE: 3-4-5 means 3 hours class, 4 hours laboratory, 5 hours credit.

Cer.E. 202. Products and Materials
2-3-3. Prerequisites: Chem. 103, Cer.E. 208.

An engineering survey of ceramics; relationship between industrial service requirements and the properties of ceramic products. The common ceramic materials are classified according to mineralogical character; their influence on each other, the effects of size, and the physical properties of particles are stressed.

Text: Norton, Elements of Ceramics.

Cer.E. 203. Equipment and Tests
2-3-3. Prerequisites: Chem. 103, Cer.E. 208.

Testing of ceramic raw materials and products; requirements of proper test methods and practical applications to industry.

Interpretation of results and writing of formal reports. Uses, operation, and calibration of machinery, apparatus, and equipment for ceramic manufacture of testing. Mathematical analysis of data; inherent errors.

Texts: Wilson, An Introduction to Scientific Research; and Cloxton, Elementary Statistics with Applications in Medicine and the Biological Sciences.

Cer.E. 204. Ceramic Data Handling
(Replaces Cer.E. 203)
2-3-3. No prerequisites.

Study of reasons for testing and details and nature of tests selected; interpretation of results, consolidation of data, analysis of effectiveness, statistical and computer methods, presentation of results and formal reports. Laboratory experiments to gain and handle data.

Cer.E. 208. Ceramic Survey
2-0-2. Prerequisite: None. General elective for non-ceramic majors.

A survey is made of the classification and physical properties of ceramic products. The physical properties of raw materials are studied briefly with emphasis on qualities and limitations which relate to design and manufacturing processes.

Text: Mitchell, Ceramics – Stone Age to Space Age.

Cer.E. 209. Ceramic Survey Laboratory
0-3-1. Prerequisite or Corequisite: Cer.E. 208.

Plant trips to local ceramic plants. Production of molds and pottery.
Cer.E. 305. Phase Equilibria for Ceramists
3-0-3. Prerequisite or Corequisite: Chem. 331.

Heterogeneous equilibria of inorganic systems. One, two, and three component systems. Solid solutions isomorphous replacement. Alkemade lines. Metastable equilibrium. Paths of crystallization.

Text: Levin and McMurdie, *Phase Diagrams for Ceramists*. (A monograph of the American Ceramic Society.)

Cer.E. 310. Principal Materials of Ceramics (Replaces Cer.E. 202)
2-3-3. Prerequisite: Cer.E. 208.

Study of nature, properties, occurrence, uses, functions, and modification of silica, clays, feldspars, carbonates, talc, carbons, and related minerals used widely in ceramic compositions. Substitutes possible; atomic and structural nature as related to properties. Laboratory introduces these minerals in various experiments.

Cer.E. 311. Processing and Forming
3-3-4. Prerequisite: Cer.E. 203.

Winning, refining and preparation of ceramic raw materials, methods and mechanism of processing and forming ceramic products; their effect on the control of the properties of the products and adaptation to service requirements.

The relation of laboratory technique to plant practice including properties of materials, machines, processing and products. Commercial raw materials and products are provided and analyzed and, where practical, the corresponding plants are visited.

Text: Kingery, *Ceramic Fabrication Processes*.

Cer.E. 315. Solid State Ceramics
3-0-3. Prerequisite: Cer.E. 311.

The physical and chemical properties of materials throughout common processes used in the production of ceramic products. Control of phases of manufacture to introduce in the product those properties service conditions require. Sintering, melting, and crystallization processes and their effects on structure and density are discussed. Whitewares, terra cotta, heavy clay products, glass; body, mold, and saggar composition and processing are studied.

Text: Kingery, *Introduction to Ceramics; Course Notes*.

Cer.E. 318. Pyrometry and Instruments
1-3-2. Prerequisite: Physics 208.

The principles of heat measurement by shrinkage rings, melting points, color, pyrometric cones, expanding metals, thermocouples, and resistance bridges. The factors governing choice of thermocouples. The principles behind construction of couples, CO₂ meters, temperature controls, and other control instruments.


Cer.E. 320. Glass
2-3-3. Prerequisite or Corequisite: Cer.E. 305.

The fundamentals of glass structure, composition, manufacture, properties, and applications. Phase relations of the important oxides. Reasons for glass formation instead of crystallization. Melting, quenching, annealing, tempering, fracturing, devitrification, and modification are phenomena studies. Techniques of forming and basis of selection of ingredients for glass forming, fluxing, color, refractive index, and other properties are carefully considered.


Cer.E. 406-7-8. Seminar
2-0-2. Prerequisite: Senior standing in Cer.E.

Discussion of current ceramic and scientific literature and reports of investigation. Course may be repeated with different numbers.

Text: Journal of American Ceramic Society.

Cer.E. 409. Microscopy
3-6-5. Prerequisites: Physics 209, Geology 414.

Involves the use of the microscope in
the study and control of composition and structure of ceramic bodies and raw materials. Nature of light and crystallography are briefly studied.


Cer.E. 420. Microscopy
(Replaces Cer.E. 409)

2-6-4. Prerequisites: Phys. 229, Geology 325.

Involves the use of the microscope in the study and control of composition and structure of ceramic bodies and raw materials. Nature of light and crystallography are briefly studied.

Cer.E. 422-23-12. Thesis
1-0-1, 0-6-2, 0-6-2. Prerequisite: Senior standing in Ceramic Engineering.

Each senior conducts an original investigation on an approved ceramic subject under the supervision of the instructor in charge. The object of this course is to place the student on his own initiative and to coordinate the knowledge that he has previously received.

Cer.E. 418. Drying and Psychrometry
2-0-2. Prerequisites: Cer.E. 315, Physics 209.

Fundamental consideration of water removal from unfired ceramic products by heat and air. Control of humidity, temperatures, air velocity, and volume; economy and efficiency of drying and driers; problems to be met in safe drying.


Cer.E. 419. Firing and Combustion
2-3-3. Prerequisites: Physics 209, M.E. 320 or equivalent.

Objectives of firing; combustion behavior of gaseous, liquid, and solid fuels; the mechanics of heat transfer; physical and chemical properties of clay and other raw materials under heat treatment; design, operation, and heat accounts of periodic and continuous kilns. The utilization of refractories in industry; the control of properties of refractories through raw materials and all phases of manufacture to best meet industrial requirements; fundamentals of aggregate packing and photoelastic study of expansion and contraction.

Texts: ASTM Refractories Specifications; Norton, Refractories.

Cer.E. 421. Cements
2-3-3. Prerequisites: Chem. 332, Cer.E. 305.

Includes the required properties of raw materials, processing and the hydraulic properties of cements. Portland, magnesia, high alumina, dental, and gypsiferous cements are included. This is an elective course for seniors and graduates, and is offered periodically upon the demand of six or more students.


Cer.E. 425-426. Physical Ceramics

Application of physical chemistry, crystal chemistry, colloid chemistry, and solid state physics to ceramics. Dispersion, viscosity, plasticity, grain size, crystal structure as related to properties, densification with additives to fill holes in structure, and theory of clay as a colloidal electrolyte are studied. Differential thermal analysis, thermal shock, thermal expansion, electrodialysis, viscosity measurement, X-ray analysis, and other techniques of analysis are studied in the laboratory. Sintering, melting, and recrystallization.

Text: Kingery, Introduction to Ceramics; Course notes.

Cer.E. 428. Thesis
(Replaces Cer.E. 423)

0-3-1. Prerequisite: Cer.E. 422.

Second quarter of undergraduate thesis. The senior student is conducting his original investigation under supervision of an instructor. Material and library search preparation for the thesis should be accomplished in this part of the thesis sequence and actual laboratory experimentation begun.
Cer.E. 429. Thesis
(Replaces Cer.E. 412)
1-6-3. Prerequisite: Cer.E. 428.
Completion of all laboratory work on investigation, submission of preliminary write-up one month before end of quarter and final submission of approved write-up in acceptable format one week before examination week.

Cer.E. 431-32-34. Design and Construction
1-3-2, 0-6-2, 0-3-1. Corequisite: Cer.E. 418. Prerequisite: Drawing 109 or 103.
Design and working drawings of ceramic manufacturing equipment and plant layouts for specified products. The student makes his own selection under the supervision and with the approval of the instructor.

Cer.E. 440. Glaze and Enamel Coatings
3-3-4. Prerequisite: Cer.E. 320.
The fundamental methods for calculating, compounding, manufacturing, and using vitreous and crystalline protective coatings as well as the methods commonly employed to correct faults. The prior preparations of frits, and ceramic bodies for glazing, or metals or glass for enameling are also considered. Compositions of low, moderate, and high temperature coatings are studied to learn basis of glass properties, adherence, color, opacification, and texture.

Cer.E. 441. Vitreous and Crystalline Coatings (Replaces Cer.E. 440)
2-3-3. Prerequisite: Cer.E. 320.
The fundamental methods for calculating, compounding, manufacturing, and using vitreous and crystalline protective coatings as well as the methods commonly employed to correct faults. The prior preparations of frits, and ceramic bodies for glazing, or metals or glass for enameling are also considered. Compositions of low, moderate, and high temperature coatings are studied to learn basis of glass properties, adherence, color, opacification, and texture.

Cer.E. 450. Engineering Materials in Nuclear Engineering
2-3-3. Prerequisites: Senior or graduate standing and consent of instructor.
The basic principles of ceramics and metallurgy with particular emphasis on problems inherent in reactor technology. Engineering aspects of the structure and constitution of materials used in reactors including ceramic materials, cermets, metals and alloys. The behavior of these materials under conditions involving elevated temperatures, corrosion, and irradiation.

GRADUATE COURSES
(Complete details about graduate courses in Ceramic Engineering are contained in the Graduate Bulletin, which is available upon request.)
SCHOOL OF CHEMICAL ENGINEERING  
(Established in 1901)


General Information

Chemical engineers perform many essential functions in those industries which convert raw materials by means of chemical and physical processes into useful finished products. Almost every major manufacturing industry employs chemical engineers, who work in research, development, design, production, sales, consulting, and management positions. Some of the industries which use substantial numbers of chemical engineers are the petroleum, petrochemical, pulp and paper, plastics, metallurgical, fiber, fertilizer, nuclear energy, space, rubber, food, photographic, heavy and fine chemical, mineral, pharmaceutical and dye industries. Environmental and pollution control activities require an increasing number of chemical engineers.

The following curriculum leads to the degree of Bachelor of Chemical Engineering, and is designed to train students both for positions immediately or for graduate work leading to master’s and doctor’s degrees.
### Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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<tbody>
<tr>
<td>Gen. 101</td>
<td>Orientation</td>
<td>1-0-0</td>
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<tr>
<td>Ch.E. 101</td>
<td>Introduction to Chemical Engineering</td>
<td>1-0-1</td>
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<tr>
<td>E.Gr. 170</td>
<td>Visual Communication and Engr. Design I</td>
<td></td>
<td>2-3-3 or 2-3-3</td>
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<tr>
<td>Chem. 111-2**</td>
<td>General Chemistry</td>
<td>4-3-5</td>
<td>4-3-5</td>
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<tr>
<td>Chem. 209</td>
<td>Chemical Principles</td>
<td></td>
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<td>3-3-4</td>
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<tr>
<td>Engl. 107-8-9***</td>
<td>Introduction to Literature***</td>
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<td>3-0-3</td>
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<tr>
<td>Math. 107-8-9</td>
<td>Calculus</td>
<td>5-0-5</td>
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<td>P.T. 101-2-3</td>
<td>Physical Training</td>
<td>0-4-1</td>
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<tr>
<td><strong>Totals</strong></td>
<td><strong>16-7-17</strong></td>
<td><strong>16-10-19</strong></td>
<td><strong>15-10-18</strong></td>
<td></td>
</tr>
</tbody>
</table>

*See page 38 of the catalog for engineering electives.

**Advanced level Chemistry for Chemical Engineering majors. However, Chem. 104-5 will be accepted for students transferring to Chemical Engineering from other curricula.

***Other humanities courses listed on p. 37 will be accepted for students transferring to Chemical Engineering from other curricula.

****These free electives courses may be taken at any time during a student’s course of study. However if six credit hours of basic ROTC are elected, then ROTC must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

### Sophomore Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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<tbody>
<tr>
<td>Ch.E. 207-8</td>
<td>Chemical Process Principles</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>Ch.E. 209</td>
<td>Computers in Chemical Engineering</td>
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<td>2-3-3</td>
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<tr>
<td>Ch.E. 304</td>
<td>Transport Phenomena</td>
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<td></td>
<td>3-3-4</td>
</tr>
<tr>
<td>Math. 207-8</td>
<td>Calculus</td>
<td>5-0-5</td>
<td>5-0-5</td>
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<tr>
<td>Physics 227-8-9</td>
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<td>Hum./S.S./M.L.*</td>
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<td><strong>Totals</strong></td>
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<td><strong>15-3-16</strong></td>
<td><strong>12-9-15</strong></td>
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</tbody>
</table>

*A language is recommended for students considering graduate work.
### Junior Year

<table>
<thead>
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<tr>
<td>Ch.E. 305</td>
<td>Transport Phenomena</td>
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<tr>
<td>Ch.E. 306-315</td>
<td>Unit Operations</td>
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<tr>
<td>Chem. 340-1-2</td>
<td>Organic Chemistry</td>
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<td>Chem. 343</td>
<td>Organic Chemistry Lab</td>
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<td>Chem. 331-2-3</td>
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<td>Chem. 339</td>
<td>Physical Chemistry Lab</td>
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<td>0-6-2</td>
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<tr>
<td>ESM 205</td>
<td>Statics</td>
<td>3-0-3</td>
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<tr>
<td>E.E. 325</td>
<td>Electrical Circuits and Fields</td>
<td>......</td>
<td>......</td>
<td>2-3-3</td>
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<tr>
<td>Met. 301</td>
<td>Engineering Materials</td>
<td>......</td>
<td>4-3-5</td>
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<td>Hum./S.S./M.L.</td>
<td>Humanities/Social Sciences/ Modern Language</td>
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### Senior Year

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<td>Ch.E. 438</td>
<td>Chemical Engineering Thermodynamics</td>
<td>4-0-4</td>
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<tr>
<td>Ch.E. 415</td>
<td>Reactor Design</td>
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<td>......</td>
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<tr>
<td>Ch.E. 413</td>
<td>Unit Operations</td>
<td>3-3-4</td>
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<td>......</td>
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<tr>
<td>Ch.E. 339</td>
<td>Chemical Engineering Literature</td>
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<tr>
<td>Ch.E. 431</td>
<td>Chemical Engineering Economics</td>
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<tr>
<td>Ch.E. 432</td>
<td>Process and Equipment Design</td>
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<tr>
<td>Ch.E. 434</td>
<td>Plant Design</td>
<td>......</td>
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<td>1-6-3</td>
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<tr>
<td>Ch.E. 416</td>
<td>Process Control</td>
<td>......</td>
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<td>Technical Electives*</td>
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<td>Totals</td>
<td></td>
<td>17-3-18</td>
<td>14-6-16</td>
<td>13-6-15</td>
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</tbody>
</table>

*From approved list.
Electives

The chemical engineering curriculum contains a total of 51 hours of electives, comprising 15 hours of free electives, 9 hours of technical electives, and 27 hours of electives in humanities, social sciences, and modern languages. Students electing to take ROTC must use 6 hours of free electives for basic ROTC and 9 hours of free electives for advanced ROTC. The 27 hours of electives in humanities, social sciences, and modern languages must be chosen from the list of courses on page 37 in accordance with the distribution there specified. The technical electives must be chosen from the following list:

Approved Technical Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Ch.E. 407</td>
<td>Chemical Process Analysis</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 414</td>
<td>Air Pollution Control</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 443, 4, 5</td>
<td>Special Problems</td>
<td>Variable</td>
</tr>
<tr>
<td>Ch.E. 450</td>
<td>Introduction to Polymer Science</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 452</td>
<td>Plastics Processing</td>
<td>3-3-4</td>
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<tr>
<td>Ch.E. 453</td>
<td>Polymerization Process Analysis</td>
<td>3-0-3</td>
</tr>
<tr>
<td>I.D. 453</td>
<td>Product Design for Plastics Processing</td>
<td>3-0-3</td>
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<tr>
<td>Chem. 344,5</td>
<td>Organic Chemistry Laboratory</td>
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<td>Chem. 403</td>
<td>Physical Chemistry</td>
<td>3-0-3</td>
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<tr>
<td>Chem. 421, 2</td>
<td>Instrumental Analysis I, II</td>
<td>3-6-5</td>
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<td>Chem. 423</td>
<td>Analytical Laboratory</td>
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<tr>
<td>Chem. 434, 5</td>
<td>Advanced Inorganic Chemistry</td>
<td>3-0-3</td>
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<td>Chem. 445, 6, 7, 8</td>
<td>Biochemistry</td>
<td>3-0-3</td>
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<td>ESM 309</td>
<td>Dynamics</td>
<td>3-0-3</td>
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<td>ESM 331</td>
<td>Mechanics of Materials</td>
<td>3-0-3</td>
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<tr>
<td>ICS 310</td>
<td>Computer-Oriented Numerical Methods</td>
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<td>ICS 406</td>
<td>Computing Languages</td>
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<td>E.E. 326</td>
<td>Electronics</td>
<td>2-3-3</td>
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<tr>
<td>E.E. 327</td>
<td>Electric Power Conversion</td>
<td>2-3-3</td>
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<tr>
<td>E.E. 336</td>
<td>Computational Methods for Simulation</td>
<td>3-0-3</td>
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<tr>
<td>E.E. 483</td>
<td>Computer Simulation of Systems</td>
<td>3-3-4</td>
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<tr>
<td>Physics 304</td>
<td>Electronics</td>
<td>5-6-7</td>
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<tr>
<td>Physics 319</td>
<td>Modern Physics for Engineers</td>
<td>3-0-3</td>
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<tr>
<td>Physics 360, 1</td>
<td>Physical Measurements</td>
<td>3-3-4</td>
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<td>Physics 370</td>
<td>Interfacing Laboratory</td>
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<tr>
<td>Physics 456, 7, 8</td>
<td>Elementary Biophysics</td>
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<tr>
<td>Math. 209</td>
<td>Advanced Differential Equations</td>
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<tr>
<td>Math. 236</td>
<td>Finite Mathematics</td>
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<tr>
<td>Math. 315</td>
<td>Elements of Statistics</td>
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<tr>
<td>Math. 411, 2, 3</td>
<td>Advanced Engineering Mathematics</td>
<td>3-0-3</td>
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<tr>
<td>Math. 443, 4, 5</td>
<td>Numerical Analysis I, II, III</td>
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</table>
Basic Extractive Metallurgy ................. 3-0-3
Nonferrous Metallurgy ........................ 2-3-3
Ferrous Metallurgy ............................. 3-3-4
Metallurgical Fabrication .................... 3-0-3
Theoretical Physical Metallurgy .......... 3-0-3
Corrosion and Protective Measures ....... 3-0-3
Fluidics ....................................... 3-3-4
Numerical Control of Machine Tools...... 3-0-3
Principles of Biology ....................... 5-3-6
Air and Water Pollution .................... 3-0-3
Nuclear Reactor Engineering ............... 2-3-3
Sanitary Engineering I ..................... 3-0-3

Other technical courses may be approved by the Director of the School of Chemical Engineering.

Areas of Concentration

By judicious choice of free and technical electives, a student may include in his curriculum an area of concentration in which he may have a special interest. Typical areas of concentration follow:

Plastics Engineering: Nine or more hours from the following: Ch.E. 407, Ch.E. 443, 4, 5, Ch.E. 450, Ch.E. 452, Ch.E. 453, I.D. 453.

Chemical Metallurgy: Met. 411, Met. 423, Met. 491.


Biomedical Engineering: Nine or more hours from the following: Ch.E. 443, 4, 5, Chem. 445, 6, 7, Bio. 210, 211, 212, Physics 456, 7, 8.


Simulation Science: Nine or more hours from the following: E.E. 336, E.E. 483, ICS 310, ICS 406, Math. 236, Math. 443, 4, 5.

Courses of Instruction

NOTE: Under Quarters, 3-3-4 means 3 hours class, 3 hours laboratory, 4 hours credit.

Ch.E. 101. Introduction to Chemical Engineering
1-0-1. Prerequisites: None.

An orientation to chemical engineering at Georgia Tech and in industry. Gives some idea of the nature of chemical engineering, the types of opportunities available, and the requirements for graduation and for a successful career.

Ch.E. 207, 208. Chemical Process Principles I, II
3-0-3. Prerequisites: Chem. 209 or concurrently with Chem. 209 and Math. 109.

A study of stoichiometric principles, physical and chemical properties, thermophysics and thermochemistry leading to rather detailed material and energy balances on chemical, metallurgical, and petroleum processes.

Ch.E. 209. Computers in Chemical Engineering
2-3-3. Prerequisites: Math. 208 and Ch.E. 208 or concurrently with Ch.E. 208.

A study of the application of digital and analog computers to the solution of chemical engineering problems.

Ch.E. 304. Transport Phenomena I
3-3-4. Prerequisites: Ch.E. 209 and Math. 208.

Fundamental principles of momentum and energy transfers are developed. Applications of these principles are stressed.
Text: Bird, Stewart and Lightfoot, Transport Phenomena.

Ch.E. 305. Transport Phenomena II
3-3-4. Prerequisite: Ch.E. 304.

The development of Ch.E. 304 is extended to include mass transfer. Major emphasis is placed on applications involving heat and mass transfer.
Text: Bird, Stewart and Lightfoot, Transport Phenomena.

Ch.E. 306. Unit Operations I
3-0-3. Prerequisites: Ch.E. 304 and concurrently with Ch.E. 305.

The analyses of chemical engineering processes and operations involving fluid and heat transfer.
Texts: McCabe and Smith, Unit Operations of Chemical Engineering; Perry, Chemical Engineer's Handbook.

Ch.E. 315. Unit Operations II
3-3-4. Prerequisite: Ch.E. 304.

Stagewise operations.
Texts: McCabe and Smith, Unit Operations of Chemical Engineering; Perry, Chemical Engineer's Handbook; Notes.

Ch.E. 329. Survey of Chemical Engineering
1-0-1. Prerequisites: Ch.E. 304, Chem. 340, 331.

A general survey of chemical engineering including processes, equipment, and calculations. Not open to students in the School of Chemical Engineering.

Ch.E. 339. Chemical Engineering Literature
1-0-1. Prerequisites: Ch.E. 304, Chem. 340, 331.

Training of students in the use of sources of information and an introduction to the finding of information in the library.
Text: Mellon, Chemical Publications.
Ch.E. 110. Elements of Chemical Engineering Design
2-3-3. Prerequisite: None.
An introduction to chemical engineering design in which simplified problems of current interest are discussed in the lectures and demonstrated in the laboratory.

Ch.E. 350. Elementary Heat and Mass Transfer
3-0-3. Prerequisites: Math. 208. Physics 209, M.E. 320, and Senior standing or consent of instructor.
Elementary heat and mass transfer primarily designed for Textile students. Not open to students in the School of Chemical Engineering. Offered in the fall quarter only.
Text: McCabe and Smith, *Unit Operations of Chemical Engineering*.

Ch.E. 407. Chemical Process Analysis
3-0-3. Prerequisites: Ch.E. 315, Chem. 342 and Chem. 333.
Introduction to the engineering of chemical reactions involving colloidal and amorphous materials.

Ch.E. 408. Chemical Process Analysis
3-0-3. Prerequisites: Ch.E. 315, Chem. 342 and Chem. 333.
Introduction to applied chemical kinetics.

Ch.E. 413. Unit Operations III
3-3-4. Prerequisite: Ch.E. 305.
Diffusional processes, including combined mass and heat transfer.
Text: Perry, *Chemical Engineer's Handbook*; McCabe and Smith, *Unit Operations of Chemical Engineering*.

Ch.E. 414. Air Pollution Control
3-0-3. Prerequisite: None.
Application of mass transfer principles to the design of pollution control systems utilizing absorbers, collectors, filters, precipitators, and the like. Air pollutant control is stressed. Other topics are combustion process optimization, fuel pretreatment, and cost analysis.

Ch.E. 415. Reactor Design
3-0-3. Prerequisites: Ch.E. 315, Chem. 342 and Chem. 333.
Kinetics and mechanisms of industrial chemical reactions. Effects of temperature, pressure, and concentrations on the rates of chemical reactions. Design of batch, backmix, tubular, and semi-batch reactors.

Ch.E. 416. Process Control
3-3-4. Prerequisites: Ch.E. 305, E.E. 325 recommended.
Dynamics of chemical processes in the unsteady state. Theory of control techniques for chemical processes. Application of measurement devices and instrumentation hardware to achieve stable process control.

Ch.E. 431. Chemical Engineering Economics
3-0-3. Prerequisite: Ch.E. 315.
A study of techniques required in project analysis in areas of systems cost analysis and the use of the economic balance for design and optimization.

Ch.E. 432. Process and Equipment Design
2-3-3. Prerequisite: Ch.E. 431, Met. 301.
A combination of theory with the
practical and empirical methods used to design the various common types of chemical process equipment. The bases for mechanical and safety requirements are included. Comprehensive problems for each of the basic types of equipment will be solved. Categories covered include pressure vessels, heat exchangers, mass transfer equipment, and materials handling equipment.


**Ch.E. 434. Chemical Plant Design**

1-6-3. Prerequisites: Ch.E. 341 or concurrently with 341, 408, 413, 431, 436, ESM 331.

A comprehensive problem in plant design.

**Ch.E. 435-436-437. Chemical Engineering Thermodynamics**

3-0-3. Prerequisites: Chem. 333 and Ch.E. 315.

A study of the principles of thermodynamics with applications to the problems of industry. The areas covered include flow of compressible fluids, estimation and use of thermodynamic properties, charts and tables, power and refrigeration cycles, phase equilibria, chemical equilibria and properties of solutions.

Text: Smith and Van Ness, *Introduction to Chemical Engineering Thermodynamics*.

**Ch.E. 438. Chemical Engineering Thermodynamics**

4-0-4. Prerequisites: Chem. 332, Ch.E. 315.

A study of the principles of thermodynamics with applications to the problems of industry. The areas covered include flow of compressible fluids; estimation and use of thermodynamic properties, charts, and tables; power and refrigeration cycles and processes; phase equilibria including properties of solutions; chemical equilibria.

Text: Smith and Van Ness, *Introduction to Chemical Engineering Thermodynamics*.

**Ch.E. 443-444-445. Special Problems**

0-3-1. Prerequisite: Ch.E. 305.

The student is given an opportunity to develop initiative and to apply fundamental principles by doing semi-original laboratory investigation of a chemical engineering research nature.

**Ch.E. 446-447-448. Comprehensive Problems**

3-0-3. Prerequisites: Ch.E. 408, 431, 436.

The integration of the professional work of the previous courses by means of a series of comprehensive problems.

Text: To be selected.

**Ch.E. 450. Introduction to Polymer Science**

3-0-3. Prerequisite: Physics 208.

An introduction to the chemistry and physics of polymers, including polymerization, structure, and properties.


**Ch.E. 452. Plastics Processing**

3-3-4. Prerequisites: Met. 301 or consent of instructor.

A description and analysis of plastics processing techniques including mixing, extrusion, molding, coating, casting and bonding operations. Fundamental equations describing specific processes are developed where possible.

Text: Selected references.

**Ch.E. 453. Polymerization Process Analysis**

3-0-3. Prerequisites: Met. 301, Ch.E. 415 or consent of instructor.

Polymerization processes are analyzed with regard to reaction mechanisms, kinetics, and reactor design. Methods of controlling polymer structure during polymerization are emphasized.

Courses of Instruction in Metallurgy

NOTE: Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.

**Met. 301. Principles and Applications
of Engineering Materials**

4-3-5. Prerequisites: Chem. 209, Physics 229.


**Met. 325. General Metallurgy**

3-0-3. Prerequisites: Chem. 103 and Physics 207.

An introductory survey of basic physical metallurgical concepts followed by a study of the characteristics and engineering applications of carbon steels, gray and malleable cast irons. Consideration is given to the engineering significance of static and dynamic properties of metals and alloys.


**Met. 401. Engineering Materials**

3-0-3. Prerequisite: Chem. 333.

Principles of physical metallurgy including binary phase diagrams and mechanical testing methods as applied to metallic materials. Production of iron, steel, and nonferrous metals is surveyed.


**Met. 402. Engineering Materials**

3-3-4. Prerequisite: Met. 401.

A study of the properties and application of carbon and alloy steels, cast irons, and nonferrous alloys. Some time is devoted to corrosion as an engineering problem and methods utilized in minimizing its effects. Laboratory work consists of metallographic observation of common ferrous and nonferrous alloys in various conditions.


**Met. 403. Introductory Nuclear Metallurgy**

3-3-4. Prerequisites: Chem. 103 and Physics 209.

The fundamentals of physical metallurgy, metal crystals, phase diagrams, properties, fabrication, and testing with emphasis on refractory metals and fuel materials. The laboratory will essentially be demonstrations and plant trips.


**Met. 411. Basic Extractive Metallurgy**

3-0-3. Prerequisite: Chem. 333 or equivalent.

Theory and practice of extraction and refining of ferrous and nonferrous metals. Calculations and reactions related to pyrometallurgical and hydrometallurgical extractive processes will be emphasized.


**Met. 421. Nonferrous Metallography**

2-3-3. Prerequisite: Met. 441 or 402, or equivalent.

The use of the microscope to study the influence of processing variables on the structure and properties of metals and alloys. Pyrometric instrumentation as applied to heat treating operations and thermal analysis of metals and alloys.

Text: Kehl, *Metallographic Laboratory Practice*.

**Met. 422. Ferrous Metallography**

3-3-4. Prerequisites: Met. 401 and 402.

The influence of processing variables on...
the microstructure and properties of steels and ferrous alloys. Heat treat operations and thermal analysis of ferrous materials.

**Met. 423. Metallurgical Fabrication**
3-0-3. Prerequisite: Met. 401.
Primary forming techniques and secondary fabrication and joining processes will be discussed. Some of the processes to be considered are casting, rolling, forging, welding.

**Met. 441. Theoretical Physical Metallurgy**
3-0-3. Prerequisites: Met. 402 and Chem. 333 or equivalent.
A study of the physical and mechanical properties of metals and alloys in the light of their structure.

**Met. 445. Electron Microscopy**
2-3-3. Prerequisites: Physics 319, Math. 208 and Met. 402.
The theory and principles of electron optics and electron microscopy will be covered. Techniques of preparation and observation of materials by electron microscopy will be presented in lecture and applied in the laboratory.

**Met. 446. X-ray Metallography**
3-3-4. Prerequisites: Met. 401.
The theory and application of x-ray diffraction to metallurgy. Crystal studies, texture studies, phase diagram determination and chemical analysis will be discussed.
Text: Azaroff and Donahue, *Laboratory Experiments in X-ray Crystallography*.

**Met. 463. Metallurgical Testing**
2-3-3. Prerequisites: Met. 402, Physics 319 or equivalent.
Destructive and nondestructive test methods are outlined. The emphasis will be on the significance of results and the choice of materials based on test data.
Text: Notes.

**Met. 464. Nondestructive Testing**
2-3-3.
The principles and theory of current industrial nondestructive testing methods will be covered. Emphasis on testing the soundness and reliability of primary and secondary fabricated metal structures.
Text: *Nondestructive Testing Handbook* and notes.

**Met. 491. Corrosion and Protective Measures**
3-0-3. Prerequisites: Chem. 333 and Met. 325 or 401.
The electrochemical theory of corrosion; recommended materials and protective measures for chemical processing equipment and for atmospheric, underground, underwater, and elevated temperature exposures.
Text: Notes.

### Graduate Courses in Chemical Engineering

<p>| Ch.E. | 601, 2, 3 | Chemical Engineering Thermodynamics I, II, III ............3-0-3 |
| Ch.E. | 604, 5, 6 | Organic Chemical Technology ..................................3-0-3 |
| Ch.E. | 610 | Aerosol Technology .............................................3-0-3 |
| Ch.E. | 611 | Industrial Emission Control ....................................3-0-3 |
| Ch.E. | 612 | Atmospheric Reactions ...........................................3-0-3 |
| Ch.E. | 613 | Technology of Fine Particles ....................................3-0-3 |
| Ch.E. | 615, 6, 7 | Transport Phenomena I, II, III .................................3-0-3 |
| Ch.E. | 619, 20 | Chemical Engineering Calculations I, II ......................3-0-3 |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch.E. 622</td>
<td>Applied Chemical Kinetics</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 624</td>
<td>Introduction to Cryogenics</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 628, 9</td>
<td>Advanced Unit Operations</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 633</td>
<td>Inorganic Chemical Technology</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 635</td>
<td>Advanced Unit Operations</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 637</td>
<td>Advanced Unit Operations</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Ch.E. 646</td>
<td>Economic Analysis of Chemical Engineering Processes</td>
<td>3-0-3</td>
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<tr>
<td>Ch.E. 648, 9</td>
<td>Chemical Plant Design</td>
<td>1-6-3</td>
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<tr>
<td>Ch.E. 650, 1</td>
<td>Polymer Structure and Bulk Properties I, II</td>
<td>3-0-3</td>
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<tr>
<td>Ch.E. 652</td>
<td>Surface and Solution Properties of Polymers</td>
<td>3-0-3</td>
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<tr>
<td>Ch.E. 699</td>
<td>Preparation for Ph.D. Qualifying Examinations</td>
<td>None</td>
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<tr>
<td>Ch.E. 701, 2, 3</td>
<td>Seminar</td>
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<tr>
<td>Ch.E. 704, 5, 6</td>
<td>Special Problems in Chemical Engineering</td>
<td>Variable</td>
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<tr>
<td>Ch.E. 710, 1, 2</td>
<td>Special Topics in Chemical Engineering</td>
<td>Variable</td>
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<tr>
<td>Ch.E. 716</td>
<td>Advanced Unit Operations</td>
<td>3-0-3</td>
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<tr>
<td>Ch.E. 722</td>
<td>Foundations of Gaseous Kinetics</td>
<td>3-0-3</td>
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<tr>
<td>Ch.E. 736, 7</td>
<td>Chemically Reacting Flow Processes I, II</td>
<td>3-0-3</td>
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<tr>
<td>Ch.E. 738</td>
<td>Advances in Transport Phenomena</td>
<td>3-0-3</td>
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<tr>
<td>Ch.E. 740</td>
<td>High Pressure Technology</td>
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**Graduate Courses in Metallurgy**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Met. 601, 2, 3</td>
<td>Seminar</td>
<td>2-0-1</td>
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<tr>
<td>Met. 604</td>
<td>Special Topics in Metallurgy</td>
<td>Variable</td>
</tr>
<tr>
<td>Met. 605</td>
<td>Dental-Medical Materials</td>
<td>2-0-2</td>
</tr>
<tr>
<td>Met. 614</td>
<td>Electrometallurgy</td>
<td>2-3-3</td>
</tr>
<tr>
<td>Met. 621</td>
<td>Metallurgical Design Problems</td>
<td>1-6-3</td>
</tr>
<tr>
<td>Met. 625</td>
<td>Powder Metallurgy</td>
<td>1-3-2</td>
</tr>
<tr>
<td>Met. 633</td>
<td>High Temperature Metallurgy</td>
<td>2-0-2</td>
</tr>
<tr>
<td>Met. 635</td>
<td>Advanced Nuclear Materials</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Met. 691</td>
<td>Advanced Theory of Metallic Corrosion</td>
<td>3-3-4</td>
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<tr>
<td>Met. 700</td>
<td>Master’s Thesis</td>
<td>Variable</td>
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<tr>
<td>Met. 701</td>
<td>Special Topics in Advanced Physical Metallurgy</td>
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<tr>
<td>Met. 741</td>
<td>Advanced Physical Metallurgy</td>
<td>3-0-3</td>
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<tr>
<td>Met. 745-6</td>
<td>Advanced Electron Microscopy I, II</td>
<td>3-0-3</td>
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<tr>
<td>Met. 751</td>
<td>Advanced Mechanical Metallurgy</td>
<td>3-0-3</td>
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<tr>
<td>Met. 752, 3</td>
<td>Dislocations and Strengthening Mechanisms I, II</td>
<td>3-0-3</td>
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<td>Met. 762</td>
<td>Magnetism in Metals</td>
<td>3-0-3</td>
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<td>Met. 763</td>
<td>Neutron Diffraction</td>
<td>3-0-3</td>
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<td>Met. 781</td>
<td>Metallurgical Thermodynamics</td>
<td>3-0-3</td>
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<tr>
<td>Met. 785</td>
<td>Metallurgical Kinetics</td>
<td>3-0-3</td>
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</tbody>
</table>

(Complete details about these courses are contained in the *Graduate Bulletin*, a copy of which is available upon request.)
SCHOOL OF CHEMISTRY
(Established in 1906)


General Information

Included in the School are:

1. The courses in chemistry required in the various engineering curricula.
2. A curriculum leading to the degree of Bachelor of Science in Chemistry.
3. Graduate courses and research leading to the degree of Master of Science in Chemistry, and Master of Science in Nuclear Science.
4. Graduate courses and research leading to the degree of Doctor of Philosophy in Chemistry.

The degree of Bachelor of Science in Chemistry will be awarded upon the completion of the following prescribed courses and 62 quarter hours of elective work. No elective course will be given for less than six applicants. A student must have had the prerequisites for any course he elects.

A prerequisite for senior courses is a minimum grade-point average of 2.0 in
the following courses: Chem. 331, 332, 333, 338, 339, 340, 341 342, 343, 344, and 345.

Particularly notable in the Chemistry curriculum is the great number of free elective hours. These elective hours permit concentrated studies in pre-medical and pre-dental requirements, minor options in geochemistry, and T-4 Certification in association with Georgia State University. Free electives may also include studies in written and oral communication, business, information and computer science, biochemistry, and environmental chemistry. Students interested in any of these particular areas of study should consult the School of Chemistry advisor for the details of that program of study.

Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 111-12</td>
<td>General Chemistry</td>
<td>4-3-5</td>
<td>4-3-5</td>
<td>......</td>
</tr>
<tr>
<td>Chem. 209</td>
<td>Chemical Principles</td>
<td>......</td>
<td>......</td>
<td>3-3-4</td>
</tr>
<tr>
<td>Math. 107-8-9</td>
<td>Calculus</td>
<td>5-0-5</td>
<td>5-0-5</td>
<td>5-0-5</td>
</tr>
<tr>
<td>Engl. 107-8-9</td>
<td>Introduction to Literature</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>Ger. 101-2-3*</td>
<td>Elementary German or Social Science</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
</tr>
<tr>
<td>P.T. 101-2-3</td>
<td>Physical Training</td>
<td>0-4-1</td>
<td>0-4-1</td>
<td>0-4-1</td>
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<tr>
<td>Electives**</td>
<td>Orientation</td>
<td>2-0-2</td>
<td>2-0-2</td>
<td>2-0-2</td>
</tr>
</tbody>
</table>

| Totals       |                      | 17-7-19 | 17-7-19 | 16-7-18 |

NOTE: Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.
*The School of Chemistry recommends that German be taken in the freshman year.
However, Social Science may be taken in the freshman year and German taken later.

**These free elective courses may be taken at any time during a student's course of study.
However, if six credit hours of basic ROTC are elected, ROTC must be scheduled the first quarter the student is enrolled. For further details, see page 29 of the catalog.

Sophomore Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
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<tbody>
<tr>
<td>Chem. 340-1-2</td>
<td>Organic Chemistry</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>Chem. 343-4-5</td>
<td>Organic Chemistry Lab</td>
<td>0-6-2</td>
<td>0-6-2</td>
<td>0-6-2</td>
</tr>
<tr>
<td>Math. 207</td>
<td>Calculus</td>
<td>5-0-5</td>
<td>......</td>
<td>......</td>
</tr>
<tr>
<td>Math. 208</td>
<td>Calculus and Linear Algebra</td>
<td>......</td>
<td>5-0-5</td>
<td>......</td>
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<tr>
<td>Physics 227-8-9</td>
<td>Physics</td>
<td>4-3-5</td>
<td>4-3-5</td>
<td>4-3-5</td>
</tr>
<tr>
<td>Electives, free*</td>
<td></td>
<td>......</td>
<td>......</td>
<td>6-0-6</td>
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</tbody>
</table>

| Totals       |                      | 12-9-15 | 12-9-15 | 13-9-16 |

*Electives, free: Of the total free electives in the Chemistry curriculum, at least eighteen hours of Social Sciences, selected from the listing of page 37, must be taken.
### Junior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
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</thead>
<tbody>
<tr>
<td>331-2-3</td>
<td>Physical Chemistry</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>339</td>
<td>Physical Chemistry</td>
<td></td>
<td>0-6-2</td>
<td></td>
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<tr>
<td>403</td>
<td>Physical Chemistry</td>
<td>3-0-3</td>
<td></td>
<td></td>
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<tr>
<td>434-5</td>
<td>Inorganic Chemistry</td>
<td></td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>421</td>
<td>Instrumental Analysis I</td>
<td>3-6-5</td>
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<tr>
<td>201-2-3</td>
<td>Survey of Humanities</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>Electives, free*</td>
<td></td>
<td>3-0-3</td>
<td>6-0-6</td>
<td>6-0-6</td>
</tr>
</tbody>
</table>

Totals: 15-6-17 15-6-17 15-0-15

*Electives, free: Of the total free electives in the Chemistry curriculum, at least eighteen hours of Social Sciences, selected from the listing on page 37 must be taken.

### Senior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
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<tr>
<td>400</td>
<td>Physical Chemistry</td>
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<td></td>
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<tr>
<td>338</td>
<td>Physical Chemistry</td>
<td>0-6-2</td>
<td></td>
<td></td>
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<tr>
<td>411</td>
<td>Applied Spectroscopy</td>
<td>3-0-3</td>
<td></td>
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<tr>
<td>422**</td>
<td>Instrumental Analysis II</td>
<td></td>
<td>3-6-5</td>
<td></td>
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<tr>
<td>Electives, free*</td>
<td></td>
<td>9-0-9</td>
<td>6-0-6</td>
<td>10-0-10</td>
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<tr>
<td>Electives, Chem.***</td>
<td></td>
<td>5-0-5</td>
<td>5-0-5</td>
<td></td>
</tr>
</tbody>
</table>

Totals: 15-6-17 14-6-16 15-0-15

*Electives, free: Of the total free electives in the Chemistry curriculum, at least eighteen hours of Social Sciences, selected from the listing on page 37 must be taken.

**May be taken in the junior year.

***A total of 10 quarter hours in elective chemistry courses are required of which a minimum of 4 hours and a maximum of 6 hours must be from laboratory electives. These laboratory electives may consist of:

- Two laboratory courses, 0-6-2 each.
- One laboratory course, 0-6-2, and Chem. 437, 438, OR
- Chem. 437-8-9.

Options b and c must have the approval of the department.

Chemistry electives may consist of those chemistry courses numbered 4xx, 6xx or 7xx with the exception of Chem. 461 and Chem. 475. Registration for courses 600 and above must have Departmental and Graduate Division approval.
Courses of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

ADDITIONAL NOTE: All students are required to wear safety glasses while working in the laboratories. The glasses will be provided at the students' expense.

Chem. 104-5. General Chemistry
4-3-5. Prerequisite: Entrance requirements.

A lecture and laboratory study of the fundamental laws and theories of chemistry designed for those students who do not plan to take more advanced chemistry courses. The courses include topics related to the thermodynamics of chemical change, the structure of atoms and molecules, the nature of chemical change and reactivity, and the chemistry of carbon compounds.

Text: Masterson, Slowinski, Chemical Principles, 2nd ed.

Chem. 111-12. General Chemistry
4-3-5. Prerequisite: Entrance requirements.

A lecture and laboratory study of the fundamental laws and theories of chemistry designed for those students who plan to pursue advanced courses in chemistry. The topics covered are more limited than those in Chem. 104-105 but are treated in a manner in which they can be built upon more readily in the advanced courses. The laboratory emphasizes the techniques of quantitative analysis necessary for advanced courses in chemistry.

Text: To be selected.

Chem. 209. Chemical Principles
3-3-4. Prerequisite: Chem. 112 or Chem. 105.

A continuation of Chem. 112 stressing thermodynamics and kinetics and their applications to chemistry. The laboratory portion of the course will be devoted to quantitative experimentation.

Text: Mahan, University Chemistry, 2nd ed.

Chem. 331, 332, 333. Physical Chemistry
3-0-3. Prerequisites: Chem. 209, Physics 228, and Math. 208.

Physico-chemical properties of matter in the gaseous, liquid, and solid states; solutions; equilibrium, kinetics and thermodynamics of chemical reactions, electrochemistry.

Text: Daniels and Alberty, Physical Chemistry.

Chem. 338. Physical Chemistry Laboratory
0-6-2. Prerequisite: Chem. 339. Concurrent with or following Chem. 333.

Applications of vibration, rotation, and electronic spectroscopy, electric and magnetic susceptibility, and resonance techniques to the study of molecular structure.

Text: Notes.

Chem. 339. Physical Chemistry Laboratory
0-6-2. Prerequisite: Concurrent with or following Chem. 332.

Applications of physical chemistry principles.

Text: Notes.

3-0-3. Prerequisite: Chem. 209 or consent of instructor.

The principal classes of organic compounds, aliphatic and aromatic, are studied.


Chem. 343, 344, 345. Organic Chemistry Laboratory
0-6-2. Prerequisite: Concurrent with or
following Chem. 340, 341, 342, respectively. But Chem. 343 is prerequisite to Chem. 344, 345.


**Chem. 348. Organic Chemistry Laboratory**

0-6-2. Prerequisite: Chem. 342, 343, or concurrent with 342.

Organic preparations and reactions – similar to, but less extensive than, Chem. 344, 345.


**Chem. 400. Physical Chemistry**

3-0-3. Prerequisites: Chem. 209, Physics 229, and Math. 208 or consent of instructor.

- Application of molecular spectroscopy, electron diffraction, X-ray diffraction, neutron diffraction, and magnetic methods to the determination of molecular structure.

Text: To be selected.

**Chem. 403. Physical Chemistry**

3-0-3. Prerequisite: Chem. 209, Phys. 229 and Math. 208 or consent of instructor.

A study of the relation of atomic and molecular structure to the physical properties of matter and the nature of chemical bonding.

Text: Royer, *Bonding Theory*.

**Chem. 411. Applied Spectroscopy**

3-0-3. Prerequisite: Chem. 342.

Application of various spectroscopic techniques in organic analysis.


**Chem. 412. Identification of Organic Compounds**

0-9-3. Prerequisites: Chem. 345 and concurrent with or following Chem. 411.


**Chem. 421. Instrumental Analysis I**

3-6-5. Prerequisite: Concurrent with or following Chem. 331.

An introductory course in both the theory and practice of modern instrumental methods: polarography, spectroscopy, colorimetry, microscopy, polarimetry, electroanalytical methods.


**Chem. 422. Instrumental Analysis II**

3-6-5. Prerequisite: Chem. 421 or consent of instructor.

A continuation of Instrumental Analysis I.

Text: Willard, Merrit, and Dean, *Instrumental Methods of Analysis*.

**Chem. 423. Analytical Laboratory**

0-6-2. Prerequisite: Concurrent with or following Chem. 422.

Advanced techniques and investigations of newer analytical methods in the practices of analysis.

Text: *Notes*.

**Chem. 432. Synthetic Inorganic Chemistry**

0-6-2. Prerequisite: To be taken concurrently with or following Chem. 434.

The preparation and characterization of inorganic compounds, with special emphasis on the apparatus and techniques employed in modern synthetic inorganic chemistry.

Text: Jolly, *Synthetic Inorganic Chemistry*.

**Chem. 434, 435. Advanced Inorganic Chemistry**

3-0-3. Prerequisites: Chem. 331 and Chem. 403.

A classroom study of selected topics with emphasis on laws, principles, and generalizations; the periodic classifi-
cations, atomic structure, natural and artificial radioactivity, valence, complex compounds, and other topics.

**Chem. 437, 438, 439. Special Problems**
0-6-2. Prerequisite: Departmental approval.

The instruction will be individual and will include library, conference, and laboratory work.

**Chem. 443, 444. Organic Reactions**
3-0-3. Prerequisite: Chem. 342.

A study of the scope and usefulness of some important reactions and theories in organic chemistry from the standpoint of physical organic chemistry.

**Chem. 445, 446, 447. Biochemistry**
3-0-3. Prerequisite: Chem. 342 or consent of instructor.

Lectures, independent reading, and discussion of topics relating to the chemistry and metabolism of plant and animal products.

**Chem. 448. Biochemistry Laboratory**
0-6-2. Prerequisite: Concurrent with or following Chem. 445.

**Graduate Courses Offered**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Chem. 612</td>
<td>Instrumental Methods of Organic Analysis</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Chem. 613</td>
<td>Analysis of Atmospheric Contaminants</td>
<td>3-0-3</td>
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<tr>
<td>Chem. 623, 4</td>
<td>Nuclear Chemistry</td>
<td>3-0-3</td>
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<tr>
<td>Chem. 626</td>
<td>Fast-neutron Interactions</td>
<td>3-0-3</td>
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<tr>
<td>Chem. 630, 1, 2</td>
<td>Organic Chemistry</td>
<td>3-0-3</td>
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<tr>
<td>Chem. 633, 4, 5</td>
<td>Reactivity, Mechanism, and Structure in</td>
<td>3-0-3</td>
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<td></td>
<td>Organic Chemistry</td>
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<td>Chem. 636</td>
<td>Organometallic Chemistry</td>
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<tr>
<td>Chem. 639</td>
<td>Organic Chemistry</td>
<td>3-0-3</td>
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</tbody>
</table>

Laboratory techniques and practices in biochemistry.
Text: To be selected.

**Chem. 461. Chemistry of Nuclear Technology**
3-3-4. For students in Nuclear Engineering only.

A course for non-chemists, covering principles of inorganic chemistry, radiation chemistry, radio chemistry, separation methods for actinide elements and fission products, and other topics related to the production and utilization of nuclear energy.
Text: *Notes.*

**Chem. 475. Physical Chemistry for Engineers**
3-0-3. Prerequisite: M.E. 320 or equivalent.

This course is designed to familiarize students who have had some thermodynamics in other areas with the applications of thermodynamics to chemical systems and with a foundation of the modern theory of chemical bonding.
Text: Barrow, *Physical Chemistry.*

**Chem. 476. Chemistry of the Solid State**
3-0-3. Prerequisite: Chem. 333 or consent of instructor.

Applications of the concepts developed in Chemistry 475 to the structure of solids and their chemical and physical properties.
Text: Barrow, *Physical Chemistry.*
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Chem. 644,5</td>
<td>Molecular Structure and Chemical Principles</td>
<td>3.0-3</td>
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<tr>
<td>Chem. 657</td>
<td>Radiochemistry</td>
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<td>Chem. 658</td>
<td>Experimental Radiochemistry</td>
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<td>Chem. 661,2,3</td>
<td>Chemical Thermodynamics</td>
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<td>Chem. 664,5,6</td>
<td>Advanced Inorganic Chemistry</td>
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<td>Chem. 667,8</td>
<td>Special Topics in Inorganic Chemistry</td>
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<tr>
<td>Chem. 669</td>
<td>Chemical Applications of Group Theory</td>
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<td>Chemical Crystallography</td>
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<td>Chem. 675</td>
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<td>Chem. 701,2,3</td>
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<td>Chem. 710-1</td>
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<tr>
<td>Chem. 727</td>
<td>Mechanisms of Inorganic Reactions</td>
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<tr>
<td>Chem. 731</td>
<td>Structure Elucidation of Natural Products</td>
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<td>Chem. 732</td>
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<td>Chem. 733,4</td>
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<td>Chem. 735,6</td>
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<td>Chem. 739</td>
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<td>Chem. 747,8,9</td>
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<td>Chem. 750</td>
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<td>Chem. 767,8</td>
<td>Principles of Quantum Mechanics</td>
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<td>Chem. 780,1,2</td>
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</table>
SCHOOL OF CIVIL ENGINEERING
(Established in 1896)


General Information

The civil engineer conceives, designs, constructs, and maintains projects coordinating and utilizing natural and human resources for urban and regional development. He works in the following broad fields of specialization within the profession: structural and construction engineering, hydraulic engineering, sanitary engineering, transportation, soils engineering, municipal and regional engineering and management, surveying and mapping. The functional phases of civil engineering are research and development, planning and design, construction, and operation and maintenance.

It is not the purpose of the four-year curriculum described herein to cover in detail all that is known or considered in the profession or in any one of its branches. Rather, emphasis is placed on fundamental laws and concepts to enable the students to attack problems in a logical manner and to draw conclusions from principles and facts. In addition to specific civil engineering courses, the curriculum provides training in the physical and social sciences and selected subjects from the other engineering professions.

Satisfactory completion of the four-year curriculum leads to the degree of Bachelor of Civil Engineering.

Laboratories

The School of Civil Engineering occupies the Civil Engineering Building, part of the old Civil Engineering Building, and most of the Joint Highway Research Laboratory. Modern laboratories provide for practical experience and research in air pollution, building materials, fluid mechanics, foundation models, highway
Civil Engineering

In addition to campus-wide academic requirements for graduation with a bachelor's degree, the following are also required for the B.C.E. degree:

(a) The scholastic average shall be a minimum of 2.0 for those quarters during which the last 54 hours toward the degree are taken.

(b) The number of quality points earned in civil engineering courses taken toward the degree must be at least twice the number of credit hours in those courses.

### Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<td>or 2-3-3</td>
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</table>

†See page 38 of catalog for engineering electives.
*See page 37.
**These free elective courses may be taken at any time during a student's course of study. However, if six credit hours of basic ROTC are elected, ROTC must be scheduled the first quarter the student is enrolled.
***See page 263 regarding Physical Training.
### Sophomore Year

<table>
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</table>

*See page 37.

**These free elective courses may be taken at any time during a student's course of study. However, if six credit hours of basic ROTC are elected, ROTC must be scheduled the first quarter the student is enrolled.

### Junior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<td>Digital Computers</td>
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</table>

*See page 37.

***Nine hours of electives must be taken if advanced ROTC is not taken. These electives are to be 300, 400, and 600 level courses from any engineering curriculum, Industrial Management, Mathematics, Physics, Chemistry, Social Sciences, Psychology, Applied Biology, Architecture, Information Science, and English.
### Senior Year

<table>
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<th>Course No.</th>
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<tr>
<td>C.E. 455</td>
<td>Transportation Engineering I</td>
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<td>C.E. 460</td>
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<td>Law I or</td>
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*See page 37.
**C.E. Electives. Each C.E. senior must choose four of the following courses: C.E. 403, 413, 433, 438, 442, 443, 447, 448, 449, 450, 453, 454, 456, 459, 461, 470. Students having earned a minimum grade point average of 2.6 on all course taken as a junior may substitute other elective courses (not ROTC) for these courses.
***Nine hours of electives must be taken if advanced ROTC is not taken. These electives are to be 300, 400, and 600 level courses from any engineering curriculum, Industrial Management, Mathematics, Physics, Chemistry, Social Sciences, Psychology, Applied Biology, Architecture, Information Science, and English.

### Courses of Instruction

**NOTE:** 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

**C.E. 110. Introduction to Civil Engineering**

1-6-3. Prerequisite: None.

What engineering is; what civil engineering is; what civil engineers do. Engineering problems that have been solved in the past, are being solved and for which solutions must be found in the future. Field trips to engineering projects.

**C.E. 201. Plane Surveying**

3-3-4. Prerequisite: E. Gr. 170.

Methods of obtaining and analyzing field data to be used in engineering planning, design, and construction. Introduction to the use of modern instruments and office procedures.
C.E. 202. Route Surveying
3-3-4. Prerequisite: C.E. 201.

Theory, computation and field techniques, of the curves required in the planning, design and layout of highways, power lines, pipe lines, and other route locations. Computation of earthwork including the effects of grade and curvature.

C.E. 206. Elementary Surveying
2-3-3. For non-C.E. students. Not offered winter quarter.

Use of tape, transit and level with applications to planimetric and topographic mapping; traverse and area computations; stadia; construction surveys; optical tooling.

C.E. 211. Civil Engineering Applications of Digital Computers
1-3-2. Prerequisite: Math. 108.

A study of the application of digital computers to the solution of Civil Engineering problems. Exercises will use an algebraic compiler language and selected numerical methods. This course is a prerequisite to all junior and senior C.E. courses.

C.E. 306. Structural Analysis II
3-3-4. Prerequisite: ESM 343. No credit for C.E. students.

Analysis of structures to find reactions, deflections, and internal forces with emphasis on methods of analysis for statically indeterminate structures.

C.E. 309. Materials of Construction
3-3-4. Prerequisites: ESM 334, Geol. 203.

Basic principles of the properties of materials. Physical, chemical, and mechanical properties of metals, concrete, timber, masonry, and asphalt. The laboratory period is for tests, demonstrations, and writing reports.

C.E. 311. Structural Analysis I
5-3-6. Prerequisite: ESM 334.

Determination of internal forces in statically determinate and indeterminate structures including influence lines with applications to beams, frames, and trusses.

C.E. 312. Advanced Surveying I
3-3-4. Fall and Spring Quarters. Prerequisite: C.E. 201.

Field astronomy. Precise taping, leveling, triangulation, sub-tense bar, adjustments of level nets and triangulation figures; special problems in land division; photogrammetry: history and fundamental principles.

C.E. 313. Fluid Mechanics I
3-0-3. Prerequisite: ESM 309.

Elementary mechanics of fluids with emphasis on analysis; fluid statics; fluid kinematics; equations of motion; momentum and energy principles; surface and form resistance.

C.E. 314. Fluid Mechanics II
3-3-4. Prerequisite: C.E. 313.

Elementary mechanics of fluids with emphasis on engineering applications. Enclosed conduit flow; open-channel flow; hydraulic machinery; fluid measurements; dynamic similitude.

C.E. 320. Fluid Mechanics Laboratory
0-3-1. Prerequisite: C.E. 314.

Experiment, demonstration and analysis of basic fluid phenomena and exercise in laboratory techniques.

C.E. 400. Reinforced Concrete Design II

Analysis and design of reinforced concrete foundations, slabs, and building frames.

C.E. 403. Construction
2-3-3. Prerequisites: C.E. 460, I.E. 425.

The relations of construction to design and ultimate use; the construction contract; basic machinery and construction operations; job planning, estimating, cost accounting; preparation of bids.

C.E. 406. Reinforced Concrete Design I
3-0-3. Prerequisites: ESM 343, Arch. 324. No credit for C.E. students.

Principles of behavior of reinforced
concrete beams and columns with application to the design of elementary structures.

C.E. 431. Hydrology
3-0-3. Prerequisite: C.E. 314.

Occurrence and movement of water on the earth; hydrologic measurements; elementary meteorology; precipitation, evapotranspiration and runoff; ground water; frequency analysis.

C.E. 433. Applied Hydraulics
3-0-3. Prerequisites: C.E. 314, 431.

Analysis and design of hydraulics works and structures. Typical exercises, stability of dams, spillway design, stilling basins, culverts, pipe systems, sediment transport, erosion, and erosion control.

C.E. 438. Elementary Aerial Photogrammetry
2-3-3. Prerequisite: C.E. 312 or consent of instructor.

Principles of stereoscopy and stereoscopic instruments. Analytical solutions of altitude, base line, line of flight and parallax. Radial line plotting for planimetric and topographic maps.

C.E. 442. Applied Hydrology
3-0-3. Prerequisites: C.E. 314, 431. Winter Quarter.

Applications of hydrology in the design of hydraulic structures for water supply, irrigation, power, drainage and flood control facilities.

C.E. 443. Water Resources Development
2-2-3. Prerequisite: C.E. 431. Spring Quarter.

Comprehensive planning for water resources management; identification of needs, problems, and issues; alternative solutions through creative thinking; economic and financial evaluation; institutional setting and public participation.

C.E. 444. Special Problems
1 Credit.

C.E. 445, 446. Special Problems
2 Credits. Prerequisite: Senior standing.

Minor research or special problems involving analytical or experimental investigations to develop student initiative and technique under supervision.

C.E. 447. Engineering Astronomy
2-3-3. Prerequisite: Math. 208. Spring Quarter.

Study of the celestial sphere including horizon and equator systems. Study of the Sun, Moon, Earth and planets, including man's early theories of the universe.

C.E. 448. Design in Timber and Prestressed Concrete
2-3-3. Prerequisite: C.E. 452.

Principles of behavior of timber and of prestressed concrete structural members; application to the design of elementary structures.

C.E. 449. Engineering Aspects of Environmental Health
3-0-3. Prerequisite: C.E. 458.

Sanitary Engineering in public health administration and the control of environmental health problems.

C.E. 450. Groundwater Hydrology
3-0-3. Prerequisites: C.E. 431, Geol. 203. Spring Quarter.

Occurrence, distribution, and movement of water below the surface of the earth; groundwater resources and dependable supply rates from wells; artificial recharge and waste disposal.

C.E. 451. Metal Structural Components
3-3-4. Prerequisites: C.E. 309 and C.E. 311.

Principles of behavior of tension and compression members, beams, and connections with application to the design of elementary structures.

C.E. 452. Concrete Structural Components
3-3-4. Prerequisites: C.E. 309 and C.E. 311.

Principles of behavior of reinforced concrete beams, columns, and slabs with application to the design of elementary structures.
C.E. 453. Structural Design
2-3-3. Prerequisites: C.E. 451, 452, 460.
Design of structures in metal and concrete with emphasis on buildings and bridges.

C.E. 454. Advanced Surveying II
2-3-3. Prerequisite: C.E. 312. Winter Quarter.
Errors and adjustments of surveying and photogrammetric instruments; analysis of measurement errors; Mercator and Lambert projections; plane table traversing; special control problems; hydrographic surveying.

C.E. 455. Transportation Engineering I
3-3-4. Prerequisite: C.E. 309.
Planning, design, and construction of streets and highways. A computer oriented laboratory problem will acquaint the student with modern highway design techniques and criteria.

C.E. 456. Transportation Engineering II
3-0-3. Prerequisite: Senior standing.
The history and economics of transportation systems; traffic and planning problems and techniques; planning and design of air, rail, highway, and water transportation facilities as a system.

C.E. 457. Sanitary Engineering I
3-0-3. Prerequisite: Junior standing.
Introduction to water treatment. The evaluation of water quality as related to public water supplies. The engineering theory and application of disinfection, chemical precipitation, coagulation, absorption, sedimentation and filtration.

C.E. 458. Sanitary Engineering II
3-0-3. Prerequisite: C.E. 457, 431.
Introduction to waste treatment. The analysis of the waste assimilative capacity of a stream. The engineering theory and application of sedimentation, chemical processes, bio-kinetics, aerobic and anaerobic fermentation techniques.

C.E. 459. Sanitary Engineering III
2-3-3. Prerequisite: C.E. 458.
The layout, hydraulic process, and operational design of water and waste water systems. The laboratory period is for supervised design problems and inspection trips.

C.E. 460. Physical Behavior of Soil and Rock
3-3-4. Prerequisites: C.E. 309, Geol. 203.
An introduction to the engineering properties of soil and rock. The origin, compositions and structure of soils. The effect of water and its control. The physical properties of soil and rock affecting engineering design and construction. Laboratory is for soil tests.

C.E. 461. Soil and Rock Engineering
2-3-3. Prerequisite: C.E. 460.
The mechanics of soil and rock masses as applied to civil engineering design and construction: footing and pile foundations, retaining walls, bulkheads, fills, embankments, and the control of landslides.

C.E. 470. Man in His Environment
3-0-3. Prerequisite: None.
An elective course open to students from all fields. Lectures, discussions, and workshop sessions on population, resources, wastes, and health as related to development of science and technology.

C.E. 471. Applications of Microbiology in Sanitary Engineering
3-3-4. Prerequisite: Senior standing. Fall quarter.
An introduction to microbiology and its applications to water and wastes. The scope and role of microbiology in environmental engineering. Special emphasis upon the relationship of Protozoa, algae, bacteria, and viruses to waterborne disease, the treatment of wastes and the deterioration of aquatic habitats.
### Graduate Courses Offered

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<tr>
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<th>Course Title</th>
<th>Credits</th>
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<td>Advanced Aerial Photogrammetry</td>
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<td>C.E. 603</td>
<td>Geodetic Engineering</td>
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<td>C.E. 604</td>
<td>Legal Principles of Land Surveying</td>
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<td>C.E. 605</td>
<td>Dock, Harbor, and Shore Structures</td>
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<td>Pavement Design</td>
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<td>Advanced Soil Mechanics</td>
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<td>C.E. 617</td>
<td>Experimental Analysis I</td>
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<td>Indeterminate Structural Theory II</td>
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<td>Geometric Design of Land Transportation Facilities</td>
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<td>C.E. 638</td>
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<td>C.E. 639, 40</td>
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<td>Analytical Methods for Air Pollution Studies</td>
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<td>C.E. 655</td>
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C.E. 704, 5, 6 Special Problems ......................................
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C.E. 730 Engineering Hydrodynamics ................................ 3-0-3
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C.E. 771 Seminar in Soil and Rock Mechanics ..................... 0-2-1
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C.E. 774 Dynamics of Massive Media ................................ 2-3-3
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C.E. 799 Doctor's Dissertation Preparation .......................
C.E. 800 Doctor's Thesis .............................................

(Complete details about these courses are contained in the Graduate Bulletin, which is available upon request.)
Almost every part of our society is influenced by the work of electrical engineers. Their pioneer work in the fields of electronics, computers, control, power, and communication has made possible the industrial world of today. Now electricity and electronics are expanding anew into the non-industrial world—into commerce, medicine, environmental technology, and a seemingly endless array of diverse areas. The computer is becoming as familiar a sight in the insurance company office as it is in the scientific laboratory. The revolutionary achievements of the past have made electricity the servant of society. The achievements of electrical engineering will probably be even more revolutionary in the future. The past, present, and future importance of electrical engineering as a profession is reflected in one basic fact: electrical energy is the only known form of energy which can be transmitted through vacuum under controlled conditions and by means of which intelligence can be processed and transferred effectively even over extremely long distances.

The School of Electrical Engineering enjoys a reputation for producing graduates recognized for their ability and initiative. The School seeks to attract the best students and to provide them with a rewarding educational experience that will serve them well in pursuing their varied career goals. A well-balanced program of fundamental theory and applications prepares the graduate for further academic work, or for a career in any of the many phases of electrical
engineering. The basic required program of instruction in fundamental theory and laboratory practice is liberally augmented with elective courses to enable the student to tailor programs to individual need, and includes a broad range of humanistic studies to help the engineer recognize and fulfill his responsibilities as a citizen. A faculty advising program provides assistance in program selection. In special instances, deviations from the basic required program may be permitted.

The program of the School of Electrical Engineering is intensive, demanding a scholastic average of C or better in the prescribed courses in mathematics, physics, and electrical engineering. In addition, the School requires an overall C average in all senior level electrical engineering courses. Successful completion of the curriculum leads to the Bachelor of Electrical Engineering.

The Electrical Engineering Course of Instruction is given below. In order to emphasize the very wide range of career objectives that can be pursued within the electrical engineering program, four specific tracks are outlined following the general course of instruction.

### Freshman Year

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<tr>
<th>Course No.</th>
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</table>

*See footnote on page 116.

**One quarter of freshman English and one quarter of History must be included in the Hum./S.S./M.L. electives. One year of freshman English is strongly recommended. Additional Hum./S.S./M.L. electives and the required distribution of these electives is given on page 37.

***See page 38 of the catalog for engineering electives.

†All students who are physically qualified will be required to take physical training courses P.T. 101 (swimming) and any other two courses from P.T. 102, 104, 105. Students with an exemption from all or any one of P.T. 101, 102, or 105 will be required to take P.T. 104. A maximum of six hours credit in P.T. courses (three required hours and three free-elective hours) may be applied toward degree requirements.
### Sophomore Year

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*See footnote on page 116.

**See footnote on page 114.

### Junior Year

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*Electives: The Electrical Engineering curriculum contains 54 hours of electives, in addition to 36 hours of specified humanities/social sciences/modern language electives. The 54 hours of electives must include a minimum of:

- 3 hours of freshman engineering electives (see footnote *** on page 114).
- 12 hours of technical electives, subject to School approval, outside the major field, including one of the following five thermodynamics options: (1) M.E. 320 (2) M.E. 326 (3) M.E. 322 and M.E. 323 (4) Physics 309 (5) A course or courses approved by School of Electrical Engineering.
- 18 hours of electives in Electrical Engineering, subject to School approval.

Thus, 21 credit hours of entirely free electives are included in the curriculum. These free electives may be taken at any time during a student's course of study. Up to six (6) hours of basic ROTC and a maximum of nine (9) hours of advanced ROTC may be used for elective credit in the program. For further details concerning the ROTC program, see page 29.

**See footnote on page 114.

NOTES:

1. It is expected that each student, through independent study, attendance of seminars or formal courses, will acquire the ability to program simple problems on one of the digital computers available on campus prior to enrollment in E.E. 210.
2. All students must demonstrate knowledge of the history and constitutions of the United States and Georgia, either by passing appropriate examinations or by completion of certain courses offered by the Department of Social Sciences.

The general course of instruction given above is sufficiently flexible to allow extensive development of specialized programs to satisfy individual student career objectives. This flexibility is exemplified by the four specific tracks that are outlined below. It is emphasized that these tracks are intended only to suggest to the student possible elective programs of study in these particular areas of interest. Each student is encouraged to define his own career objectives early in his program so that, in consultation with his faculty advisor, he may outline an elective program best suited to the achievement of his specific goals.

**Bioelectronics Track**

The increasing utilization of electrical measurements and data analysis techniques in health care systems creates a need for engineers with substantial life science training and medical doctors with electrical engineering backgrounds.
The program outlined below is intended for those who plan graduate training pursuant to a bioelectronics career either in engineering or directly in medicine. For those who plan to enter a graduate medical school, the program outlined will generally satisfy entrance requirements. However, students planning this route are urged to determine specific entrance requirements of individual universities.

**Electrical Engineering Electives**

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<tr>
<td>E.E. 420</td>
<td>Solid State Electronics</td>
<td>4</td>
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<tr>
<td>E.E. 481</td>
<td>Introduction to Bioelectronics</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 483</td>
<td>Computer Simulation of Systems</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 484, 485</td>
<td>Transistor Circuit Analysis</td>
<td>4</td>
</tr>
</tbody>
</table>

**Non-E.E. Electives**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio. 210-11-12</td>
<td>Introductory Biology</td>
<td>18</td>
</tr>
<tr>
<td>Bio. 431</td>
<td>Cytology</td>
<td>5</td>
</tr>
<tr>
<td>Chem. 209</td>
<td>Chemical Principles</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 340-1-2</td>
<td>Organic Chemistry</td>
<td>9</td>
</tr>
<tr>
<td>Physics 456,458</td>
<td>Elementary Biophysics</td>
<td>7</td>
</tr>
<tr>
<td>Physics 363,463</td>
<td>Biophysics</td>
<td>7</td>
</tr>
<tr>
<td>Psy. 409</td>
<td>Introduction to Engineering Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

**Energy Engineering Track**

Transmission and control of energy in electrical form is of fundamental economic importance to society. Increasing emphasis on meeting the needs of society for energy, while maintaining an ecological balance, creates exciting and challenging career opportunities for energy system engineers. The required program of the School of Electrical Engineering provides background in the basics of electrical energy conversion, transmission, and control. The elective program outlined below will prepare the student to begin an energy engineering career or to undertake graduate studies specializing in energy systems.

**Electrical Engineering Electives**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.E. 412</td>
<td>Electric Energy Conversion</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 415</td>
<td>Principles of Feedback Control</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 419</td>
<td>Power Systems Analysis</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 440</td>
<td>Energy Conversion Engineering</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 483</td>
<td>Computer Simulation of Systems</td>
<td>4</td>
</tr>
</tbody>
</table>
### Non-E.E. Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 326-7</td>
<td>Thermodynamics</td>
<td>7</td>
</tr>
<tr>
<td>M.E. 447 or</td>
<td>Elements of Nuclear Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 201-2-3</td>
<td>Economic Principles</td>
<td>9</td>
</tr>
<tr>
<td>Econ. 489</td>
<td>Economics of Regulated Industries</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 421</td>
<td>The Influence of Man's Activities on the Environment</td>
<td>4</td>
</tr>
<tr>
<td>N.E. 411-2-3</td>
<td>Nuclear Reactor Engineering</td>
<td>9</td>
</tr>
</tbody>
</table>

### Information and Computer Engineering Track

Information coding, transmission, and processing form a cornerstone of the electrical engineering profession. Communication engineering has long been a basic stem in electrical engineering curricula. Rapid developments in electronic digital computers and digital data processing have vastly expanded the range of application and the economic and social significance of information and communication technology. The School of Electrical Engineering provides a program which will enable the student to develop truly professional stature in this dynamic field. Basic principles of communication systems and the fundamentals of computer system design are given in the required curriculum. In addition, the electives listed below provide the depth and breadth of training necessary for career development and further study.

#### Electrical Engineering Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.E. 110</td>
<td>Computer Programming and Graphics</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 332-3-4</td>
<td>Computer Engineering</td>
<td>9</td>
</tr>
<tr>
<td>E.E. 335</td>
<td>Introduction to Digital Systems</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 478</td>
<td>Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 479</td>
<td>Introduction to Automaton Theory</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 480</td>
<td>Introduction to Sequential Systems</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 483</td>
<td>Computer Simulation of Systems</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Non-E.E. Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 320</td>
<td>Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>Math. 236</td>
<td>Finite Mathematics</td>
<td>5</td>
</tr>
<tr>
<td>Math. 415</td>
<td>Introduction to Probability</td>
<td>3</td>
</tr>
<tr>
<td>Math. 435</td>
<td>Elements of Information Theory</td>
<td>3</td>
</tr>
<tr>
<td>ICS 406</td>
<td>Computing Languages</td>
<td>3</td>
</tr>
</tbody>
</table>

### Instrumentation and Controls Track

Electrical measurements and transmission and processing of electrically coded data have fostered techniques for the instrumentation and control of a wide...
variety of processes. Applications range from automation of industrial processes to monitoring and control of environmental factors. Instrumentation and control engineering constitute the foundation of the field of cybernetics, which is of increasing technological importance.

The electrical engineering student is exposed to the basic principles of instrumentation and control in the required curriculum. The elective offerings listed below provide additional background necessary for career initiation and further studies.

**Electrical Engineering Electives**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.E. 342</td>
<td>Electrical Measurements</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 412</td>
<td>Electric Energy Conversion</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 415</td>
<td>Principles of Feedback Control</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 335</td>
<td>Introduction to Digital Systems Design</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 477</td>
<td>Interfacing Small Computers</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 482</td>
<td>Linear System Theory</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 483</td>
<td>Simulation of Systems</td>
<td>4</td>
</tr>
</tbody>
</table>

**Non-E.E. Electives**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 320</td>
<td>Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>M.E. 449</td>
<td>Numerical Control of Machine Tools</td>
<td>3</td>
</tr>
<tr>
<td>ESM 385, 402</td>
<td>Intermediate Dynamics</td>
<td>6</td>
</tr>
<tr>
<td>Ch.E. 341</td>
<td>Process Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>ISyE 417</td>
<td>Modeling and Measurement</td>
<td>3</td>
</tr>
<tr>
<td>ISyE 425</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses of Instruction**

**NOTE:** 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

**E.E. 101. Introduction to Electrical Engineering**

1-0-1. Prerequisite: Entrance requirements.

An orientation to electrical engineering, both at Georgia Tech and in industry. A major goal of the course is to provide insight into what electrical engineers do and what exciting directions their profession is taking. Open to all freshmen and transfer E.E. students only.

Text: None.

**E.E. 110. Computer Programming and Graphics**

2-3-3. Prerequisite: Entrance requirements.

An introduction to computer programming and graphical display on the U-1108 digital computer using Fortran V computer language. Graphical display of the solution of simple electrical engineering problems.

Text: To be selected.

**E.E. 111. Electrical Engineering Fundamentals**

2-3-3. Prerequisite: Entrance requirements.

The presentation of a perspective view of the diverse areas of specialization encompassed by the field of electrical engineering. Subject areas delineated by relating them to past, present, and future
engineering activities. Basic engineering concepts developed and applied quantitatively to representative engineering problems.

Text: To be selected.

**E.E. 210. Elements of Electrical Engineering**

3-0-3. Prerequisites: Physics 228, Math. 207.

Fundamentals of general active and passive circuit analysis. An introduction to the theory of d-c and a-c circuit analysis. Definitions of fundamental parameters, network theorems, general (voltage and current variable) analysis techniques, models of active devices, steady state and transient solutions.

Text: Close, *Analysis of Linear Circuits*.

**E.E. 211. Elements of Electrical Engineering**


Fundamentals of electronic devices and circuits. Physical operation of electronic devices, models from a physical viewpoint, bias techniques, stability, transfer functions, two-port representation, input and output impedance concepts, mutual inductance, introduction to circuit configurations.

Text: Close, *Analysis of Linear Circuits*; and class notes.

**E.E. 212. Instrumentation Laboratory**

1-3-2. Prerequisite: E.E. 210.


Text: Class notes.

**E.E. 315. Mechanical Plant of Buildings**

3-0-3. Prerequisites: Junior or senior Architecture or Building Construction standing. Others may schedule this course only by special permission of the School Directors and with the consent of the instructor. This course is not to be scheduled by Electrical Engineering students.

A study of the electrical and lighting systems of buildings. Construction and code requirements and personnel safety are covered. Lectures, recitations, and special problems.


**E.E. 325. Electric Circuits and Fields**

2-3-3. Prerequisites: Physics 228, Math. 209. For non-electrical engineering students.

A study of electric circuit elements and the steady state and transient response of such circuits to periodic and step inputs. Lectures, quizzes, recitations, and computation periods.

Text: Smith, *Circuits Devices and Systems*.

**E.E. 326. Elementary Electronics**

2-3-3. Prerequisites: E.E. 325. For non-electrical engineering students.

An introduction to electronic and semiconductor devices and a study of circuits containing these elements.

Text: Smith, *Circuits Devices and Systems*.

**E.E. 327. Electric Power Conversion**

2-3-3. Prerequisite: E.E. 325. For non-electrical engineering students.

A study of energy conversion principles and devices such as motors, generators, and rectifiers. Lectures, computation, and laboratory periods.

Text: Smith, *Circuits Devices and Systems*.

**E.E. 332. Computer Engineering I**

3-0-3. Prerequisite: E.E. 110 or equivalent.

A discussion of machine language, machine organization, and the design concepts of digital computers as they affect the language. Emphasis is placed on the interaction between system software and the computing system. A hypothetical language is used for several assembly
language programming problems. A major class project is to design an assembler for this language and to simulate the computer on the U-1108.

Text: To be selected.

E.E. 333. Computer Engineering II
3-3-4. Prerequisite: E.E. 110 or equivalent.

Introduction to AND/OR, NAND/NOR logic, fundamentals of digital computers, number systems and computer arithmetic. A detailed study is made of the arithmetic, memory, control and input-output sections of digital computers. Each student will be expected to complete one major design problem.


E.E. 334. Computer Engineering III
3-0-3. Prerequisite: E.E. 110 or equivalent.

A study of the upper levels of computer structure; the instruction of sets which define a computer system at the programming level; and the organization of processors, memories, switches, input-output devices, controllers, and communication links which provide the functioning system level. Evaluations are made of several modern computer systems. A framework is developed for computer system analysis and classification. Each student is expected to apply the analysis framework to an existing computer system as a class project.


E.E. 335. Introduction to Digital Systems Design
3-3-4. Prerequisite: E.E. 211.

A study of the application of digital techniques to the design of special purpose digital systems. Design techniques are discussed for making effective use of the gates, flipflops, and medium-scale integrated circuits available today. Commonly used memory, input, and output devices are also studied. Considerable emphasis is placed upon the solution of meaningful design problems. The laboratory work consists of designing, implementing, and debugging several design problems on the digital synthesizer in the Digital Systems Laboratory.


E.E. 336. Computational Methods for Simulation
3-0-3. Prerequisite: Math 209.

The course objective is to develop computational methods suitable for the solution of complex electrical engineering problems. Attention is given to a comparative analysis of the methods and potential difficulties. Emphasis is placed on the application of the various methods to several typical problems.

Text: Notes.

E.E. 342. Electrical Measurements
3-3-4. Prerequisites: E.E. 212, or concurrently.

The theory and practice of measurements of electrical quantities using both analog and digital methods. This course also considers the recording, indication, and processing of measurement data.

Text: Cooper, *Electronic Instrumentation and Measurement Techniques*.

E.E. 350. Electromagnetics
3-0-3. Prerequisites: Math. 208, Physics 228, and E.E. 211.

An introduction to electromagnetic theory including the study of vector analysis. Maxwell's equations, and static electric and magnetic fields.

Text: Paris and Hurd, *Basic Electromagnetic Theory*.

E.E. 351. Electromagnetics

A continuation of E.E. 350. Includes a study of energy and power, steady-state fields, and plane waves in lossless and in dissipative media.

Text: Paris and Hurd, *Basic Electromagnetic Theory*.

E.E. 352. Electromagnetics
3-0-3. Prerequisite: E.E. 351.
A continuation of E.E. 351. Steady state and transient response of lossless transmission lines, dissipative transmission lines, waveguides, radiation, antennas, and quasistatics.

Text: Paris and Hurd, Basic Electromagnetic Theory.

E.E. 355. Circuits and Systems
3-0-3. Prerequisite: E.E. 211.

Frequency and time domain analysis of circuits and systems. Phasors, resonance, power, three phase circuits, singularity functions, Fourier series, Fourier transforms, Laplace transforms and analysis techniques, frequency spectra, initial conditions, and convolution.

Texts: Close, Analysis of Linear Circuits and Angelo, Electronics: BJT, FETs, and Microcircuits.

E.E. 356. Circuits and Systems
3-0-3. Prerequisite: E.E. 355.


Text: Melsa and Shultz, Linear Control Systems.

E.E. 356. Engineering Electronics
3-0-3. Prerequisite: E.E. 211.

Modeling and analysis of electronic devices at all frequencies, configurations of active devices, multistage amplifiers, integrated circuits, rectifiers and power supplies, feedback amplifiers, oscillators and power amplifiers.

Texts: Close, Analysis of Linear Circuits and Angelo, Electronics: BJT, FET, and Microcircuits.

E.E. 361. Nonlinear Devices and Circuits

Analysis and synthesis of nonlinear devices and circuits. Nonlinear shaping circuits, logic circuits, general analysis techniques applicable to nonlinear systems.

Text: Millman and Taub, Pulse, Digital, and Switching Waveforms.

E.E. 362. Electromechanical Systems and Energy Conversion

Fundamentals of electromechanical energy conversion, electromechanical devices and systems. Energy state functions, force energy relationships, basic transducers, introduction to a-c and d-c machines.

Text: Woodson and Melcher, Electromechanical Dynamics.

E.E. 363. Random Signals and Noise
3-0-3. Prerequisite: E.E. 355.

An introduction to the theory of random signals and noise. The concepts of probability theory are applied to the characterization of random waveforms through the use of probability distributions, correlation functions and power spectra. A study is made of the behavior of electrical systems excited by random signals and noise.


E.E. 370. Junior Electrical Engineering Laboratory I
0-3-1. Prerequisites: E.E. 211, E.E. 212.

Experiments in linear circuits and electronics.

E.E. 371. Junior Electrical Engineering Laboratory II
0-3-1. Prerequisites: E.E. 360, E.E. 370.

An experimental study of electronics with emphasis upon non-linear operation.

E.E. 372. Junior Electrical Engineering Laboratory III
0-3-1. Corequisite: E.E. 352.

Experiments in electromagnetics.

E.E. 412. Electric Energy Conversion
3-3-4. Prerequisite: E.E. 362.

Principles of rotating a-c and d-c machines. Analysis techniques and application studies of individual and interconnected devices. Coordinated laboratory exercises.
E.E. 415. Principles of Feedback Control
3-3-4. Prerequisite: E.E. 356.
A study of automatic control systems. Basic control principles, system modeling and analysis techniques. Design studies of both continuous and discrete data systems. Coordinated laboratory exercises.

Text: To be selected.

E.E. 417. Pulse Circuits
3-0-3. Prerequisite: E.E. 361.
A study of the analysis and design of devices and circuits for pulse generation and shaping.

Text: To be selected.

E.E. 419. Power System Analysis
3-0-3. Prerequisites: E.E. 362 or consent of instructor.
A study of power system parameters, fault currents, stability, and protective relaying.

Text: To be selected.

E.E. 420. Solid-State Electronics
3-3-4. Prerequisite: E.E. 460.
A study of crystalline state, waves in crystals, transport properties of solids, semiconductors, semiconductor junctions, and integrated circuits.


E.E. 421. Electromagnetic Properties of Solids
3-3-4. Prerequisite: E.E. 460.
A study of dielectric and magnetic processes, domain magnetics, thin film electronics, and quantum electronics.

Text: Kittel, Introduction to Solid State Physics.

E.E. 422. Industrial Electronics
3-3-4. Prerequisites: E.E. 355 and E.E. 360.
Components and analysis of continuous and two-position industrial control systems, including polyphase and controlled rectifiers, transducers, photosensitive devices, and timing circuits.

Text: Zeines, Principles of Industrial Electronics.

E.E. 428. Communication Engineering
3-3-4. Prerequisites: E.E. 355 and E.E. 360.
A study of circuit components in the radio-frequency region below one kilomegahertz. The theory and operating characteristics of low-pass and band-pass amplifiers at radio frequencies. Distortion in amplifiers and the application of feedback are included in the study. Laboratory and computation are included.

Text: Terman, Electronic and Radio Engineering.

E.E. 430. Communication Engineering
3-3-4. Prerequisites: E.E. 355 and E.E. 360.
A study of relaxation oscillators, wave shaping techniques, pulse generation, and kindred subjects. Noise, interference, propagation, antenna systems, and the problem of frequency allocation are studied. Receivers and transmitters for radio and television are also studied.

Text: Terman, Electronic and Radio Engineering.

E.E. 432. Communication Circuits
3-3-4. Prerequisite: E.E. 356.
A study of two-port communication circuits by means of methods of modern network synthesis.

Text: Kuh and Pederson, Principles of Circuit Synthesis.

E.E. 434. High-Frequency Measurements
3-0-3. Prerequisite: E.E. 352.
A study of high-frequency measurements. The course emphasizes the operating characteristics of standard laboratory equipment, techniques of high-frequency measurements, design of systems to make specialized measurements, and the state-of-the-art of high-frequency measurement equipment. The course makes use of manufacturer application notes and cur-
E.E. 436. Ultra-High-Frequency Techniques
3-3-4. Prerequisite: E.E. 352.
Primarily concerned with rectangular and cylindrical waveguides and resonators; qualitative study of klystrons, magnetrons, and traveling wave tubes; introduction to ferrite devices, such as gyrators and ferrite isolators. Coordinated laboratory exercises concerned with basic measurements at microwave frequencies.
Texts: Ishii, Microwave Engineering; Hewlett Packard Engineering Staff, Microwave Theory and Measurements.

E.E. 437. Antennas
3-3-4. Prerequisite: E.E. 352.
An introductory course in antenna theory and practice for senior students. Topics emphasized are the linear antenna, antenna arrays, aperture antennas, antenna patterns, and antenna gain. The important characteristics of specialized antennas such as the helix, the rhombic, and the log-periodic, etc. are presented.
Text: Kraus, Antennas.

E.E. 438 (Physics 330). Laser Theory and Applications
3-0-3. Prerequisite: Senior standing.
An introduction to the theory and application of lasers and related instrumentation. Lasers considered will include gas, solid state, and liquid dye lasers. Applications include optical communication, metrology, holography, optical data processing, material working and diagnostics.
Text: Class Notes.

E.E. 440 (M.E. 456 and N.E. 440). Energy Conversion Engineering
3-0-3. Prerequisite: Thermodynamics.
This course is intended to familiarize students with advanced energy conversion techniques which are being developed for the generation of electric power. It covers the principles of operation and engineering aspects of these conversion devices, their present state of development, and their operating characteristics. Topics include energy sources, basic principles of energy conversion, semiconductors, thermoelectric converters, photovoltaic generators, thermionic systems, magneto-hydrodynamics, fuel cells, and applications of these devices for power generation.

E.E. 442. Electrical Design
3-3-4. Prerequisite: E.E. 356.
Design problems of various types of electrical and electronic systems. Lectures and computation periods.
Text: To be selected.

E.E. 443. Linear Graph Theory
3-0-3. Prerequisite: E.E. 355.
Text: Shu-Park, Introductory Topological Analysis of Electrical Networks.

E.E. 450. Special Topics
3-0-3. Prerequisite: Senior standing.
Special topics of unusual current interest; introductory treatments of new developments in electrical engineering technology.
Text: To be selected.

E.E. 452-453-454-455. Special Problems
0-3-1. Prerequisite: Senior E.E. standing.
Special engineering problems will be assigned to the student according to his needs and capabilities.

E.E. 456-457-458-459. Special Topics
Credit to be arranged. Prerequisite: Senior E.E. standing.
New developments in electrical engi-
neering are presented as special lecture courses.

**E.E. 460. Materials Science**


A study of properties of dielectrics in static and alternating fields, magnetic properties of ferrous materials, atomic interpretation of conduction in crystals, photo-conductivity, and related optical phenomena.


**E.E. 461. Communication Systems**

3-0-3. Prerequisite: E.E. 363.

The definitions and basic concepts of various analog and digital modulation techniques are considered. Modulators for generating the signals and demodulators for information recovery are studied. Applications are discussed.

Text: Carlson, *Communication Systems*.

**E.E. 470. Senior Electrical Engineering Laboratory I**

0-3-1. Prerequisite: E.E. 362.

Experimental studies in electromechanics and control.

**E.E. 471. Senior Electrical Engineering Laboratory II**

0-3-1. Prerequisite: E.E. 461.

Experiments in signal processing and communication systems.

**E.E. 472. Project Laboratory**

0-3-1. Prerequisite: Senior standing.

Individual student projects tailored to student interests.

**E.E. 476. Special Purpose Digital Systems Design**

3-3-4. Prerequisite: E.E. 335.

A study of the systems structures commonly encountered in the design of special purpose digital systems. Iterative circuits and the implementation alternatives which they make possible are considered. Special purpose structures, recirculation loop structures, and pipeline structures provide three approaches to configuring a system. ROM (read-only memory) oriented design is studied as a hardware simplicity. Designing automatic malfunction detection capability into a system is also considered. Design problems are undertaken which illustrate the power of these techniques and which can be implemented on the digital synthesizer in the Digital Systems Laboratory.

**E.E. 477. Interfacing Small Computers**

3-3-4. Prerequisite: E.E. 335.

The input-output structure of small computers is studied together with the characteristics of a variety of peripheral devices. The design of interface circuitry for these devices makes up the heart of the course. Emphasis is placed on design problem work.

Text: Notes.

**E.E. 478. Digital Signal Processing**

3-0-3. Prerequisite: E.E. 356.

An introductory treatment of the theory and applications of digital signal processing. The course covers the basic theory of linear discrete systems, Z-transform, digital filter design in the frequency domain and fast Fourier transforms.

Text: Notes.

**E.E. 479. Introduction to Automaton Theory**

3-0-3. Prerequisite: Senior standing.

The course aims at the study of the properties of linear sequential systems in relation to their applications in various digital tasks such as: computation in ring of polynomials and finite fields, counting, timing, memory addressing, generation of codes, etc.

Text: Gill, *Linear Sequential Systems*.

**E.E. 480. Introduction to Sequential Systems**

3-0-3. Prerequisite: Senior standing.

The course aims at developing procedures for synthesis of synchronous and
asynchronous sequential systems. Models related to practical design problems will be studied.


**E.E. 481. Introduction to Bio-electronics**

3-0-3. Prerequisite: E.E. 360 or consent of instructor for non-E.E. students.

An introduction to the study of the electrical phenomena of biological systems. Emphasis is placed on the application of electrical engineering techniques to the measurement and control of biological systems.

Text: To be selected.

**E.E. 482. Linear System Theory**

3-0-3. Prerequisite: E.E. 356.

Linear system theory is developed with emphasis placed on transform methods, state variable methods, and analysis of time varying systems. Applications to both continuous and discrete control and information systems are given.


**E.E. 483. Computer Simulation of Systems**

3-3-4. Prerequisite: E.E. 356.

A study of simulation methods using analog computers, digital computers, and hybrid computers. Emphasis is placed on simulation languages and applications of the three techniques to actual problems.

Text: R.E. Stephenson, *Computer Simulation for Engineers*.

**E.E. 484. Transistor Circuit Analysis**


A study of the application of linear electronic circuits in the design of special purpose amplifiers. Specific topics studied include large signal amplifiers, tuned circuit amplifiers, field-effect and bipolar transistors, multistage amplifier design, and linear integrated circuits.

Text: To be selected.

**E.E. 485. Electronic Design Laboratory**

0-3-1. Corequisite: E.E. 484.

Practical design problems which emphasize creativity and imagination are posed and their solutions are individually implemented in the laboratory.

**E.E. 490. E.E. Senior Seminar**

1-0-1. Prerequisite: Second quarter senior E.E. standing or above.

This seminar is intended to serve as a bridge between an undergraduate education and a postgraduate career. The program will generally be a talk followed by a question and answer period with various authorities. Offered only in the spring quarter and open only to senior E.E. students nearing graduation. Junior and first quarter seniors will be admitted to the Seminar if they will have graduated before the Seminar is offered during the following year.

**Graduate Courses Offered**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.E. 601</td>
<td>Automata Theory (Logical System Design)</td>
<td>3-0-3</td>
</tr>
<tr>
<td>E.E. 602</td>
<td>Automata Theory (Analysis and Fault Detection)</td>
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E.E. 753,4,5  Advanced Communication Theory ..............................3-0-3
E.E. 762  Advanced Network Theory II (Applied
           Combinatorics).................................................................3-0-3
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           of Networks)...................................................................3-0-3
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E.E. 800  Doctor’s Thesis..............................................................
E.E. 801,2,3,4  Seminar ...........................................................1-0-1

(Complete details about these courses are contained in the Graduate Bulletin, a copy of which is available upon request.)
DEPARTMENT OF ENGINEERING GRAPHICS
(Established in 1962)

Department Head—R. Kenneth Jacobs; Assistant Head—H. William Streitman; Professor—Joseph C. Durden, Jr.; Associate Professors—John D. Hutcheson, Earl M. Wheby, Ira E. Wilks; Lecturer—Glen F. Hart; Principal Secretary—Mrs. Hugh C. Murphy.

General Information

Engineering Design Graphics, i.e., Engineering Graphics, is a multi-faceted descriptive title involving Creative Design with its avenues of expression, Graphics, which is the communications vehicle for conveying one’s ideas.

While creativity is an art rather than a science it is an art that can be learned and applied. When applied to Engineering Design it becomes an orderly, step-by-step, structured, decision-making process, actually more related to inventiveness than to research. Success in this relatively new addition to engineering curricula is predicated upon continued practice, oblivious to fear of failure or ridicule. Success breeds self-confidence, and so this iterative growth process is prescribed early in the student’s career.

The goals of this Department propose (a) to kindle in the student an awareness of the professional role he is ultimately to play in the area of design, (b) to afford him live opportunities to participate creatively, and (c) to provide instruction in the most flawless communication medium known to man.

The variety of courses offered is devised to meet the requirements of this Institute and, by a wise choice of electives, to prepare not only the engineering graduates to satisfy the expressed needs of industry, but also to reinforce, graphically, by computer and otherwise, the analytics of mathematics and physics majors so that each can live more comfortably within his professional environment.

Courses of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit. Students are expected to use drawing instruments approved by the Department of Engineering Graphics.

E.Gr. 105. Managerial Graphics
0-6-2. Prerequisite: None.

This course is designed specifically for Industrial Management students and others who must, at times, present technical data in an elegantly attractive and succinct manner. Areas of interest include the translating of statistical data into meaningful graphic forms and the design and construction of charts for noting business trends, etc. The histogram, the frequency polygon, the method of least squares, and other aids are employed.

Text: Murphy, Managerial Graphics.

E.Gr. 113. Introduction to Engineering Graphics
0-6-2. Prerequisite: None.

An introduction to graphics in engineering and science. Primary emphasis on
effective graphic communication through freehand and instrument representation of multiview orthographic projections, sections and conventions, primary auxiliary views, isometric, and oblique drawings.


**E.Gr. 114. Engineering Descriptive Geometry**

0-6-2. Prerequisite: E.Gr. 113 or E.Gr. 170.

Graphic solutions of engineering problems utilizing auxiliary views and rotation methods. Point, line, and plane relationships. Intersections of lines, planes, and solid geometric forms. Development of surfaces. Solutions of concurrent vector systems.

Text: *Slaby, Fundamentals of Three-Dimensional Descriptive Geometry.*

**E.Gr. 115. Engineering Graphics**

0-6-2. Prerequisite: E.Gr. 113 or E.Gr. 170.

Use of the graphic techniques of sectioning, dimensioning, pictorial representation, detail and assembly sketches and drawings in engineering design. Application of graphical computations, (graphic algebra, graphic calculus, nomography, and empirical equations) to the analysis and synthesis of engineering problems.


**E.Gr. 170. Introduction to Visual Communication and Engineering Design I**

2-3-3. Prerequisite: None.

This is the first of a multi-discipline two-course sequence in visual communication and engineering design. The engineering design portion of this course introduces the student to 1) the theory of design, through a lecture series on the design process, and 2) the application of this problem-solving process, through the completion of an assigned design project. In the area of visual communications, the student is introduced to those elements of projection theory and those techniques of engineering graphics which will enhance 1) his ability toward rapid visualization and 2) his ability to communicate through graphic presentation.


**E.Gr. 171. Introduction to Visual Communication and Engineering Design II**

2-3-3. Prerequisite: E.Gr. 170.

The lecture series builds on the student's previous knowledge of the design process by considering some of the factors which influence good creative design; namely, environmental factors, human factors, material factors, and socio-economic factors. Students are organized into teams for design projects assigned during this course. The visual communications portion of the course provides for an in-depth study of the use of engineering graphics as a tool for engineering analysis, with emphasis on empirical equations, graphic calculus, and nomography.


**E.Gr. 190-191. Special Topics in Engineering Graphics**

2-3-3; 2-3-3. Prerequisite: Consent of instructor.

These courses are designed to permit students to pursue common, specialized interests in areas of graphics not represented or treated extensively in other offerings of the Department.

**E.Gr. 213. Industrial Graphics**

1-6-3. Prerequisites: E.Gr. 170 or equivalent.

Sketching and simplified representation techniques as applied to production drawings; advanced study of auxiliary views and sections; threads and fasteners; geometric tolerancing and true-position dimensioning; working drawings and assembly drawings as a part of the design process; use of air brush in technical illustration.

Text: To be selected.
E.Gr. 108. An Introduction to Spatial Structures for Computer Simulation
3-0-3. Prerequisite: E.Gr. 170 or consent of instructor. Co-requisite: Math 108 or equivalent.

First of a two course series in spatial structures designed to strengthen a student's visual perception of space forms as well as provide an acquaintance with spatial constructs related to computer simulation of digital models. Participants should acquire both a knowledge and an appreciation of computer simulation skills involved in the application of computer graphics to engineering problems. Special emphasis on the algorithmic approach of formulation for both graphical and analytical model construction. Topics include an introduction to the techniques of manipulating both two- and three-dimensional figures; these techniques include: (1) basic point and coordinate transformations, (2) matrix and vector operations, (3) an algorithm for generating displays of three-dimensional space forms, (4) a graphical analogue of the least squares line, and (5) the idealized draftsman's spline algorithm.

E.Gr. 209. Computer Simulation of Spatial Structures

Second of a two course series in spatial structures provides participants with an overall appreciation of the applications of digital computer simulation and its role in the solution of real engineering problems. These problems cover such topics as, (1) the utilization and visualization of spatial analogies, (2) geometric transformations of space forms, (3) the concept of ruled surfaces, and (4) sculptured surface forms and their application to computer simulation. Participants will be introduced to the fundamentals of digital computer programming, the use of remote and batch processing, and the elementary principles of graphic manipulation. Current facilities include on-campus teletype terminals, a digitally driven CALCOMP plotter, and batch access to the UNIVAC 1108.

E.Gr. 304. Graphic Statics I
0-3-1. Prerequisite: ESM 205 or equivalent.

Graphical solutions of coplanar force systems, resultants, equilibrium of simple structures, funicular polygon through three points, trusses, friction.

Text: Notes and Departmental Work Sheets.

E.Gr. 305. Graphic Statics II
1-3-2. Prerequisites: E.Gr. 170 and E.Gr. 304 or ESM 344.

Graphical solutions of three dimensional force systems and structures; graphical integration and funicular polygon solutions of areas properties and beam slopes and deflections.

Text: Notes and Departmental Work Sheets.

E.Gr. 413. Introduction to Graphical Computation
3-0-3. Prerequisites: E.Gr. 115 or E.Gr. 171 or consent of instructor and Math. 209 or equivalent.

An introduction to the use of graphics as an applied science in the solution of engineering problems. Special emphasis on empirical equations, calculus, and differential equations.


E.Gr. 415. Nomography
3-0-3. Prerequisite: E.Gr. 115 or E.Gr. 170.


E.Gr. 423. Descriptive Geometry Systems
3-0-3. Prerequisite: E.Gr. 114 or E.Gr. 171.

A presentation of Mongean descriptive geometry theory with a study of applications of different descriptive geometry systems to advanced spatial analysis.

Text: Schumann, *Descriptive Geometry*. 
E.Gr. 433. Pictorial Projections
3-0-3. Prerequisite: E.Gr. 170 or consent of instructor.

A study of the communication of engineering information through pictorial representations. The theoretical basis of parallel and perspective pictorial projections including axonometric, oblique, and oblique-axonometric projections; parallel, angular and three-point perspective.

Text: Rule and Coons, Graphics; and Lawson, Practical Perspective Drawing.
SCHOOL OF ENGINEERING SCIENCE AND MECHANICS
(Established in 1959)

Director—Milton E. Raville; Regent's Professor Emeritus—Phil Blasier Narmore; Regents' Professor—Andrew W. Marris; Professor Emeritus—William B. Johns, Jr.; Professors—Helmut F. Bauer, Bryan L. Brown, Francis M. Hill, William J. Lnenicka, Charles E. Stoneking, James T. S. Wang; Associate Professor Emeritus—Francis C. Bragg; Associate Professors—James H. Armstrong, Michael C. Bernard, Wilton W. King, David J. McGill, George M. Rentzepis, Robert W. Shreeves, George J. Simites, Charles E. S. Ueng; Assistant Professors—Jerry M. Anderson, Donald G. Berghaus, John C. Clark, Stephen L. Passman; Instrument Maker—Memory G. Turner; Principal Secretary—Peggy A. Stallings; Secretary—Velma J. Connell; Accounting Clerk—Madelyne B. Watson.

General Information

The undergraduate program administered by the School of Engineering Science and Mechanics leads to the degree Bachelor of Engineering Science and may be obtained under the regular or the co-operative plan of study.

The primary objective of this curriculum is to prepare students for careers in engineering and related fields. With this in mind, the program emphasizes fundamental principles and techniques in mathematics and the engineering sciences—solid mechanics, fluid mechanics, materials science, electrical sciences, heat transfer, and thermodynamics. The program presently provides for 80 hours of elective credit, including 26 hours of free electives, 15 hours of technical electives, 6 hours of mathematics electives, and 33 hours of Humanities/Social Science/Modern Language electives. Even more flexibility is being planned for the curriculum in the near future. It is vitally important that a student be able to pursue in depth certain technical (or technically-related) areas of particular interest to him.

Graduates of Engineering Science undergraduate programs find employment in a wide variety of areas—aircraft, automotive, electrical and electronic industries, industrial and governmental research laboratories, and many other such organizations. However, it is anticipated that the majority of the graduates will pursue graduate degrees, and to this end they receive a broad education in the fundamentals of several engineering fields. Such study gives the student the widest possible choice for specialization in graduate study; further, his knowledge enables him, should he desire, to work in interdisciplinary research areas, such as bioengineering, systems engineering, or materials science.

The rapid development of our urban society has produced many technologically-related problems that require imaginative and innovative solutions. The graduate who has completed a program that emphasizes flexibility, as well as a broad knowledge of the important fundamentals underlying modern engineering practice, will be able to contribute successfully to the solution of
these problems.

A minimum scholastic average of C is required in the prescribed courses in mathematics, physics, and engineering science and mechanics. Students who fail to meet this requirement may continue only on a probationary status.

Several modern experimental research laboratories are maintained for graduate and undergraduate research in the areas of Experimental Stress Analysis, Vibrations, and Materials. A departmental research machine shop under the direction of a competent machinist is maintained for constructing special research equipment and models and for servicing laboratory equipment.

In addition to the four-year bachelor's degree program, the School of Engineering Science and Mechanics offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. The requirements for the B.S. in Engineering Science are listed on the following pages; the requirements for the M.S. and Ph.D. degrees may be found in the Graduate Bulletin.

Elective Programs

Each student is encouraged to define career objectives early in his college program. In conference with his faculty advisor he can then outline an elective program best suited to the achievement of these objectives. Examples of elective programs and suggested courses are:

Materials Science: The search for new materials in engineering to be used in unusual environments is becoming more and more important. The Materials Science Program uses courses in Chemistry, Metallurgy, and Mathematics as well as the ESM 480 which is a required course in the ESM program. The basic principles contained in the required ESM courses enable the student to obtain the maximum benefit from his elective courses and also provide the depth and breadth of training necessary for advanced study.

Chem. 209; Met. 301, 403, 446; Cer.E. 209.

Information and Computer Science: This program is designed for the student interested in information processing and computing techniques and their application in the field of engineering. The electives listed below provide the depth and breadth of required background for career development and further study.

Math. 239; ICS 151, 256, 310, 325, 342, 355, 445.

Engineering Mechanics: This program should be of special interest to the student who wishes to work in industry in the area of research and development or to pursue graduate study in Engineering Mechanics.

ESM 385, 422, 441, 444, 446; M.E. 313, 413, 485.

Bio-engineering: The student electing this program will be well prepared to undertake graduate study in the Bio-engineering field or to collaborate in
research and development efforts in the field.

Bio. 210, 211, 212, 311, 341; E.E. 481; ESM 484.

Programs in many other areas can be constructed as the individual student’s needs and interests dictate.

**Freshman Year**

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NOTE: Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.

*These free elective courses may be taken at any time during a student’s course of study. However, if six credit hours of basic ROTC are elected, then it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

A maximum of nine hours of free electives in junior-senior years may be in advanced ROTC.

**See page 38 of the catalog for engineering electives.

**Sophomore Year**

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### Junior Year

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<td>E.E. 211</td>
<td>Elements of Electrical Engineering</td>
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<td>E.E. 212</td>
<td>Instrumentation</td>
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<td>ESM 334</td>
<td>Mechanics of Deformable Bodies</td>
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<td>ESM 374</td>
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<td>Econ. 204</td>
<td>Survey of Principles of Economics</td>
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*To be selected from Math 309, 411, 412, 413, 415.

### Senior Year

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<td>M.E. 326, 327</td>
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<td>ESM 490</td>
<td>Projects in Engineering Science</td>
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<td>M.E. 414</td>
<td>Heat Transfer</td>
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<td>Physics 319</td>
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*At least six hours of electives must be in the area of Design, Synthesis, or Systems.
Courses of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

ESM 110. Introduction to Engineering
2-3-3. Prerequisites: None.

Historical and evolutionary aspects of engineering; the engineer and design; the relation between the student's curriculum and his career in engineering; the engineer as a professional. Emphasis is placed on student participation in the creative design process.

Text: Beakley and Leach, Engineering – An Introduction to a Creative Profession.

ESM 205. Statics
3-0-3. Prerequisites: Math. 207 or concurrently.

Topics of study include elements of statics in two and three dimensions; review of centroids; laws of equilibrium applied to machines and structures; friction.

Text: Beer and Johnston, Statics; or Lnenicka, Bernard, Stoneking, Programmed Statics.

ESM 309. Dynamics I
3-0-3. Prerequisites: ESM 205; Math 208, or concurrently; Physics 227.


Text: Beer and Johnston, Dynamics.

ESM 310. Dynamics II
3-0-3. Prerequisites: ESM 309.

Application of the laws of Newtonian mechanics to problems involving systems or particles or continuous media. Kinetics of rigid bodies; angular momentum; kinetic energy; work-energy relation; applications.

Text: Beer and Johnston, Dynamics.

ESM 334. Mechanics of Deformable Bodies
5-0-5. Prerequisites: ESM 205; Math. 208 or concurrently.

Simple stresses and strains; membrane stresses; torsion; shear and bending moment diagrams; flexure stresses and shearing stresses in beams; introduction to plastic bending of beams; combined stresses; deflection of beams; statically indeterminate beams; introduction to strain energy; column theory.


ESM 337. Mechanics of Materials
3-0-3. Prerequisite: ESM 334.

Review of the analysis and design of statically determinate and indeterminate beams emphasizing the use of singularity functions; analysis and design of structural elements by energy methods; analysis and design of thick-walled cylinders and rotating discs; analysis and design of curved beams.

ESM 344. Statics
3-3-4. Prerequisites: Math. 109. Physics 211, Arch. 271.

Topics of study include elements of statics in coplanar force systems; equilibrium of particles and rigid bodies; simple structures; centroids, center of gravity; beam shear and bending moment; cables; friction. Algebraic and graphical solutions.

Text: Beer and Johnston, Statics. Departmental work sheets.

ESM 345. Mechanics of Materials
3-0-3. Prerequisite: ESM 344.

Topics of study include Hooke's Law; simple stresses and strains; mechanical properties of materials; torsion; shear and bending moment equations and diagrams; area moment of inertia; flexure and shearing stresses; design of beams.


ESM 346. Mechanics of Materials
3-0-3. Prerequisite: ESM 345.
Topics of study include plane stresses, Mohr's circle; compound stresses; combined stresses; deflection of beams; analysis of columns.


**ESM 374. Experimental Methods in Engineering Science**


Consideration is given to physical parameters studied in engineering problems and to the methods used to observe their behavior. Electronic circuits useful in engineering measurement are treated in sufficient detail to show how they may be applied with transducers and electronic instruments to study engineering problems. Models and analogies are introduced with particular emphasis given to the analog computer.

**ESM 380. Computer Applications in Engineering Science and Mechanics**

2-3-3. Prerequisites: ESM 337, ESM 421, or consent of instructor.

Introduction to the use of the digital computer; Fortran and Algol languages; computer solutions of problems in statics, dynamics, mechanics of deformable solids, vibrations, and fluid mechanics.

**ESM 385. Intermediate Dynamics I**

3-0-3. Prerequisite: ESM 310, or consent of instructor.

Topics of study include the two and three dimensional kinematics and kinetics of particles and systems of particles with application to motion in a resisting medium, central force motion, problems involving redistribution of mass and the motion of a particle allowing for the effects of the earth's rotation.

Text: Marris and Stoneking, *Advanced Dynamics*.

**ESM 392. Fluid Mechanics**

5-0-5. Prerequisites: Math. 208 or concurrently, ESM 310.


**ESM 402. Intermediate Dynamics II**

3-0-3. Prerequisite: ESM 385, or consent of instructor.

Topics of study include the two and three dimensional motion of a rigid body, Euler's Equations, and an introduction to energy methods and Lagrange's Equations.

Text: Marris and Stoneking, *Advanced Dynamics*.

**ESM 421. Mechanical Vibrations**

3-0-3. Prerequisites: Math. 209 or 304 or 305; ESM 309.

Kinematics of vibration; free and forced vibrations of single and many degree of freedom systems, without and with damping; critical speeds.


**ESM 422. Mechanical Vibrations**

3-0-3. Prerequisite: ESM 421, ESM 337 or equivalent.

Continuation of ESM 421. Complex representation; Fourier series; step and impulse loads; many degrees of freedom; influence coefficients; matrix method; stability of solution; beam vibrations; approximate methods.


**ESM 441. Mechanics of Deformable Bodies**

3-0-3. Prerequisite: ESM 334.

The presentation is chiefly scalar with some results summarized in cartesian tensor form. Topics of study include analysis of stress and strain in two and three dimensions; linear stress strain relations; general theorems in linear small strain elasticity; application to problems in
generalized plane stress and plane strain; introduction to the torsion of noncircular cross sections; introduction to the technical theory of bending.

**ESM 444. Stress Analysis**

3-3-4. Prerequisite: ESM 441.

Further treatment of torsion and the membrane analogy; further treatment of the technical theory of bending including shear center, strain energy, virtual work and the reciprocal theorem; symmetrical problems in the bending of thin plates and in simple types of shells; introduction to contact stresses; introduction to numerical methods.

**ESM 446. Continuum Mechanics**

3-0-3. Prerequisite: Math. 209.

Geometrical foundations; concept of stress and strain tensors; analysis of stress and strain; fundamental physical laws; constitutive equations; introduction to elasticity, plasticity, thermoelasticity, viscoelasticity, wave propagation.

**ESM 471. Introduction to Experimental Stress Analysis**

1-6-3. Prerequisites: ESM 334 or equivalent, Senior standing.

Topics of study include the elements of two dimensional photoelasticity; the elements of electric resistance strain gage theory and practice; strain recording devices; transducer applications.

Text: Holister, *Experimental Stress Analysis*.

**ESM 480. Materials Science**

3-0-3. Prerequisite: Senior standing.

Topics of study include fatigue; creep; effect of shape, size, temperature, and microstructure of specimen; the more common stress-strain equations, hysteresis, after effect, etc.; theories of failure. Considerable reading and report writing required.

**ESM 484. Biomechanics**

3-0-3. Prerequisites: Math 412 or equivalent; ESM 392 or equivalent.

Mechanical modeling of the human body in various positions; muscle mechanics of stimulated muscles, steady non-Newtonian flows; material properties of various parts of the human body; pulsatile flow of biological liquids, hemodynamics; anomalies of blood; wave propagation in arteries; venous hemodynamics; action of the heart and regulation of the circulation; peristaltic transport.

**ESM 490. Projects in Engineering Science**

3-0-3. Prerequisite: Consent of instructor.

An experimental and/or theoretical investigation of some branch of engineering science. The student will define the problem, design an experiment if required, and correlate theory with experimentation. Both oral and written reports required.

**ESM 497-8-9. Special Problems in Engineering Science**

Hours and credit to be arranged.

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**Graduate Courses Offered**

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<td>ESM 422</td>
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<td>Mechanics of Deformable Bodies</td>
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<td>ESM 444</td>
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<td>ESM 613</td>
<td>Vibration of Elastic Bodies</td>
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<td>ESM 615</td>
<td>Gyroscopic Motion and Devices</td>
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(Complete details pertaining to these courses are contained in the Graduate Bulletin, which is available upon request.)
Department of English


General Information

At the freshman-sophomore level the Department of English offers a unified six-quarter sequence of courses devoted to the study and appreciation of literature and to intensive practice in composition. The freshman courses stress the relationship between content and literary form; the sophomore courses emphasize the humanistic values of literature in Western culture. The practice in composition makes use of the literature for subject matter and stresses logical thinking, proper organization of material, effective use of evidence, and clarity and precision of expression. This sequence of six courses is required by the General College and the College of Industrial Management.

The Department also offers elective courses in both written and oral communication and in literature and language. The courses in communication include practical training in public speaking and in various kinds of writing that are useful in science, business, and industry. The electives in literature cover a variety of approaches: major writers since the Renaissance studied in the scientific and philosophical context of their times; types of literary form; thematic approaches; and seminars in individual writers. Credit in drama is granted for participation in Drama Tech productions.

A special two-year program in the English language, composition, and American literature is offered for students whose native language is other than English. Four of these courses—English 133, 231-2-3—are classified as courses in the humanities.

Students who score sufficiently high on the Advanced Placement Examination administered by the College Entrance Examination Board are exempted from certain freshman-sophomore courses. Students who wish to take examinations for advanced standing should follow the Institute's official procedure in handling these examinations. A number of students in the Engineering College whose scores on the College Board SAT-Verbal and the
English Achievement examinations are sufficiently high are given the option of waiving one or more of the freshman courses as prerequisites to enrollment in the upper-level courses offered by the Department.

Courses of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

**Engl. 50. Reading for Speed and Comprehension**
2-0-0. Prerequisite: None

Mechanics of reading, exercises in increasing speed and improving comprehension. Recitations, tests, and individual practice.


**Engl. 107-8-9. Analysis of Literature**
3-0-3. Freshman year. Courses must be taken in numerical sequence.

Guided analysis of selected literary works, with special attention to the relationship of content and form. Intensive practice in written composition on subjects provided by the literature studied. Discussions, papers.


**Engl. 110. Vocabulary Building**
3-0-3. Prerequisite: None.

Development of a useful vocabulary required in technical and scientific courses and general reading. Recitations, written exercises, individual practice and research, quizzes.


**Engl. 131-2-3. English for International Students**
5-0-5. Freshman year, consecutive quarters. Admission by consent of the Department.

A one-year course designed as an introduction to written and spoken English, stressing American pronunciation, idiomatic phrases, and language appropriate to basic social situations and customs of the American people. Engl. 133 includes some study of literature.

Texts: To be announced.

**Engl. 201-2-3. Survey of the Humanities**

A sequence of courses studying the contribution of several Western civilizations from the Greeks to modern times as revealed in literature. Lectures, reports, papers, quizzes.

Texts: Selected readings in each period.

**Engl. 204. Creative Writing**

Study and practice in several forms and methods of creative writing. Recitations, compositions.

**Engl. 206. Survey of English Literature**

A study of English literature since Shakespeare, with emphasis on significant figures and their works through the 19th century. Lectures, reports, papers, quizzes.

Texts: To be announced. May be substituted for Engl. 203.

**Engl. 207. Survey of American Literature**

A study of the development of literature in America with emphasis on significant figures and their works through the 19th century. Lectures, reports, papers, quizzes.

Texts: To be announced. May be substituted for Engl. 203.

**Engl. 221-2-3; 331-2-3. Acting and Producing the Play**
0-3-1. Prerequisite: Admission by consent of the Department.

Participation in the Drama Tech pro-
ductions of various kinds of plays, including the presentation of one play before an audience.

**Engl. 231-23. Literature for International Students**
5-0-5. Sophomore year, consecutive quarters. Prerequisite: Engl. 133.

An introduction to American ideas as expressed in American literature, with continued training in writing and speaking the American language.

Texts: To be announced.

**Engl. 301. Contemporary Drama**

An analytical survey of prominent playwrights and trends in contemporary drama. Lectures, reports, collateral reading, quizzes.

Text: To be announced.

**Engl. 302. Shakespeare**

A brief statement of the life and times of Shakespeare and a careful study of certain of his principal works. Lectures, reports, papers, quizzes.

Text: *The Complete Plays of Shakespeare*.

**Engl. 304. Contemporary Fiction**

An analytical study of prominent writers and trends in contemporary fiction. Lectures, reports, collateral reading, quizzes.

Texts: To be announced.

**Engl. 306. The English Language**

Study of the origin of the English language, its relation to other languages, and its differentiation and development into modern English and American. Lectures, quizzes, term paper.

Text: Pyles, *Origin and Development of the English Language*.

**Engl. 307. Chaucer**
3-0-3. Prerequisite: English 107-8-9.

A brief examination of Chaucer's language and of the political, social, and religious history of his times, and a careful study of Chaucer's narrative poetry. Lectures, discussions, papers.

Text: To be announced.

**Engl. 308. Logic and the Use of Language**
3-0-3. Prerequisite: English 107-8-9.

Study of basic principles of logic and semantics as an introduction to techniques of sound reasoning and their use in increasing the effectiveness of oral and written communication. Special emphasis on the detection and analysis of common fallacies as they appear in propaganda and in the mass media. Lectures, discussions, reports.

Text: To be announced.

**Engl. 315. Public Speaking**
3-0-3. Prerequisite: Junior standing.

Instruction in the basic principles of effective public speaking, with emphasis on practice and criticism. The course is conducted as a laboratory.

Text: To be announced.

**Engl. 318. Persuasive Speaking**
3-0-3. Prerequisite: Admission by consent of the instructor.

Principles of argumentation and persuasion, with emphasis on issues of current public interest.

Text: To be announced.

**Engl. 319. Oral Communication in Science, Business and Industry**
3-0-3. Prerequisite: English 315.

Study of informative oral communication in satisfying the needs of science, business, and industry, especially in committee, panel, round table, and technical briefing settings. Emphasis on the relationship of audio-visual aids to oral presentations and on practice in the effective use of such aids. The course is conducted as a laboratory or workshop.

Text: To be announced.
Engl. 323. Written Communication in Science, Business and Industry
3-0-3. Prerequisite: Junior standing.

An examination of the nature of the communicative process and practice in the application of the principles of effective written communication to the important types of professional writing—reports, letters, and memorandums. Case method of instruction and individual projects.
Text: To be announced.

Engl. 324. Advanced Writing

Intensive practice in composition at an advanced level in informative, argumentative, and persuasive forms; discussion of principles and theory of composing; analytical reading of models of appropriate essays and articles.
Text: To be announced.

Engl. 331-2-3. Acting and Producing the Play
0-3-1. Prerequisite: Admission by consent of the Department.
See Engl. 221-2-3.

Engl. 341. Writers in the Age of Galileo

Intensive study of the works of three of the following: Donne, Bacon, Jonson, Milton, Defoe. Special attention to the significance of these writers in reflecting the social, scientific, and philosophical attitudes of the age. Lectures, discussions, papers, quizzes.
Texts: To be announced.

Engl. 342. Writers in the Age of Newton

Intensive study of the works of three of the following: Swift, Fielding, Thoreau, Wordsworth, Keats. Special attention to the significance of these writers in reflecting the social, scientific, and philosophical attitudes of the age. Lectures, discussions, papers, quizzes.
Texts: To be announced.

Engl. 343. Writers in the Age of Darwin

Intensive study of the works of three of the following: Carlyle, Melville, Arnold, Tennyson, Twain. Special attention to the significance of these writers in reflecting the social, scientific, and philosophical attitudes of the age. Lectures, discussions, papers, quizzes.
Texts: To be announced.

Engl. 344. Writers in the Age of Freud and Einstein

Intensive study of the works of three of the following: James, Yeats, Shaw, Lawrence, Eliot. Special attention to the significance of these writers in reflecting the social, scientific, and philosophical attitudes of the age. Lectures, discussions, papers, quizzes.
Texts: To be announced.

Engl. 360. The Literature of the Bible

Study of a number of Biblical selections of unusual literary merit. Lectures, collateral reading, reports, quizzes.

Engl. 381-2-3. Seminars in Literature
3-0-3. Prerequisite: Consent of the Department.

Intensive study of individual writers, movements, periods, or themes in literature, with the purpose of developing knowledge in depth, critical independence, and expository skill. Discussions, papers, quizzes.
Texts: To be announced.

Engl. 441. Studies in the Novel

Intensive critical analysis of selected novels, with special emphasis on the artistic excellence and significance of the works in the development of modern scientific and philosophical attitudes. Lectures, discussions, papers, quizzes.
Texts: To be announced.
Engl. 442. Studies in the Drama

Intensive critical analysis of selected plays, with special emphasis on the artistic excellence and significance of the works in the development of modern scientific and philosophical attitudes. Lectures, discussions, papers, quizzes.
Texts: To be announced.

Engl. 443. Studies in Poetry

Intensive critical analysis of selected poems, with special emphasis on the artistic excellence and significance of the works in the development of modern scientific and philosophical attitudes. Lectures, discussions, papers, quizzes.
Texts: To be announced.

Engl. 444. Studies in the Essay

Intensive critical analysis of selected essays, with special emphasis on the artistic excellence and significance of the works in the development of modern scientific and philosophical attitudes. Lectures, discussions, papers, quizzes.
Texts: To be announced.

Engl. 451. Seminar in Themes and Problems in Contemporary Literature

Intensive study of selected works of modern literature which treat the theme of Man and Himself as these works reflect problems and issues of immediate concern to contemporary times. Discussions, papers, quizzes.
Texts: To be announced.

Engl. 452. Seminar in Themes and Problems in Contemporary Literature

Intensive study of selected works of modern literature which treat the theme of Man and Society as these works reflect problems and issues of immediate concern to contemporary times. Discussions, papers, quizzes.
Texts: To be announced.

Engl. 453. Seminar in Themes and Problems in Contemporary Literature

Intensive study of works of modern literature which treat selected issues of immediate concern to contemporary times. Discussions, papers, quizzes.
Texts: To be announced.
SCHOOL OF GEOPHYSICAL SCIENCES
(Established in 1970)

Director and Professor—Charles E. Weaver; Adjunct Professor—David W. Menzel; Associate Professors—J. Helmut Reuter, J. Marion Wampler; Assistant Professors—Kevin C. Beck, L. Timothy Long, Robert P. Lowell, G. Lafayette Maynard, Charles O. Pollard, Jr., Herbert L. Windom; Adjunct Assistant Professor—James L. Harding; Supporting Faculty—R. A. Young; Principal Secretary—Dianne Clark.

General Information

The newly established School of Geophysical Sciences offers a graduate study program leading to the M.S. degree, with approval of the Ph.D. degree pending. The graduate program includes study of the science of fluid and solid environments, including those environments that have been modified by man. Joint research with engineers and other basic scientists is encouraged, so that graduate students can relate their basic scientific studies to interdisciplinary research such as the solution of environmental problems. Graduate programs are individually tailored to the student's needs and desires.

The geophysical sciences are multidisciplinary and require a strong background in chemistry, physics, mathematics, biology, or engineering. Specialization starts at the graduate level. For these reasons the undergraduate program in geophysical sciences has been developed within existing B.S. programs of other Schools at Georgia Tech. Several possibilities exist for the undergraduate student who would like to develop a curriculum with potential for application to advanced work in the earth sciences, or who would otherwise like to structure his elective courses within the School of Geophysical Sciences. First, undesignated degree curricula can be developed with emphasis in such fields as geochemistry, geophysics, or engineering geology. Second, a minor in Geophysical Sciences can be obtained in addition to the undergraduate major in another School. The minor in Geophysical Sciences can be obtained by completing Geology 203, 325, and 15 other credit hours in geology courses with course numbers 300 or above. Third, since major curricula in some of the Schools whose students would most naturally be inclined to minor in Geophysical Sciences have few elective hours available, several options within their normal B.S. programs have been proposed to the faculties of those Schools. The School of Chemistry has offered an option in Geochemistry, whereby Geology 203, 325, 326, 460, and 10 other hours in Geology courses (300 or above) are substituted for the normally required 10 hours of Chemistry electives and 13 hours of free electives. A similar option in Engineering Geology has been proposed to the faculty of the School of Civil Engineering. Interested undergraduate students should consult a faculty member of the School of Geophysical Sciences before their junior year.
Present areas of specialization include geophysics, geochemistry, mineralogy, and sedimentology. Interdisciplinary studies can be carried out in such areas as crystallography, engineering geology, organic geochemistry, and nuclear science. Research and study in oceanography and marine geology is conducted in cooperation with the staff of the Skidaway Institute of Oceanography at Savannah, Georgia.

Man must become increasingly concerned about understanding, controlling, and protecting his physical environment. As a result, the geophysical scientists will play an increasingly important role in the fight for survival.

**Undergraduate Courses of Instruction**

**NOTE:** 2-3-3 means 2 hours class, 3 hours laboratory, 3 hours credit.

**Geol. 101. Introduction to the Earth Sciences**
3-0-3. Prerequisite: None.

An introduction to study of the earth, intended to give general insight into the nature of man's environment.

An introduction to some of the geophysical sciences. A careful examination of the movement of the earth with respect to celestial bodies; of the physical interactions of the earth, sun, and moon; and of the earth's gravitational and magnetic fields. These physical relationships are the basis of an introduction to planetary science, geodesy, meteorology, oceanography and climatology. (Note: Geology 101 does not include a study of the composition and structure of the solid earth.)

**Geol. 201. General Geology**
3-0-3. Prerequisite: Chem. 104.

An introduction to earth's structure, composition, and the records of geologic time. Nature and rate of continental denudation, the origin and cycling of sedimentary rocks, the evidence for and causes of the evolution and migration of continents.

**Geol. 203. Physical Geology**
3-3-4. Prerequisite: Chem. 104 or equivalent. Corequisites: Che. 105 or equivalent and Phys. 207 or equivalent.

Introduction to the nature of minerals and rocks, the processes forming them, and their pattern in space and time. Laboratory exercises on minerals, rocks, and geologic maps.

**Geol. 306. The Earth-Moon System**
3-0-3. Prerequisites: Chem. 105 and Phys. 229.

An introduction to the earth and moon as a planetary system, with emphasis on topics which are of significance in the geophysical sciences.

**Geol. 308. History of the Earth**
3-3-4. Prerequisites: Chem. 105 and Geol. 201, or Geol. 203.


**Geol. 311. Mineral Resources**
3-0-3. Prerequisite: None.

A study of the causes and effects of the earth's environment with applications in the area of soil development, mineral deposits, and topography.

**Geol. 325. Mineralogy**
3-3-4. Prerequisites: Geol. 203 or consent of instructor.

Bonding and symmetry in the crystalline state; mineral structure and crystal chemistry; application to geologically important minerals. Laboratory is devoted to crystal morphology structure models, hand specimen verification, x-ray diffraction, and silicate analysis (x-ray fluorescence, atomic absorption).
Geol. 326. Optical Mineralogy
0-3-1. Prerequisite: Geol. 325 or consent of instructor.

A brief introduction to the use of the polarizing microscope for identification and study of minerals and thin sections of rocks.

Geol. 420. Applied Geophysics
2-3-3. Prerequisites: Geol. 203 and Phys. 229.

Introduction to theory of geophysical exploration methods. Methods to be considered include electrical, magnetic, gravity, seismic refraction and seismic reflection. Laboratory provides exercises in applications to problems in exploration and in the use of instruments.

Geol. 421. The Influence of Man's Activities on the Global Environment
3-3-4. Prerequisites: Chem. 105 and Geol. 201, or Geol. 203.

The interacting equilibrium of atmosphere, hydrosphere, biosphere, and lithosphere. The energy cycle; the water cycle; the carbon cycle; the oxygen cycle; the nitrogen cycle. The interfering effects of man's activities on the cyclic equilibria on the earth.

Geol. 422. Structural Geology
3-3-4. Prerequisite: Geol. 203 or equivalent.

An introduction to the description and analysis of structural features of rocks. Primary structures produced during sedimentation and igneous activity are briefly reviewed, but the major part of the course is devoted to the structures produced by rock deformation during tectonic and metamorphic activity. The laboratory will include several field trips.

Geol. 423. Introduction to Geophysics
3-3-4. Prerequisites: Geol. 203 and Phys. 229.

General survey of terrestrial geophysics. Topics discussed include the earth's composition, heat flow, seismicity, gravity field, magnetic field, paleomagnetism, and global tectonics.

Geol. 424-25-26. Field Methods in Geology
0-6-2, 0-6-2, 0-6-2, Prerequisites: Geol. 203. Senior standing.

Methods and procedures of areal and subsurface geological mapping.

Geol. 427. Introduction to Physical and Chemical Oceanography
3-0-3. Prerequisites: Geol. 203 or consent of instructor.

Ocean geometry and physiography; physical properties of sea water; theory of water movements and energy fluxes; marine sedimentation; sea water geochemistry; marine geophysics and tectonics; ocean history (sea water origin, sea floor spreading, Pleistocene glaciation.)

Geol. 435. Petrology of the Sedimentary Rocks
2-3-3. Prerequisites: Geol. 325, and Geol. 326 or Cer.E. 409 or consent of instructor.

Texture, composition, and structure of sediments and sedimentary rocks; sedimentary processes (hydraulics and aqueous geochemistry); analysis of sedimentary environments.

Geol. 436. Petrology of Igneous and Metamorphic Rocks
3-3-4. Prerequisites: Geol. 326 or Cer.E. 409 and Geol. 422.

Composition, texture, and structure of igneous and metamorphic rocks; physical and chemical factors controlling genesis of igneous and metamorphic rocks; geologic conditions controlling metamorphism and igneous activity.

Geol. 443. Engineering Geology
3-3-4. Prerequisites: Geol. 203.

Applications of geological science to problems of civil engineering.

Geol. 450. Special Problems in the Earth Sciences
0-6-2. Prerequisites: Junior or senior standing.

Literature, laboratory or field investiga-
tion, and preparation of a written or oral report or both covering some branch of earth sciences.

Geol. 460. Introduction to Geochemistry
3-3-4. Prerequisite: Geol. 325 or consent of instructor.

Distribution and behavior of the chemical elements and natural compounds in the earth, its waters, and atmosphere. Application of chemical principles to geologic processes.

Graduate Courses Offered

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 601-2-3</td>
<td>Advanced Geological Problems</td>
<td>2-0-2, 2-0-2, 3-0-3</td>
</tr>
<tr>
<td>Geol. 607</td>
<td>Geophysics I Seismology and the Earth's Interior</td>
<td>3-3-4</td>
</tr>
<tr>
<td>Geol. 608</td>
<td>Geophysics II Gravity and Geomagnetism</td>
<td>3-3-4</td>
</tr>
<tr>
<td>Geol. 609</td>
<td>Geophysics III Paleomagnetism and Global Tectonics</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Geol. 610</td>
<td>Clay Mineralogy</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Geol. 611</td>
<td>Advanced Clay Mineralogy</td>
<td>2-3-3</td>
</tr>
<tr>
<td>Geol. 615</td>
<td>Sedimentary Geology</td>
<td>3-3-4</td>
</tr>
<tr>
<td>Geol. 616</td>
<td>Stratigraphy and Sedimentation</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Geol. 621</td>
<td>Regional Tectonics</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Geol. 622</td>
<td>Tectonophysics</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Geol. 640</td>
<td>Geology of Ground Water</td>
<td>3-0-3</td>
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<tr>
<td>Geol. 651</td>
<td>Analytical Methods in Geophysics I</td>
<td>3-3-4</td>
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<tr>
<td>Geol. 652</td>
<td>Analytical Methods in Geophysics II</td>
<td>3-3-4</td>
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<tr>
<td>Geol. 655</td>
<td>Observational Seismology</td>
<td>3-3-4</td>
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<tr>
<td>Geol. 656</td>
<td>Theoretical Seismology</td>
<td>3-3-4</td>
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<tr>
<td>Geol. 660</td>
<td>Aqueous Geochemistry</td>
<td>3-0-3</td>
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<tr>
<td>Geol. 661</td>
<td>Organic Geochemistry</td>
<td>2-3-3</td>
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<tr>
<td>Geol. 662</td>
<td>Nuclear Geochemistry</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Geol. 670</td>
<td>Igneous Petrology</td>
<td>3-4-4</td>
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<tr>
<td>Geol. 671</td>
<td>Metamorphic Petrology</td>
<td>3-4-4</td>
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<tr>
<td>Geol. 700</td>
<td>Thesis</td>
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</table>

(Complete details about graduate courses in Geophysical Sciences are contained in the Graduate Bulletin, which is available upon request.)
SCHOOL OF INDUSTRIAL & SYSTEMS ENGINEERING
(Established in 1945—Option in M.E., 1924-1945)

Director—Robert N. Lehrer; Associate Director for Undergraduate Programs—William N. Cox, Jr.; Associate Director for Graduate Programs—William W. Hines; Professor and Director Emeritus—Frank F. Groseclose; Regents' Professor—Harold E. Smalley; Professors—James M. Apple, L. G. Callahan, David E. Fyffe, P. Gray, Cecil G. Johnson, Lynwood A. Johnson, Joseph Krol, Rocker T. Staton, Harrison M. Wadsworth; Professor Emeritus—Paul T. Eaton; Associate Professors—Norman R. Baker, Jerry Banks, Robert B. Cooper, J. Gordon Davis, Willard R. Fey, John J. Jarvis, Nelson K. Rogers, Frank E. Roper, C. M. Shetty, Gerald J. Thuesen, V. E. Unger, Pranas Zunde; Visiting Associate Professor—J. R. Watt; Assistant Professors—K. M. Bafna, M. S. Bazaraa, T. Connolly, R. H. Deane, R. G. Heikes, T. O. Kvalseth, J. B. Mathews, Douglas C. Montgomery, R. G. Parker, Thomas L. Sadosky, Joseph J. Talavage, D. B. Young; Visiting Assistant Professors—G. Patzak, A. Sakuna; Instructors—F. B. Alt, M. P. Deisenroth, J. R. Freeland, J. L. Kennington, D. M. Miller; Adjunct Lecturer—George W. Greenwood; Postdoctoral Fellow—T. Kumagai; Administrative Assistant—Frances L. Cochran; Mechanical Technician—Clarence F. Heriford

General Information

Industrial & Systems Engineering provides both a basic engineering foundation and a grounding in the interactions between technology and management. Students studying industrial and systems engineering are usually interested in obtaining a fundamental engineering background as the basis for professional specialization in activities associated with the field—operations research, management science, systems engineering, methods, organization, planning—or as preparation for other endeavors, such as management. The study of Industrial and Systems Engineering places emphasis upon developing the student's abilities to analyze and design systems which integrate technical, economic and social-behavioral factors both in industrial and in various service-social-governmental organizations.

Two bachelor degree programs are offered: The Bachelor of Industrial Engineering (BIE); and the Bachelor of Engineering Economic Systems (BEES), approved early in 1972.

BIE

The principal strength of the program leading to the Bachelor of Industrial Engineering degree lies in a solid, well coordinated core of courses in systems analysis and systems design, which rely heavily upon the engineering sciences, basic sciences, and social sciences. Elective hours make the program flexible as does the senior year design sequence, which permits a student to place emphasis on operations and facilities system design, information and control systems...
design, systems engineering, or a variety of other aspects of the field.

**BEES**

The program leading to the Bachelor of Engineering Economic Systems degree provides preparation for dealing with systems problems in the socio-economic sector. The program provides for a background in physical science and in behavioral or social science, and a grounding in the concepts and methodologies associated with systems analysis, industrial and systems engineering, computer technology, operations research, and management science. Opportunity is also provided to develop insight and background in specific areas of socio-economic problems by means of selected course work under the Major Selection requirement. A senior year project facilitates integration of earlier course work in dealing with selected project problems.

This program is grounded in the conviction that basic engineering methodologies have considerable potential for approaching socio-economic problems in a unique way, offering promise of better solution to problems of major social importance. The methodologies of systems analysis, industrial and systems engineering, computer technology, operations research and management science have been successful in dealing not only with complex industrial and production problems, but also with socio-economic problems. This program is designed to further focus these methodologies upon the broad sector of socio-economic problems, ranging from education and health care to urban development. The program is essentially engineering, but does not follow the usual engineering curriculum patterns. The "engineering sciences," based upon engineering development of the physical sciences, have been replaced by behavioral sciences—sociology or political science, psychology and economics. A background in the behavioral sciences is necessary for dealing with systems and problems having a high socio-behavioral-economic content as contrasted with systems and problems having a high technological content.

**Options for Exceptional Students**

An Option program is available to encourage students with superior abilities to fully avail themselves of a range of unusual educational opportunities. Participation in these programs requires demonstrated scholastic excellence, requires prior arrangements with the student's advisor, and provides the following options, individually or in combination.

a. *Graduate level courses in lieu of senior year electives:* for students with a cumulative grade-point average of 3.3 or above, up to 18 credit hours of approved graduate level courses may be scheduled. For such students, up to 18 credit hours of senior year electives may be waived. These credits, when approved by the student's advisor, may be made available for subsequent credit toward a graduate degree.
b. *Accelerated study:* for students with a 3.3 or above average during the three preceding quarters (including at least 45 credits) course requirements for any non-project Industrial & Systems Engineering course may be completed at the student's own pace by self study, and counseling and guidance by the course instructor. Students may register for any number of courses, but must satisfy instructor and course examination requirements. This may be done by the student’s own timing. Class attendance is not required. Arrangements *must* be made with course instructors prior to the start of the quarter.

c. *Individual project and research work:* for students with a 3.0 or above average during the preceding three quarters (including at least 45 credits) up to 18 credits of project and/or research work, done in collaboration with the faculty or advanced graduate students, may be substituted for senior year electives.

d. *Director's Honor Seminar (I.Sy.E. 500):* for senior students with a 3.0 or above cumulative grade point average, the Director's Honor Seminar may be taken as an elective.

**Graduate Programs**

Graduate programs are available leading to the degree of Master of Science, Master of Science in Industrial Engineering, Master of Science in Operations Research, and Doctor of Philosophy. Enrollment in the graduate program provides opportunity for students from BIE programs to continue their professional preparation, and for students from other engineering and science programs to enrich their educational exposure by study and research which relates engineering, management, and science. The growing recognition of the importance of advanced education in this field has caused a substantial growth of graduate study during recent years.

While graduate study within the educational philosophy of the School is a highly individual matter which allows each student to design his own program of study, emphasis in course and research work is typically along the lines of (a) operations research and systems engineering, (b) facilities design (including facilities location, facilities layout, materials handling, transportation and logistics), and (c) industrial engineering contributions to the health and medical care fields (including hospital industrial engineering). Other emphases, or cross-discipline programs, may be pursued.
### The BIE Curriculum

#### Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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<th>3rd Q.</th>
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<tr>
<td>Chem. 104-105</td>
<td>Inorganic Chemistry</td>
<td>4-3-5</td>
<td>4-3-5</td>
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<tr>
<td>E.Gr. 170</td>
<td>Visual Communication and Engr. Design I</td>
<td>2-3-3 or</td>
<td>2-3-3</td>
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<tr>
<td>Eng. 107-8-9**</td>
<td>Introduction to Literature</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>Math. 107-8-9</td>
<td>Calculus I, II, III</td>
<td>5-0-5</td>
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<td>Physics 227</td>
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<td>......</td>
<td>4-3-5</td>
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<tr>
<td>P.T.***</td>
<td>Physical Training</td>
<td>0-4-1</td>
<td>0-4-1</td>
<td>0-4-1</td>
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<tr>
<td>Free Elec.****</td>
<td>Orientation</td>
<td>2-0-2</td>
<td>2-0-2</td>
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<td>Gen.</td>
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<td>1-0-0</td>
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<td><strong>Totals</strong></td>
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<td>17-10-19</td>
<td>16-10-19</td>
<td>14-7-16</td>
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Note: Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.
*See page 38 of the catalog for engineering electives.
**English 107-8-9 will apply toward the satisfaction of the Engineering College Humanities requirement. See page 37 for the Modern Language Option.
***Three physical training courses are required during the freshman year. All students who are physically qualified will be required to take P.T. 101 (Swimming) and any other two courses from the remaining three offered (P.T. 102, 104, 105). Students with an exemption from all or any one of P.T. 101, 102, or 105 will be required to take P.T. 104 (Health Education). A maximum of six credit hours of P.T. courses may be used for degree credit.
****These free elective courses may be taken at any time during a student's course of study. However, if six credit hours of basic ROTC are elected, ROTC must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tr>
<td>Hum./S.S./M.L.</td>
<td>Humanities/Social Science/Modern Language</td>
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<tr>
<td>ISyE 200</td>
<td>Introduction to Industrial &amp; Systems Engineering</td>
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<td>ESM 205</td>
<td>Statics</td>
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<td>ESM 309</td>
<td>Dynamics I</td>
<td>......</td>
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<td>ICS 151</td>
<td>Digital Computer Organization and Programming</td>
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<tr>
<td>Econ. 201*</td>
<td>Economic Principles and Problems</td>
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<td>......</td>
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<tr>
<td>Math. 207</td>
<td>Calculus IV</td>
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<td>Math. 208</td>
<td>Calculus and Linear Algebra</td>
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<td>Math. 209</td>
<td>Ordinary Differential Equations</td>
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*Economics 201-202 will apply toward the satisfaction of the Engineering College Social Sciences requirement.
### Junior Year

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<td>Econ. 202*</td>
<td>Economic Principles &amp; Problems</td>
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<td>Mgt. 340</td>
<td>Analysis of Financial Data</td>
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<td>Thermodynamics</td>
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<tr>
<td>ISyE 310</td>
<td>Man-Machine Systems</td>
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<tr>
<td>ISyE 325</td>
<td>Engineering Economy</td>
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<tr>
<td>ISyE 333</td>
<td>Deterministic Models in Operations Research</td>
<td>4-0-4</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>ISyE 335</td>
<td>Applications of Probability</td>
<td>4-0-4</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>ISyE 336</td>
<td>Statistical Methods</td>
<td>.......</td>
<td>4-0-4</td>
<td>.......</td>
</tr>
<tr>
<td>ISyE 444</td>
<td>Simulation</td>
<td>.......</td>
<td>.......</td>
<td>2-3-3</td>
</tr>
<tr>
<td>ISyE 448</td>
<td>Systems Design Methodology</td>
<td>.......</td>
<td></td>
<td>3-0-3</td>
</tr>
<tr>
<td>Electives**</td>
<td></td>
<td></td>
<td>-6</td>
<td>-6</td>
</tr>
</tbody>
</table>

**Totals** 11-0-17 10-3-17 12-3-16

*Economics 201-202 will apply toward the satisfaction of the Engineering College Social Sciences requirement.

**Electives will include 12 hours of Humanities/Social Science/Modern Language; 18 hours of Industrial & Systems Engineering; 16 hours of Free Electives. The 16 hours of Free Electives may be used to accommodate basic ROTC, 6 credits, and advanced ROTC, 9 credits. Students must select Humanities and Social Sciences courses which satisfy the Engineering College requirements.

### Senior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.E. 325</td>
<td>Electric Circuits &amp; Fields</td>
<td>2-3-3</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>ESM 334</td>
<td>Mechanics of Deformable Bodies</td>
<td>.......</td>
<td>5-0-5</td>
<td>.......</td>
</tr>
<tr>
<td>Matl. Sci. Elec.*</td>
<td></td>
<td>3-0-3</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>Design I, II**</td>
<td></td>
<td>2-6-4</td>
<td>2-6-4</td>
<td>.......</td>
</tr>
<tr>
<td>Electives***</td>
<td></td>
<td>-5</td>
<td>-5</td>
<td>-15</td>
</tr>
</tbody>
</table>

**Totals** 7-9-15 7-6-14 -15

*Materials Science elective to be selected from the following courses: Met. 325, Met. 401, M.E. 212, ESM 480, Ch.E. 328, C.E. 309.

**The Design I, II requirement is to be satisfied by selection of one of the following: A. ISyE 471, 472; B. ISyE 481, 482; C. ISyE 461, 462; D. ISyE 451, 452.

**Electives will include: 12 hours of Humanities/Social Science/Modern Language; 18 hours Industrial & Systems Engineering; 16 hours of Free Electives. The 16 hours of Free Electives may be used to accommodate basic ROTC, 6 credits, and advanced ROTC, 9 credits. Students must select Humanities and Social Sciences courses which satisfy the Engineering College requirements.
## The BEES Curriculum
### Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 107-8-9</td>
<td>Calculus I, II, III</td>
<td>5-0-5</td>
<td>5-0-5</td>
<td>5-0-5</td>
</tr>
<tr>
<td>Engl. 107-8-9*</td>
<td>Introduction to Lit.</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
</tr>
<tr>
<td>ISyE 110</td>
<td>Basic Concepts of Industrial &amp; Systems Engineering</td>
<td>2-3-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Econ. 201-2</td>
<td>Economic Principles &amp; Problems</td>
<td></td>
<td>3-0-3</td>
<td>3-0-3</td>
</tr>
<tr>
<td>**</td>
<td>Science</td>
<td>5-0-5</td>
<td>5-0-5</td>
<td></td>
</tr>
<tr>
<td>Physics 227</td>
<td>Physics</td>
<td></td>
<td></td>
<td>4-3-5</td>
</tr>
<tr>
<td>**</td>
<td>Electives</td>
<td>2-0-2</td>
<td>2-0-2</td>
<td>2-0-2</td>
</tr>
<tr>
<td>P.T.****</td>
<td>Physical Training</td>
<td>0-4-1</td>
<td>0-4-1</td>
<td>0-4-1</td>
</tr>
<tr>
<td>Gen. 101</td>
<td>Orientation</td>
<td>1-0-0</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
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<tr>
<td>Totals</td>
<td></td>
<td>18-7-19</td>
<td>18-4-19</td>
<td>17-7-19</td>
</tr>
</tbody>
</table>

Note: Under Quarters, 3-3-4 means 3 class hours, 3 hours lab., 4 hours credit.

*English 107-8-9 will apply toward the satisfaction of the Engineering College Humanities requirement. See page 37 for the Modern Language Option, and requirements for Humanities and Social Sciences credits.

**The requirement for Science may be satisfied by Chem. 104-105 or by other natural and/or life science courses approved by the student's advisor, for a total of 10 credits.

***These free elective courses may be taken at any time during a student's course of study. However, these six credit hours may be satisfied by selecting basic ROTC. If basic ROTC is elected by the student, then it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

****Three physical training courses are required during the freshman year. All students who are physically qualified will be required to take P.T. 101 (Swimming) and any other two courses from the remaining three offered (P.T. 102, 104, 105). Students with an exemption from all or any one of P.T. 101, 102 or 105 will be required to take P.T. 104 (Health Education). A maximum of six credit hours of P.T. courses may be used for degree credit.

### Sophomore Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 207</td>
<td>Calculus IV</td>
<td>5-0-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 208</td>
<td>Calculus and Linear Algebra</td>
<td></td>
<td>5-0-5</td>
<td></td>
</tr>
<tr>
<td>Math. 209</td>
<td>Differential Equations</td>
<td></td>
<td></td>
<td>5-0-5</td>
</tr>
<tr>
<td>Physics 228-9</td>
<td>Physics</td>
<td>4-3-5</td>
<td>4-3-5</td>
<td></td>
</tr>
<tr>
<td>Psy. 303-4</td>
<td>General Psychology A, B</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td></td>
</tr>
<tr>
<td>Psy. 410</td>
<td>Social Psychology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Econ. 203</td>
<td>Economic Principles &amp; Problems</td>
<td>3-0-3</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>**</td>
<td>A Computer Course</td>
<td></td>
<td>-3</td>
<td></td>
</tr>
<tr>
<td>ISyE 200</td>
<td>Introduction to I&amp;SyE</td>
<td></td>
<td></td>
<td>3-0-3</td>
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</tbody>
</table>
### Sophomore Year (Cont.)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 201</td>
<td>Projects</td>
<td>.......</td>
<td>.......</td>
<td>0-6-2</td>
</tr>
<tr>
<td>PHS 343</td>
<td>History of Engineering</td>
<td>.......</td>
<td>.......</td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td><strong>Totals</strong></td>
<td>15-3-16</td>
<td>12-3-16</td>
<td>14-6-16</td>
</tr>
</tbody>
</table>

*Two additional courses in Economics (selected from Econ. 328, 331, 332, 333, 352, 460, and 486) must be included in each student's program. These courses may be taken as "electives" or as part of the "major selection" in the junior or senior years.

**An appropriate computer course, or demonstrated ability to effectively use the computers on campus, may be substituted for this requirement. Substitution for this requirement must be approved by the student's advisor.

### Junior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>Major Selection</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
</tr>
<tr>
<td>**</td>
<td>Sociology or Political Science</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
</tr>
<tr>
<td>ISyE 335</td>
<td>Applications of Probability</td>
<td>4-0-4</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>ISyE 336</td>
<td>Statistical Methods</td>
<td>.......</td>
<td>4-0-4</td>
<td>.......</td>
</tr>
<tr>
<td>ISyE 333</td>
<td>Deterministic Models in Operations Research</td>
<td>.......</td>
<td>4-0-4</td>
<td>.......</td>
</tr>
<tr>
<td>ISyE 444</td>
<td>Simulation</td>
<td>.......</td>
<td>.......</td>
<td>2-3-3</td>
</tr>
<tr>
<td>Mgt. 340</td>
<td>Analysis of Financial Data</td>
<td>.......</td>
<td>.......</td>
<td>3-3-4</td>
</tr>
<tr>
<td>PHS 344-5</td>
<td>History of Engineering</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>.......</td>
</tr>
<tr>
<td>***</td>
<td>Electives</td>
<td>3-0-3</td>
<td>.......</td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td><strong>Totals</strong></td>
<td>16-0-16</td>
<td>17-0-17</td>
<td>14-6-16</td>
</tr>
</tbody>
</table>

*The major selection should provide the student with additional background relative to the application area of most interest to him, and will likely be involved in his project work. For example, should the student be primarily interested in educational systems, his Major Selection would provide background in education. The student interested in urban problems would select courses related to urban sociology and city planning. Should his interest be in health care systems, the selections would develop understanding of this area. Appropriate engineering courses related to transportation, pollution, sanitary engineering, and systems engineering may also satisfy the major selection requirement. Major selections should be discussed with the student's advisor, and must be approved by him. The resources of all educational organizations in the Atlanta area should be considered, particularly the offerings of Georgia State University.

**The Sociology or Political Science requirement may be satisfied by courses in sociology, political science, or any behavioral sciences which are acceptable to the student's advisor and approved by him. Offerings of Georgia State University may be used to satisfy this requirement.

***Nine hours of electives may be used for advanced ROTC. Students not electing basic ROTC will normally take 6 credits of electives, as listed in the freshman year, during the junior year.
## Senior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 448</td>
<td>Systems Design Methodology</td>
<td>3-0-3</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>ISyE 325</td>
<td>Engineering Economy</td>
<td>3-0-3</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>ISyE 310</td>
<td>Man-Machine Systems</td>
<td>3-0-3</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>*</td>
<td>Project</td>
<td>.......</td>
<td>0-12-4</td>
<td>0-12-4</td>
</tr>
<tr>
<td>**</td>
<td>Elective</td>
<td>3-0-3</td>
<td>6-0-6</td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>3-0-3</td>
<td>5-0-5</td>
<td>6-0-6</td>
</tr>
<tr>
<td></td>
<td>Totals</td>
<td>15-0-15</td>
<td>11-12-15</td>
<td>9-12-13</td>
</tr>
</tbody>
</table>

*The project work is intended as an integrative experience for the student dealing with socio-economic problems related to the student’s major selection. Project work usually involves dealing with a live situation and field activity for gathering data, problem definition, and direct interaction with those individuals involved within the problem setting. It also usually requires pilot implementation of project results and recommendations. Project work may also be done in conjunction with ongoing research, and need not be done with the School of Industrial & Systems Engineering. Arrangements with the student’s advisor must be made in selecting appropriate project work and approval must be secured where work is done in collaboration with faculty outside the School of Industrial & Systems Engineering. Project requirements may also be satisfied by ISyE 451 and 452, ISyE 461 and 462, ISyE 471 and 472, or ISyE 481 and 482. Advisor approval is required to confirm arrangements for appropriate project selection.

**Nine hours of electives may be used for advanced ROTC. Two courses in Economics, selected from Econ. 328, 331, 332, 333, 352, 460, and 486, must be included in each student’s program. Humanities requirements, as listed on page 37, must also be satisfied.
The Systems Engineering program started on campus with a committee effort to focus upon the emerging field of systems engineering by encouraging multidisciplinary approaches to engineering education and a pooling of instructional talent from several of the engineering schools involved with systems problems. The program is intended to provide elective support for students in all engineering programs such that they may complement their disciplinary curriculum emphasis with broad and fundamental instruction in systems technology, and also further develop the more specialized systems engineering applications associated with their discipline. Two packages of elective courses are listed below. Other courses are also available. School faculty will assist interested students in selecting appropriate courses.

What is Systems Engineering?
Systems engineering emphasizes the coordination of man and machines in complex arrangements. It is largely a development of the last 25 years and has received impetus from the building of defense systems and the rapid development of other forms of modern technology. Computers and automated equipment play a role in virtually all systems engineering efforts.

The concepts of systems engineering are as important today for civil engineers designing complicated highway systems as they are for electrical engineers devising sophisticated communication systems, or any other engineer dealing with systems complexities. Teams of engineers and scientists use systems engineering principles to build the systems for missile flights, to develop transportation systems, and many other complex jobs.

Planned Systems Engineering Programs
Two elective programs in systems engineering are offered. Program A consists of 10 quarter credit hours of course work. This program has been tailored for students who have a limited number of elective hours and who wish to obtain a basic knowledge of systems engineering. Program B involves a minimum of 11 quarter credit hours of course work and has been tailored for students who want to study more about the mathematical bases of systems engineering and who would like to go on to more advanced work in the field. Additional courses are available as part of this program.

Case Studies in Systems Engineering (ISyE 461) is contained in both Programs A and B. This course gives the student an opportunity to help design a system as a member of a design team, and illustrates the important team approach required in the solution of systems engineering problems.
Program A

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 380 Systems Engineering I</td>
<td>2-3-3</td>
</tr>
<tr>
<td>ISyE 381 Systems Engineering II</td>
<td>3-0-3</td>
</tr>
<tr>
<td>ISyE 461 Case Studies in Systems Engineering I</td>
<td>2-6-4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7-9-10</strong></td>
</tr>
</tbody>
</table>

Program B

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 380 Systems Engineering I</td>
<td>2-3-3</td>
</tr>
<tr>
<td>ISyE 410 Systems Analysis I</td>
<td>4-0-4</td>
</tr>
<tr>
<td>ISyE 461 Case Studies in Systems Engineering I</td>
<td>2-6-4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8-9-11</strong></td>
</tr>
</tbody>
</table>

Courses of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

ISyE 110. Basic Concepts in Industrial and Systems Engineering
2-3-3. (Not available for junior or senior elective credit.) May be substituted for E.Gr. 171 in BIE curriculum.

This course presents a broad cross section of the types of problems with which the Industrial and Systems Engineer is concerned. Emphasis on the presentation of structured problems to be solved by the student in his own way. The student will be motivated to relate his approach to solving the problems with concepts and solution techniques presently available to the Industrial and Systems Engineer.

ISyE 200. Introduction to Industrial and Systems Engineering
3-0-3. Prerequisite: None.

This course introduces the student to the role of Industrial and Systems Engineering in the organization and society. Subjects covered include an introduction to industrial organization as a basis for the discussion of the several systems operating within the organization. Analytical methodologies introduced as they apply to the study of the various systems and activities.

Course also provides an opportunity for the student to select his field of interest from those offered by the School. ISyE 200 must be scheduled by ISyE students as their first ISyE course.

ISyE 201. Projects
0-6-2.

A project course requiring student groups to deal with analysis of an unstructured problem situation, to experience the frustration of dealing with an unfamiliar and unknown "live" situation; an experience in relevancy, and in learning how to successfully and systematically identify structure, relationships, and problems within a live situation. Effective oral and written communication, effective interpersonal relationships also stressed.

ISyE 304. Organization for Production
3-0-3. Prerequisite: None.

The principles of organization and administration applicable to various engineering and industrial enterprises. An elective course for all non-Industrial Engineering students.

ISyE 310. Man-Machine Systems
3-0-3. Prerequisite: None.
Course is to introduce the student to methods for analysis and design of man-machine systems. Emphasis placed on the development and use of quantitative techniques in the analysis and design of man-machine systems and their environment. Topics covered deal with individual work center designs and the broader area of work systems design.

ISyE 313. Physiological and Biomechanical Analysis of Work
2-0-2. Prerequisite: ISyE 310.

This course deals with physiological and biomechanical aspects of work. Emphasis on techniques for collecting physiological and biomechanical data and on the application of work physiology and biomechanics in tool and work place design. Some of the topics covered: oxygen consumption measures, heart rate measures, electromyographic measures, acceptable physiological work levels, biomechanical models, and work in hot and cold environments.

ISyE 314. Systems and Productivity
3-0-3. Prerequisite: ISyE 310, Psy. 410.

Emphasis on the human contributions to productivity and on the interaction of technical advances with human performance. The impact of individual needs, leadership styles, and organizational design on motivation and productivity are examined in depth. Objective is to develop a theoretical and practical understanding of people, productivity, and organizations for students primarily oriented toward technological change.

ISyE 315. Analysis of Production Operations
4-0-4. Prerequisite: None.

This course deals with the analysis, synthesis, and improvement of individual operations within a production system, with emphasis upon measurement, data generation, work center design, and work systems design.

ISyE. 325. Engineering Economy

A study of the important principles and methods of economic analysis in engineering and management science, including developments in decision theory, and statistical decision theory. Topics treated include the structure of decision problems, value measurement, interest relationships, criteria for decisions under certainty, risk, and uncertainty, and statistical decision theory.

ISyE 333. Deterministic Models in Operations Research
4-0-4. Prerequisite: Math. 208.

An introduction to the methodology of operations research in the solution of engineering and management problems. Emphasis on the formulation and solution of deterministic models. Linear programming models, and dynamic programming models are included. Solution algorithms, sensitivity analysis, and the dual problem in linear programming are also covered.

ISyE 335. Applications of Probability
4-0-4. Prerequisites: Math. 209 or concurrently.

An introduction to applied probability with emphasis on applications in industrial engineering and operations research. Emphasis on the application of the theory of probability and random variables in the analysis of industrial systems.

ISyE 336. Applications of Statistical Methods
4-0-4. Prerequisites: ISyE 335 or equivalent.

Emphasis on the application of statistical methods. Topics include statistical methods which have broad application in the practice of Industrial Engineering in particular, and engineering research in general.

ISyE 337. Introduction to Design of Experiments
3-0-3. Prerequisite: ISyE 336, or equivalent.

Introduction to concepts of experimental design. Emphasis on the design of the most efficient experiments. Appropriate analytic techniques needed for these designs are also taught. Balanced factorial designs are stressed.
ISyE 349. Elementary Quality Control
3-0-3. Prerequisite: Not to be scheduled for credit if credit in ISyE 439 has been earned. Not open to Industrial Engineering students.

Introduction to industrial quality control using statistical methods. Course includes methods of data analysis, sampling, and control charts as applied to manufacturing processes.

ISyE 380. Systems Engineering I
2-3-3. Prerequisite: Math 208 or equivalent.

Introduction to systems engineering as a professional area, and exposure to methodological and conceptual foundations which subsequent undergraduate and graduate courses will develop in detail. It draws on many of the student's previous undergraduate mathematics, physics, and engineering courses such as Linear Algebra, Differential Equations, Laplace Transforms, and design courses. The course will integrate them into an overall consideration of the analysis and design of interdisciplinary systems involving electrical, mechanical, hydraulic, and other types of engineered systems.

ISyE 381. Systems Engineering II
3-0-3. Prerequisite: ISyE 380.

Continuation of ISyE 380. Broadens the student's understanding of systems by extending system engineering concepts to sociological, biological, and economic systems. Also builds the foundation for systems design capability. Topics include modeling and simulation, man-machine interaction, decision theory, information measures, reliability, and network planning.

ISyE 390. Computer Methods in Systems Engineering
2-3-3. Prerequisite: ISyE 380 and ICS 151 or equivalent.

This course considers the notion of simulation of system behavior from a broad viewpoint. Several kinds of systems models are considered for simulation by analog and/or digital methods. Special topics, such as hybrid computation, are covered.

ISyE 400. Introduction to Systems Theory
3-0-3. Prerequisite: Consent of instructor.

Basic concepts of systems, logical and set theoretical foundations of systems theory. Modeling, examples of mathematical models of systems. Description of input-output time systems. Behavioral and structural classification of time systems. Introduction to finite-state machines and linear dynamical systems. Consideration of the properties of systems such as stability, computability, and controllability. (Graduate credit not normally granted for both ISyE 400 and ISyE 682.)

ISyE 404. Optimization Methods
3-0-3. Prerequisite: ISyE 333 or equivalent.

A study of the theoretical aspects of optimization techniques employed in the solution of system problems. Course covers the classical optimization methods of calculus including constrained optimization, the theory and development of the simplex method of linear programming, and duality theory.

ISyE 405. Non-Linear Programming
3-0-3. Prerequisites: ISyE 333 or equivalent.

Non-linear optimization methods and applications. Topics include univariable and multivariable search procedures for unconstrained problems, penalty function formulations for constrained non-linear models, and geometric programming.

ISyE 406. Integer and Dynamic Programming
3-0-3. Prerequisites: ISyE 333 or equivalent.

Course deals with the solution of optimization problems by integer and dynamic programming. Various applications of these methods discussed. Subjects covered include the solution of integer programming problems by cutting plan methods and implicit enumeration and the solution of multistage decision problems by dynamic programming.
ISyE 410. Systems Analysis I
4-0-4. Prerequisite: ISyE 380 and Math. 209 or equivalent.

Linear Deterministic Systems
This course an extension of ISyE 380; intended to broaden the student's understanding of the analysis of linear systems by expanding and developing the methodologies previously introduced. Emphasis on modern use of matrix theory and the state variable sets of first order differential equations for system representation, as opposed to the complex function and frequency response analysis.

ISyE 411. Systems Analysis II
4-0-4. Prerequisite: ISyE 380 and ISyE 335 or equivalent.

Linear Stochastic Systems
Introduction to the analysis of systems whose input varies randomly in time. Emphasis on the statistical description of random processes and the response of linear systems to stationary random input processes. Examples will be drawn from electrical, mechanical, and industrial engineering.

ISyE 412. Systems Analysis III
4-0-4. Prerequisites: ISyE 380; ISyE 410 recommended.

Nonlinear Systems
Introduction to the analysis of nonlinear systems. Techniques for the study of these systems including analytical and numerical analysis, graphical analysis, and approximation methods.

ISyE 413. Systems Analysis IV
ISyE 417. Modeling and Measurement
3-0-3. Prerequisite: ISyE 380 and ISyE 411 or equivalent.

Construction of mathematical models for systems using measured data discussed. The characteristics and use of physical measurement instruments and the statistical theory of measurements will be presented in a unified manner. The effect on the models of measuring instruments and errors in measurement studied.

ISyE 418. Industrial Engineering in Hospitals
3-0-3. Prerequisite: Senior standing or consent of instructor.

Study of hospital management systems and the means by which such systems improved through the application of industrial engineering principles and techniques. The hospital as a managerial environment, characteristics of the management systems utilized in striving toward hospital goals, and the philosophies and approaches involved in improving hospital management systems. An introduction to health systems and a survey of medical terminology.

ISyE 420. Physical Systems Laboratory
1-3-2. Prerequisites: ISyE 380 and consent of instructor.

This is a laboratory course designed to give the student experience with systems composed of components from several fields. Experiments conducted using automatic control systems, human factors, mechanical vibrations, process control systems and statistical systems. The experiments designed to illustrate important concepts of systems engineering covered in prerequisite courses.

ISyE 422. Job Evaluation and Wage Incentives
3-0-3: Prerequisite: ISyE 310.

A study of the principles used in establishing wage rates and salaries. The characteristics and objectives of different wage incentive plans and the design and analysis of incentive formulas and curves.

ISyE 424. Fundamentals of Materials Handling
2-3-3. Prerequisites: ISyE 310 and ISyE 325.

A combined lecture and laboratory course dealing with procedures and techniques for the analysis and solution of materials handling problems. Plant trips utilized to illustrate modern handling methods.

ISyE 425. Engineering Economy
3-0-3. Prerequisites: Junior standing. Not open to Industrial Engineering students.
The fundamental principles and basic techniques of economic analysis of engineering projects. Topics such as time value of money, economic measures of effectiveness, costs and their estimation, basic comparative models, break-even analysis, and replacement analysis.

**ISyE 428. Introduction to Feedback Dynamics**

2-3-3. Prerequisite: None.

Examination of feedback processes as a cause of dynamic behavior in socio-economic and managerial situations; discussion of both the knowledge of feedback processes and the use of computer simulation to analyze the multi-loop, many variable, nonlinear feedback systems encountered in socio-economic and managerial situations.

The fundamental assumption of managerial control is that much of the dynamic behavior seen in the world is caused by feedback processes.

**ISyE 429. Feedback Dynamics Principles**

2-3-3. Prerequisite: ISyE 428 or consent of instructor.

Course continues ISyE 428 by presenting the principles of feedback dynamics model building, simulation, feedback system analysis, and syntheses. This includes the formulation of level, rate, and auxiliary equations; simulation by hand and using the DYNAMO computer program; isolation of causes of oscillation, growth and decay, frequency sensitivity, and lead-lag phasing in feedback models; analysis of noise; model trouble shooting; and model improvement.

**ISyE 433. Electronic Data Processing**

3-0-3. Prerequisite: Senior standing.

A survey of electronic data processing, including important applications, characteristics of data processing equipment, programming systems and methodology for analysis and design of management information systems. Some insight into the use of computers for scientific applications, such as systems simulation, mathematical programming, and statistical analysis.

**ISyE 434. Introduction to Operations Research**

3-0-3. Prerequisites: ISyE 333 and ISyE 335 or equivalents.

An introduction to the methodology of operations research in the solution of engineering and management problems. Emphasis on the development and use of mathematical decision models.

**ISyE 435. Project Management Systems Design**

2-3-3. Prerequisite: Senior standing.

A study of project planning and control using activity network analysis. Topics include network logic, scheduling computations, resource scheduling under various constraints, time-cost trade-off algorithms, cost control, and multi-project resource allocation. Laboratory work provides practical applications and use of computer programs.

**ISyE 436. Elements of Safety Engineering**

3-0-3. Prerequisites: ISyE 200, ISyE 335 and ISyE 310.

The nature and extent of the industrial accident problem with particular emphasis on the role of the engineer in modern industrial operations. The identification and solution of technical accident problems using appropriate analysis procedures. Design principles and characteristics for accident prevention in the plant, the process, and the work-center. Not to be scheduled for credit if credit for ISyE 437 has been earned.

**ISyE 437. Industrial Safety Administration**

3-0-3. Prerequisites: Senior standing.

The nature and extent of the industrial accident problem. Selection and evaluation of data appropriate to accident control measurements and decisions, including realistic treatment of cost factors. Modern organizational relationships in the safety program. The control of industrial accidents by non-technical measures. Not to be scheduled for credit if credit for ISyE 436 has been earned.
ISyE 438. Industrial Fire Prevention and Protection
3-0-3. Prerequisite: Senior standing.

The economics of the industrial fire risk. Design of the plant, process, and work-center of optimum fire hazard. Design of fire protection facilities under varying industrial conditions.

ISyE 439. Quality Control
3-0-3. Prerequisite: ISyE 336.

A detailed study of theory and methods for the design and analysis of quality control systems. Included are quantitative techniques for solution to problems of product specifications, process control, acceptance inspection, and other means of quality assurance.

ISyE 440. Case Problems in Industrial Engineering
3-0-3. Corequisite: Senior standing.

Experience in dealing with problems approximating those encountered by practicing Industrial Engineers. Cases used simulate actual situations by bearing little or no identification as to the nature of the problem, by containing extraneous information.

ISyE 441. Sales Engineering
3-0-3. Prerequisite: Senior standing in engineering.

A study of problems involved in selling technical goods and services requiring engineering skill and knowledge in their application. Particular attention given to the engineering application and service aspects of this work.

ISyE 444. Simulation
2-3-3. Prerequisites: ISyE 333 and ISyE 336.

A study of simulation methodology including random process generators, timekeeping, calendar structure, statistical considerations, variance reduction; a consideration of discrete unit flow systems and sequencing problems; and a study of simulation languages. Project work enables the student to develop models and utilize computer facilities for their simulation.

ISyE 448. Systems Design Methodology
3-0-3. Prerequisite: ISyE 310. Corequisites: ISyE 325 and ISyE 444.

Development of the student's system design capability, utilizing advanced methodologies and concepts. Achieved by generating diverse alternatives culminating in operable solutions, and by emphasizing procedural, systematic and creative approaches to a spectrum of real world problems.

ISyE 451 & 452. Design I, II
2-6-4. Prerequisites: ISyE 448.

This course sequence involves students in professional design work associated with the field, requiring systems definition, analysis, synthesis, and specification for a systems design. Topical areas will be drawn from research and professional interests of faculty, and from interests of student groups. In most cases the project will require dealing with the real-life situation, from intimate contact with the problem environment to presentation of recommendations and formal reporting to the "sponsoring" organization.

ISyE 453. Introduction to Socio-Economic Systems Analysis
3-0-3. Prerequisite: Senior standing.

This course is intended to present the current status of the application of operations research/systems analysis technology and methodology to the difficult social problems of the times. Problems discussed will include air and water pollution, safety, education, population, transportation, consumer protection, and poverty. Students will survey and discuss case studies, papers, and articles by individuals who have applied their expertise to the solution of these complex social problems.

ISyE 454 & 455. Projects.
0-12-4. Prerequisites: Senior standing.

Project work will involve students in systems studies and/or problems related to the broad objectives of the BEES Program requiring system (or problem) definition, analysis, synthesis, and specification for solution or system design. Topical areas will be drawn from research and professional interests of the faculty, and from
interests of student groups. In most cases the projects will require dealing with the real-life situation, from intimate contact with the problem environment to presentation of recommendations and formal reporting to the "sponsoring" organization.

**ISyE 456. Technological Forecasting**
3-0-3. Prerequisite: Senior standing.

Emphasis on the subject of forecasting future trends and specific developments in various areas of technology. Discussion of what is technological change and how does it relate to other human functions. Presentation of specific methodologies for identifying possible future functional capabilities and future needs, for forecasting by trend extrapolation and by heuristic and intuitive means, and for developing scenarios and obtaining consensus. Case histories of successes and failures in forecasting will be discussed.

**ISyE 461 & 462. Case Studies in Systems Engineering I, II**
2-6-4. Prerequisites: ISyE 380 and ISyE 381 or consent of instructor.

This course (two-quarter sequence) permits students from all schools to carry out a preliminary design of a significant, complex system via an interdisciplinary team. Detailed design of subsystems is performed by smaller student groups, with emphasis on trade-offs between subsystems. Necessary background lectures and examination of selected case studies are given by faculty members and invited speakers from industry and government. The project culminates with an oral presentation and publication of a final report.

**ISyE 470. Fundamentals of Operations and Facilities Systems Design**
3-3-4. Prerequisites: ISyE 310, and ISyE 448 or concurrently.

A study of the fundamental design procedures and techniques involved in creating an economic enterprise which is product or service oriented. Includes a discussion of market analysis; product analysis; process, operations, and material flow design; and equipment and facilities design. Special emphasis is placed on the organization, methods, and performance design of the enterprise.

**ISyE 471. Operations and Facilities Systems Design I**
2-6-4. Prerequisites: ISyE 448 and ISyE 470.

The first course of a two course sequence concerned with the design of operations and facilities required to establish and operate a manufacturing or other enterprise. The organizational relationships, procedures, and techniques involved in product design, manufacturing processes, process design, and materials handling are emphasized.

**ISyE 472. Operations and Facilities Systems Design II**
2-6-4. Prerequisites: ISyE 471.

Continuation of ISyE 471; consists primarily of an off-campus project. Emphasizes work area design, storage and warehousing, service area planning, space requirements, and the final layout, evaluation and presentation of the plant project.

**ISyE 473. Storage and Distribution Systems Design**
3-0-3. Prerequisite: ISyE 470.

A study of the factors in designing efficient materials and product distribution systems— including storage and warehouse planning, materials flow, information flow, equipment selection, building design, facility location, automated warehousing and transportation.

**ISyE 474. Facilities Management**
3-0-3. Prerequisite: ISyE 470.

A study of the functions, activities, procedures and organizational interrelationships involved in managing the physical facilities of the enterprise—including maintenance and repair policies and procedures, maintenance planning, design and construction liaison, safety, facility protection, waste control and salvage, plant location and long range planning.
ISyE 475. Engineering the Manufacturing Environment
3-0-3. Prerequisite: ISyE 470.
A study of analysis procedures and methods for designing the environment within which the enterprise must operate including building design concepts, construction methods, cost factors, environmental systems, plant services, noise and vibration, and pollution control.

ISyE 480. Analysis of Production—Inventory Systems
3-3-4. Prerequisites: ISyE 333 and ISyE 335.
A study of analytical methods useful in the design of systems for inventory control, production planning, and scheduling.

ISyE 481. Information and Control Systems Design I
2-6-4. Prerequisites: ISyE 448 and ISyE 480.
This sequence deals with the design of information and control systems. Design principles and techniques developed and applied to design problems in production, inventory, distribution, quality, manpower, and fiscal control systems.

ISyE 482. Information and Control Systems Design II
2-6-4. Prerequisite: ISyE 481.
This course, a continuation of ISyE 481 emphasizes the analysis and synthesis of information-decision systems for managerial control. An off-campus project provides opportunity to analyze existing systems and and to apply design principles and techniques. The integration of information-decision systems, automatic data processing, and the motivational aspects of control are included.

ISyE 490. Legal and Ethical Phases of Engineering
3-0-3. Prerequisite: Senior standing.
Topics: contracts, patents, copyrights and trademarks, agency, sales agreements, and engineering specifications; the engineer and his relations to the law, to the public and the ethics of his profession.

ISyE 491, 492, 493. Special Problems
0-3-1. Senior year, first, second and third quarters. Prerequisites: Senior standing and special permission.
Opportunity to develop initiative and to apply fundamental principles by doing semi-original laboratory or research work of an industrial engineering nature.

ISyE 494, 495, 496. Research and Projects
Credit to be arranged.
Open to students in the Honors Program. Research or project work in conjunction with faculty investigations, which may result in an undergraduate thesis.

ISyE 497, 498, 499. Topics
Credit to be arranged. Prerequisite: Consent of instructor.
This course permits the School of Industrial & Systems Engineering to offer formal course work in special topics not included in regular courses.

ISyE 500. Director's Honor Seminar
3-0-3. Prerequisite: cumulative grade point average of 3.0 or better and senior standing in the School of Industrial & Systems Engineering.
An informal discussion-study course dealing with topics to be selected by the course participants, intended to provide an informal and intellectual interchange dealing with topics and issues of significance to the profession, and to the professional development of the student. Offered only in the winter quarter and open only to students with superior academic records. Junior students who will not be in school during the winter quarter of their senior year may register.
### Graduate Courses Offered

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<td>ISyE 601</td>
<td>Modern Organizations</td>
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<tr>
<td>ISyE 602</td>
<td>Project Selection Methodology for Research and Engineering</td>
<td>3-0-3</td>
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<tr>
<td>ISyE 604</td>
<td>The Operating Characteristics of Industrial Engineering Functions</td>
<td>3-0-3</td>
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<td>ISyE 607</td>
<td>Management of Improvement</td>
<td>3-0-3</td>
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<tr>
<td>ISyE 610, 611</td>
<td>Safe Design and Utilization of Industrial Facilities</td>
<td>3-0-3</td>
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<tr>
<td>ISyE 612</td>
<td>Design of Industrial Engineering Programs</td>
<td>3-0-3</td>
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<tr>
<td>ISyE 613</td>
<td>The Design of Manufacturing Enterprises</td>
<td>3-0-3</td>
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<tr>
<td>ISyE 615</td>
<td>Analysis of Distribution Systems</td>
<td>3-0-3</td>
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<td>ISyE 616</td>
<td>Advanced Work Measurement</td>
<td>3-0-3</td>
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<tr>
<td>ISyE 617</td>
<td>Work Center Design</td>
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<tr>
<td>ISyE 618</td>
<td>Work Systems Design</td>
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<tr>
<td>ISyE 624</td>
<td>Material Flow Systems</td>
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<td>ISyE 625</td>
<td>Advanced Engineering Economy</td>
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<td>ISyE 627</td>
<td>Applied Statistical Decision Theory</td>
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<tr>
<td>ISyE 628</td>
<td>Econometrics Models in Engineering Economy</td>
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<td>ISyE 631</td>
<td>Quality Control Systems</td>
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<td>ISyE 634</td>
<td>Methods of Operations Research</td>
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<td>ISyE 635</td>
<td>Forecasting Systems</td>
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<td>ISyE 636</td>
<td>Inventory Systems</td>
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<td>ISyE 637</td>
<td>Scheduling Theory</td>
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<td>ISyE 638</td>
<td>Analysis of Production Operations</td>
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<td>ISyE 639</td>
<td>Experimental Statistics</td>
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<td>ISyE 640</td>
<td>Design of Experiments</td>
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<td>ISyE 645-646</td>
<td>Response Surfaces I, II</td>
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<td>ISyE 647</td>
<td>Theory of Sampling</td>
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<td>ISyE 656</td>
<td>Queuing Theory</td>
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<td>ISyE 665</td>
<td>Case Studies in Hospital Management Systems</td>
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<tr>
<td>ISyE 671</td>
<td>Foundations of Optimization</td>
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<td>ISyE 672</td>
<td>Optimization: Adjacent Extreme Point Methods</td>
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<tr>
<td>ISyE 673</td>
<td>Non-linear Programming</td>
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<td>ISyE 674</td>
<td>Dynamic Programming</td>
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<td>ISyE 675</td>
<td>Network Flows</td>
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<td>ISyE 677</td>
<td>Integer Programming</td>
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<td>ISyE 678</td>
<td>Decomposition Methods for Large Systems</td>
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<tr>
<td>ISyE 680-681</td>
<td>Systems Research and Applications, I, II</td>
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<tr>
<td>ISyE 682-683</td>
<td>Systems Theory I, II</td>
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<td>ISyE 685</td>
<td>Reliability Engineering</td>
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<tr>
<td>ISyE 690-1-2</td>
<td>Topics</td>
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<td>ISyE</td>
<td>696-7-8</td>
<td>Topics in Safety Engineering</td>
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<tr>
<td>ISyE</td>
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<td>ISyE</td>
<td>701-2-3</td>
<td>Seminar</td>
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<td>ISyE</td>
<td>704-5-6</td>
<td>Special Problems in Industrial Engineering</td>
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<tr>
<td>ISyE</td>
<td>730</td>
<td>Industrial Dynamics</td>
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<tr>
<td>ISyE</td>
<td>733</td>
<td>Simulation Techniques</td>
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<tr>
<td>ISyE</td>
<td>741-742</td>
<td>Linear Statistical Models I, II</td>
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<tr>
<td>ISyE</td>
<td>756</td>
<td>Advanced Queuing Theory</td>
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<tr>
<td>ISyE</td>
<td>765</td>
<td>Projects in Hospital Management Systems Credit to be arranged</td>
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<tr>
<td>ISyE</td>
<td>780-1-2</td>
<td>Seminars in Systems Research</td>
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<tr>
<td>ISyE</td>
<td>785-6-7</td>
<td>Seminars in Operations Research</td>
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<td>Projects in Operations Research</td>
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<td>ISyE</td>
<td>800</td>
<td>Doctor's Thesis</td>
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COLLEGE OF INDUSTRIAL MANAGEMENT

(Established in 1935)


General Information

The principal objective of the College of Industrial Management is to provide education of the highest possible quality to prepare students for careers as managers or for additional study at the graduate level. The continuing growth of industry in Georgia, the South and the nation, and the increasing complexity of modern industrial operations have resulted in a great need for college graduates with formal preparation in management and economics. Georgia Tech's College of Industrial Management concentrates on long-range career objectives rather than attempting to develop specific job knowledge.

The College of Industrial Management offers five undergraduate programs leading to the following degrees:

1. Bachelor of Science in Industrial Management
2. Bachelor of Science in General Management
3. Bachelor of Science in Behavioral Management
4. Bachelor of Science in Management Science
5. Bachelor of Science in Economics

The general management degree program has as its primary objective the development of students with a broad interest in the totality of management activities and operating problems of the manager. The program builds upon
knowledge of the functional, environmental, behavioral, and economic aspects of business, and provides tools with which managers can analyze complicated business problems. It prepares the student for managerial responsibilities and decisionmaking in the tradition of the generalist. The industrial management degree program is designed for students who wish to develop their analytical skills, with an emphasis on the application of these techniques toward the solution of problems faced by complex industrial organizations. It also includes substantial content from the operations areas of production, marketing and finance. The degree programs in behavioral management, management science, and economics are designed to give the student considerable concentration in developing specialized skills and knowledge in managerial or economic tools for complex problem solving and decisionmaking. These programs stress precise and pertinent disciplines.

Since complex problem solving takes place in a technical, social and political environment, the tools of management and economics are sharpened by an understanding of the natural and life sciences, psychology, the environment of the business enterprise and by a knowledge of the internal activities of the enterprise itself. To this end every student is required to take substantial work in laboratory science, English, psychology, and social science. All students must become familiar with the fundamental activities of business by taking courses in areas such as accounting, management, and computer applications.

As much uniformity as possible has been retained in all five degree programs during the first two years so that a student can change his curriculum with little or no loss in hours of credit. In most cases any course taken in one program but not needed after transfer to another may be used as elective hours. A fairly large number of hours of elective courses has been retained in all of the alternative programs to give the student the opportunity to develop an area of concentration within the program of his choice or to broaden himself either within or outside the College of Industrial Management.

Transfers to Industrial Management. Many students who enter Georgia Tech intending to major in one of the engineering or scientific areas become interested in transferring to the College of Industrial Management. Only students who demonstrate their ability to successfully complete the requirements of the program are permitted to transfer. Therefore, it is definitely to the student's advantage to determine as early as possible in consultation with the Associate Dean of the College of Industrial Management the requirements which must be met before transfer will be permitted.

Graduate Program. The program leading to the degree of Master of Science in Industrial Management provides an opportunity for graduates from a broad range of rigorous undergraduate curricula to prepare themselves for general management or challenging staff responsibility. The graduate admission requirements and the courses listed on pages 197–199 are described in detail in the Graduate Catalog.

Courses for Non-Majors. In addition to courses offered primarily for its own
undergraduate and graduate programs, the College of Industrial Management offers several courses designed expressly for non-majors, as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<tr>
<td>Econ. 204</td>
<td>Survey of Principles of Economics</td>
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<tr>
<td>Mgt. 336</td>
<td>Accounting Principles and Applications II</td>
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<tr>
<td>Mgt. 340</td>
<td>Analysis of Financial Data</td>
<td>3-3-4</td>
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</table>

**Bachelor of Science in Industrial Management**

The program in industrial management is designed to apply the tools of analysis to the management problems encountered in a modern industrial concern. It emphasizes quantitative methodology to a greater extent than does the general management degree program, but the emphasis on these techniques is applications-oriented instead of the more theoretical orientation of the management science degree program.

As in the general management degree program, much of the required work during the first two years is taken in other schools. Within the first two years, transfers to either the general management degree program or the behavioral management degree program can be easily accomplished without substantial loss of credit.

**Industrial Management**

**Freshman Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
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<tbody>
<tr>
<td>Chem. 104-5</td>
<td>Inorganic Chemistry and Elective or</td>
<td>4-3-5</td>
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<td>Biol. 110-111-112</td>
<td>Introduction to Biology I, II, III</td>
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<td>Engl. 107-8-9</td>
<td>Introduction to Literature</td>
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<td>S.S. or M.L. *</td>
<td>Social Sciences or Modern Language</td>
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<td>Math. 100</td>
<td>College Algebra and Trigonometry</td>
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<td>Math. 105</td>
<td>Calculus for Management I</td>
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<tr>
<td>Math. 106</td>
<td>Calculus for Management II</td>
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<td>Mgt. 120</td>
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<td>P.T. 101-2-3</td>
<td>Physical Training</td>
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### Freshman Year (Cont.)

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*Choice of: (1) two quarters of one of the following: American History, Political Science, Philosophy and History of Science, or Sociology, with the third quarter selected from one of the three remaining areas; or (2) German 101-2-3, French 107-8-9, or Spanish 113-14-15.

**These free elective courses may be taken at any time during a student's course of study. However, these six credit hours may be satisfied by selecting basic ROTC. If basic ROTC is elected by the student, it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

### Sophomore Year

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*English 206 or 207 may substitute for English 203.

**The student must take the two courses in statistics from the same college.

### Junior Year

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### Industrial Management / 173

**Junior Year (Cont.)**

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**Senior Year**

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*Mgt. 491 is offered only during winter quarter.*
Bachelor of Science in General Management

The general management program is designed to provide the student with a broadly based course of study which introduces him to the general theory of management; the operational areas of business such as finance, production, and marketing; and the foundation tools such as economics, statistics, and accounting. The program stresses breadth of concept instead of concentration in a narrow major. The required courses provide a broad knowledge of management while the elective hours can be used for a cluster of courses allowing some degree of specialization in a discipline or functional area in the senior year.

Although quantitative methodology plays an important role in this program, major emphasis is on the application of techniques rather than on their mathematical derivation. Within the first two years, transfer between the general management degree program and the behavioral management degree program can be accomplished without loss of credit hours or the need for additional make-up work.

Freshman Year

<table>
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*Choice of: (1) two quarters of one of the following: American History, Political Science, Philosophy and History of Science, or Sociology, with the third quarter selected from one of the three remaining areas; or (2) three quarters of Modern Language in either German, French, or Spanish. Three quarters of either M.L. or S.S. are required.

**These free elective courses may be taken at any time during a student's course of study. However, these six credit hours may be satisfied by selecting basic ROTC. If selected, basic ROTC must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.
### Sophomore Year

<table>
<thead>
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<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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*Engl. 206 or 207 may substitute for Engl. 203.

### Junior Year

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*Econ. 486 (National Income and Fiscal Policy) may substitute for Econ. 352.
Senior Year*

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*Minimum grade average of "C" must be earned during the student's last three full-time quarters to qualify for graduation.

**Mgt. 491 is offered only during winter quarter.

***This elective must be selected from the following: Econ. 474, Econ. 478, Econ. 485, Econ. 487, Mgt. 467, Hist. 304, or Hist. 310.

Bachelor of Science in Behavioral Management

One of the greatest challenges our society faces is how to best develop and use human resources. This challenge is particularly acute as it thrusts itself into the management of the various agencies on which we depend. The problem is how to take the best economic advantage of our technological capability, while making it possible for the people in our work force to build and maintain an image of their individual importance and worthiness.

The behavioral program in the undergraduate management curriculum is designed for those students whose capabilities and interests are focused on the individual and group relationships that are inherent in society, relative to problems of complex organization and advanced technology that characterize modern enterprise. The intent is to develop for the management team those people who have special competence for the task of effectively marshaling, organizing, and using the human resources of an enterprise.
### Behavioral Management

#### Freshman Year

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*These free elective courses may be taken at any time during a student's course of study. If these six credit hours are satisfied by selecting basic ROTC, it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

#### Sophomore Year

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<th>Subject</th>
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*English 206 or 207 may substitute for 203.
## Junior Year

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<td>M.Sc. 210</td>
<td>Management Applications of Data Processing</td>
<td>2-3-3</td>
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<td>Mgt. 325</td>
<td>Law I</td>
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<td>Mgt. 320</td>
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## Senior Year*

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<td>Analysis of Consumer Behavior</td>
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<td>Mgt. 475</td>
<td>Contemporary Research In Management</td>
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<td>Mgt. 465</td>
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**Senior Year* (Cont.)

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*Minimum grade average of "C" must be earned during the student's last three full-time quarters to qualify for graduation.

**Nine additional hours of psychology electives must be selected from the following courses:

- Psy. 401 Industrial Psychology
- Psy. 402 Psychology of Adjustment
- Psy. 403 Introduction to Psychological Testing
- Psy. 404 Psychology of Advertising
- Psy. 407 Experimental Psychology I
- Psy. 480 Socio Psychology-Sociology Measurement Seminar

***Six additional hours of social science electives must be selected from the following courses:

- Pol. 474 Science Technology and Public Policy
- Soc. 476 Technology and Society
- Soc. 377 Social Ecology
- Soc. 477 Urban Sociology
- Pol. 362 International Organization
- Soc. 379 Demographic Analysis

It is recommended that electives in the College of Industrial Management be selected from the following courses:

- Mgt. 347 Techniques of Industrial Communications (Management Communications)
- Mgt. 408 Personnel Management Problems
- Mgt. 458 Contemporary Unionism and Collective Bargaining
- Mgt. 428 and
- Econ. 429 Industrial Relations
- Mgt. xxx International Labor Relations (to be developed)

**Bachelor of Science in Management Science**

The management science program is designed for the student who possesses strength and interest in mathematics and an interest in applying mathematics to managerial problems. The program is based upon a foundation of applied mathematics and the institutional aspects of the modern firm. The advanced work integrates these two areas by developing and applying mathematical models to problems involved in the allocation of resources within the firm. The curriculum also contains a three-course sequence of specialization electives which permit the student either to concentrate in an application area or to strengthen his theoretical foundation.

Graduates of the option will typically be employed as staff analysts in industry and government, as systems analysts, or in a wide variety of staff positions where a high degree of analytical ability is required. The program also provides a strong base for graduate study in business, management science, operations research, and related areas.
### Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tr>
<td>Chem. 104-5</td>
<td>Inorganic Chemistry and Elective or Biology I, II, III</td>
<td>4-3-5</td>
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<td>Biol. 110-11-12</td>
<td>Introduction to Literature</td>
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<td>3-3-4</td>
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<tr>
<td>Engl. 107-8-9</td>
<td>Introduction to Literature</td>
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<td>Math. 107-8-9</td>
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<td>P.T. 101-2-3</td>
<td>Physical Training</td>
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<td>Gen. 101</td>
<td>Orientation</td>
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</table>

**Totals**: 18-7-19 18-7-20 15-7-16 17-7-18 17-7-19 16-7-18

*Choice of (1) two quarters of one of the following: American History, Political Science, Philosophy and History of Science, or Sociology, with the third quarter selected from one of the three remaining areas; or (2) Three quarters of Modern Language in either German, French, or Russian.

**These free elective courses may be taken at any time during a student's course of study. If these six credit hours are satisfied by selecting basic ROTC, it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

### Sophomore Year

<table>
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<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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**Totals**: 15-0-15 15-0-15 18-3-19

*English 206 or 207 may be substituted for English 203.
### Junior Year

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*Nine hours of specialization electives which may be chosen from the following courses depending upon one's interests are required. Since most specialization sequences consist of three courses, the sequence should begin during the first quarter of the senior year.*

### Senior Year

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</table>

*Nine hours of specialization electives which may be chosen from the following courses depending upon one's interests are required. Since most specialization sequences consist of three courses, the sequence should begin during the first quarter of the senior year.*
Bachelor of Science in Economics

Among the complex problems facing society today, economic issues stand in the forefront. Social objectives such as full employment, price stability, economic growth, poverty, adaptation to technological advances, efficiency in the management of complex industrial organizations, and international prosperity all receive high priority in the nation's agenda. The program in economics is designed to prepare the student to understand these problems and to participate in solving them.

Modern economics is quantitatively oriented and analytically rigorous. The curriculum for this option is designed to prepare the student to cope with the advances that have been made in this field of study. The program requires a solid grounding in mathematics, statistics, and economic theory.

The economics degree within the College of Industrial Management is most
suitable for students who wish to major in some basic discipline at the undergraduate level. Students who plan to enter business after receiving their undergraduate degree, but choose to take the economics program, will be advised to use a large part of their elective hours in taking carefully selected courses in management. Such students will receive rigorous undergraduate training in a basic discipline but also obtain, through elective courses in management, professional management training. The degree in economics also provides excellent background for work at the master's level in management and for graduate work in economics.

Economics

Freshman Year

<table>
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<th>Course No.</th>
<th>Subject</th>
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<tr>
<td>Biol. 110-11-12</td>
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Totals 18-7-19 18-7-20 15-7-16 17-7-18 17-7-19 16-4-18

*Choice of: (1) two quarters of one of the following: American History, Political Science, Philosophy and History of Science, or Sociology, with the third quarter selected from one of the three remaining areas; or (2) three quarters of Modern Language in either German, French, or Spanish.

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### Sophomore Year

<table>
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<tr>
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<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
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<tbody>
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<td>Mechanics, Electricity, Heat, Light and Sound</td>
<td>4-0-4</td>
<td>4-0-4</td>
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<tr>
<td>Engl. 201-2-3*</td>
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<tr>
<td>Econ. 201-2-3</td>
<td>Principles of Economics</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 220</td>
<td>Industrial Organization</td>
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<tr>
<td>M.Sc. 210</td>
<td>Mgt. Application of Data Processing</td>
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<td>Totals</td>
<td>18-4-18</td>
<td>15-0-15</td>
<td>16-0-16</td>
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*Engl. 206 or 207 may substitute for 203.

### Junior Year

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<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
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<tbody>
<tr>
<td>Mgt. 215</td>
<td>Accounting I</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 336</td>
<td>Accounting Principles and Applications II</td>
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<td>3-0-3</td>
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<tr>
<td>Econ. 331-2-3</td>
<td>Intermediate Econ. Theory I, II, III</td>
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<tr>
<td>M.Sc.* 323-324</td>
<td>Statistics I and II</td>
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<td>Psy. 303 or S.S.**</td>
<td>Introductory Psychology</td>
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<tr>
<td>Psy. 410 or S.S.**</td>
<td>Social Psychology</td>
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<td>3-0-3</td>
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<td>Eng. 315</td>
<td>Public Speaking</td>
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<tr>
<td>M.Sc. 409</td>
<td>Analytical Methods in Management</td>
<td>3-0-3</td>
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<td>Mgt. 325</td>
<td>Law I</td>
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<td>3-0-3</td>
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<td>Econ. 328</td>
<td>Introduction to Econometrics</td>
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<td>3-0-3</td>
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<td>Econ. 340</td>
<td>Money and Banking</td>
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<td>Electives***</td>
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</tbody>
</table>

*Math 415-416 may substitute for M.Sc. 323-324.

**Social Science Courses substituted for Psychology 303 and 410 must be approved by the student's advisor.

***Of the 38 total hours of electives shown, at least 8 courses (24) hours must be in economics. These electives must be chosen with consent of advisor.
### Courses of Instruction

**NOTE:** 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

**Management**

**Management 120. Management Orientation**

1-0-1. Prerequisite: None.

An introduction to the field of management and the related areas of economics and management science. The course will consider the curriculum in the five program options of the College of Industrial Management, jobs in management and the changing roles and responsibilities of management. **Required of all freshmen and optional for transfer sophomores. This course will be offered in winter quarter only. Juniors and seniors may not take the course.**

Text: Selected readings.

**Mgt. 215, 216, 217. Accounting I, II, and III**

3-0-3. Prerequisite: Sophomore standing.

This three-course sequence is designed to provide a basic understanding of general and cost accounting systems as well as a basis for utilizing the accounting data generated by these systems.

The emphasis in this series is on “use of” rather than the “mechanics of” the systems employed. However, during the first and second quarter of the sequence a basic presentation of the system will be included.

Third quarter of the sequence emphasizes the relationship of accounting data to the decision process in a management environment.

Credit will not be given for Mgt. 215, 216, 217, and Mgt. 335, 336.

Text: To be selected.

**Mgt. 220. Industrial Organization**

3-0-3. Prerequisites: Econ. 201 and Mgt. 215.

The role of the manager in today’s era of pervasive change. Describes the functions of management in terms of the technical and the administrative aspects as well as the entrepreneurial dimension of the manager’s task.

Text: To be selected.

**Mgt. 310. Marketing I**

3-0-3. Prerequisite: Econ. 203 or equivalent.

The role of marketing in the productive process, the functions performed and the institutional organizations supporting the marketing task are examined. In addition the environmental constraints affecting the marketing process will be studied.

Text: To be selected.
Mgt. 311. Marketing II
3-0-3. Prerequisite: Mgt. 310.

Designed to focus the student on the managerial problems of a firm's marketing operations. The planning of marketing strategy and the major decision areas of marketing management are stressed.

Text: To be selected.

Mgt. 316. Finance Survey
3-0-3. Prerequisite: Junior standing.

Designed to acquaint the student with the more popular types of business organizations, with special emphasis on the corporation, its organization, management and types of securities issued. Credit not given for both Mgt. 316 and Mgt. 361.

Mgt. 317. Industrial Marketing
3-0-3. Prerequisite: Junior standing.

Marketing principles and policies, with emphasis on the functions that must be performed by manufacturers and industrial marketing institutions to ensure customer satisfaction and profitable operation of the firm.

Text: To be selected.

Mgt. 320. Industrial Management Principles
3-0-3. Prerequisite: Mgt. 220.

A presentation of evolving theory of management as a framework for the analysis of the interaction between the characteristics of humans, and the social-task environment created by complex industrial organizations and their objectives.

Text: To be selected.

Mgt. 322. Organizational Development
3-0-3. Prerequisite: Mgt. 320.

A study of the development of the organization and its structure. The process of organizing is considered in an open-systems context with particular emphasis given to the organization as it is influenced by technology and market changes. Specific topics include the transactions between the organization and its resource supplies, the resulting structural properties of the organization, the measure of efficiency and effectiveness, and the management of technological and organizational change.

Text: To be selected.

Mgt. 325. Law I
3-0-3. Prerequisite: Junior standing.

Background of the law and legal procedures; the problem of organizing a business; forms it may take and procedure of organization; agency and business organizations.

Text: To be selected.

Mgt. 326. Law II
3-0-3. Prerequisite: Junior standing.

This course is conducted on the basis of daily lectures, guest lecturers, outside readings, and class discussion. The student is assigned cases to brief from the State and Federal Reporter Systems and collateral readings from paperback books and library materials, to determine the student's ability to comprehend rules of law and to widen his perspective on the problems of the urban poor. The course stresses the development and function of law, court organization and procedure, and the substantive law in the following areas: family problems, consumer problems, bankruptcy, housing problems, and constitutional guarantees.

Text: To be selected.

Mgt. 335, 336. Accounting Principles and Applications I and II.
3-0-3. Prerequisite: Sophomore standing.

This two quarter sequence is designed to provide a basic understanding of general and cost accounting systems and to relate these systems and the data generated by them to the other functions of the business enterprise.

The first quarter will deal with the systems and the nature of information generated by them.

The second quarter will concentrate on the analysis of reports and the interpretation of reported information for decisions in the other functional areas of the enterprise.
Credit will not be given for Mgt. 335, 336 and Mgt. 215, 216, 217.

Text: To be selected.

**Mgt. 340. Analysis of Financial Data**
3-3-4. Prerequisite: Junior standing. Not open to College of I.M. undergraduates.

A survey in general and cost accounting. The first portion is devoted to familiarizing students with the accounting data collection system and with an examination and evaluation of accounting data output in financial statement form. Considerations involved in the analysis of costs and the development of the control and decision function of management in industrial operations follow. The course emphasizes the use of accounting data in a decision atmosphere rather than the generation of accounting data. Treatment of "accounting mechanics" is minimal. Credit will not be given for Mgt. 340 and Mgt. 215, 216, and 217. Neither will credit be given for Mgt. 340 and Mgt. 335, and 336.

Text: Slavin, Reynolds, and Malchman, *Basic Accounting for Managerial and Financial Control*.

**Mgt. 343. Taxation**
3-0-3. Prerequisite: Mgt. 215.

This course deals with federal income taxes and is directed toward the management planning necessitated by various tax alternatives. The tax implications of business management are reviewed. Major emphasis is on the business income tax requirements, though some attention will be given to the personal incidence of income tax, covered relative to tax applications in the partnership and proprietorship forms of business organization.


**Mgt. 344. Cases in Management Control through Accounting Analysis**
3-0-3. Prerequisites: Mgt. 217 or Mgt. 336 and Econ. 203 or 204.

A case and problems course designed to stress the application of accounting data to decisions in a management framework. Limitations as well as direct applicability of such accounting type data will be studied.


**Mgt. 347. Techniques of Industrial Communications**
3-0-3. Prerequisite: Junior standing.

A study of the basic techniques of communication as employed in industry by management, by employees and by the public. Internal and external functions of public relations are covered with emphasis on the application of practical media in achieving definite results.

Text: To be selected.

**Mgt. 349. Procurement Management**
3-0-3. Prerequisite: Junior standing.

The functions and procedures involved in purchasing for industrial use and in the supervision and management of materials are considered in relation to the development of effective procurement policies.

Text: To be selected.

**Mgt. 361. Financial Management**
3-0-3. Prerequisites: Econ. 203 and Mgt. 216 (Acct. II).

The objectives of this course are to introduce the concepts of financial management and provide experience in financial decisionmaking. The course acquaints the student with the long term sources of funds, including long term debt, equity instruments, and financial leasing. Concepts of corporate valuation and modifications in the capital structure are also studied. Analysis of alternative security issues and the bargain for funds are studied through the use of the case method.

Text: To be selected.

**Mgt. 365. Capital Budgeting**
3-0-3. Prerequisite: Mgt. 361.

The development and application of analytical techniques pertaining to the capital budgeting decision of the firm, including the theory of cost of capital, measurement of investment profitability,
and a treatment of uncertainty.

Text: To be selected.

Mgt. 380. (Psy. 380) Leadership
1-3-2. Prerequisite: None.

The purpose of this course is to foster the development of leadership and communication skills which can facilitate effective functioning of small groups. Topical coverage represents a survey of material which is of immediate usefulness to the student, rather than intensive treatment of subject matter. Class discussion will be supplemented by opportunities to practice leadership and communication skills in the laboratory.

Mgt. 402. The Management of Organized Effort
3-0-3. Prerequisites: Mgt. 320, Psy. 410 and consent of instructor.

This course builds on and employs the material presented in the prerequisite courses to develop a systematic overview of the management of organized human effort within the complex agencies characteristic of modern society. Emphasis will be shifted from "the management of people" to the use of organization as a managerial vehicle for developing and controlling situations toward which members of organizations act and to which they respond.

Text: Instructor's syllabus and assigned readings.

Mgt. 408. Personnel Management Problems
3-0-3. Prerequisite: Junior standing.

This course concentrates on typical problems encountered by the personnel department in an industrial organization, such as selection, training and placement of workers, merit rating and promotion, and the development of sound personnel management techniques.

Text: To be selected.

Mgt. 409. Career Analysis
3-0-3. Prerequisite: Mgt. 408.

A course designed to enable students to analyze classified jobs in a company to determine career paths, training and development needs of workers for promotion, and programs of guidance and counseling of workers.

Mgt. 411. Public Administration
3-0-3. Prerequisite: Mgt. 320.

An examination of the structure of the federal government with emphasis on the role of the administrator in the federal civil service.

Mgt. 418. Production Management I
3-0-3. Prerequisites: Mgt. 320 and Econ. 352.

The objective of this course is to develop student understanding of the organizational, economic, and physical framework within which the manufacturing division functions and contributes to overall objectives. Students are expected to develop a philosophy of production management as well as analytical insight in solving various production problems.

Text: To be selected.

Mgt. 420. Integrated Management Problems
3-0-3. Prerequisite: Last quarter in residence.

Comprehensive cases are used to integrate knowledge at the policy level about the operations areas of management — production, finance, marketing, industrial relations, human relations and administration. Emphasis will also be given to the relationship of managerial decisions to the economic and competitive forces affecting business.

Text: Selected cases.

Mgt. 427. Management as a Creative Force
3-0-3. Prerequisite: Junior standing.

The course objective is to help prepare students for management roles in an environment of constantly accelerating change. An analysis will be made of management as society's principal tool for coping with change. The innovative management tasks common not only to industry but to all organized activity will be examined as a part of the role of management in introducing changes into the society and directing these changes...
toward constructive ends.
Text: None.

Mgt. 428. Industrial Relations
3-0-3. Prerequisite: Junior standing.
Historical development, internal procedures, and legal questions involved in union-management relations.
Text: To be selected.

Mgt. 430. Management Decision Laboratory
0-3-1. Prerequisite: Senior standing.
This course gives students practice in making certain management decisions. Use is made of computers and simulated operations of manufacturing firms in a competitive market.

Mgt. 433. Business Research
3-0-3. Prerequisite: M.Sci. 324 or consent of instructor.
This is a course designed to familiarize the student with techniques used in industrial and business research. Emphasis is put on practical illustrations that allow a discussion of methodologies in a survey of all types of studies commonly used in practice.
Text: None.

Mgt. 440. Organizational Analysis
3-0-3. Prerequisites: Mgt. 320 and Mgt. 322.
An analysis of the outcomes of the organizing process which are internal to the organization. The individual-organization interface is studied to understand the impact of the organization on behavior and to facilitate the effective use of the organization's human resources. Occasional cases emphasize such topics as authority, status, and communication; formal and informal group formation; and individual and group change methods.
Text: To be selected.

Mgt. 443. Investments
3-0-3. Prerequisite: Mgt. 361 or Mgt. 316.
A study of the sources of financial information and its interpretation, the operation of stock exchanges, over-the-counter markets, and methods of underwriting. A study is also made of the various types of securities available for investment and tests to determine their investment quality.
Text: To be selected.

Mgt. 455. Marketing III
3-0-3. Prerequisite: Mgt. 311.
This course consists of cases involving the management of marketing activities. Careful consideration is given to the functions of planning, organizing, and controlling the essential elements of the overall marketing program of the firm.
Text: To be selected.

Mgt. 456. Marketing Management Problems
3-0-3. Prerequisite: Mgt. 311 or permission of instructor.
This is an advanced problems course in the field of marketing management.
Text: To be selected.

Mgt. 459. Industrial Relations in the Piedmont Region
3-0-3. Prerequisite: Senior standing.
The ecological, anthropological and social as well as the economic dimensions of the emergence of the southeastern Piedmont as an industrial region are investigated. This course demonstrates a method of analysis having general applicability for the study of regional industrial development.
Text: To be selected.

Mgt. 460. International Marketing
3-0-3. Prerequisite: Mgt. 311.
This course will focus on the unique management problems of multinational marketing. Emphasis will be given to comparative analysis, techniques for marketing decisions, the role of marketing in economic development, and marketing strategies and policies of multinational firms. (This course may be used to fulfill the international elective requirement for
the general management program.)

Text: To be selected.

**Mgt. 465. Nonmarket Environment of the Firm**

3-0-3.

Corporate planning relative to social, legal, political, and tax problems as they affect management actions and decision-making.

**Mgt. 467. Management Concepts and Issues in World Business**

3-0-3. Prerequisite: Senior standing.

No business or industry today is immune to the effects of international business. It is important that every student understand the nature of this swiftly changing field and the implications it has for U.S. industry and the job of the manager.

The course will cover organizing for international business; industrial, economic, political, social, legal, labor, and technological aspects of international business; the changing patterns of world industry; the emergence of common markets; the role of U.S. industry overseas.

**Mgt. 470. Contemporary Management Thought**

3-0-3. Prerequisite: Mgt. 320.

Through extensive reading and small group discussions, students will develop an understanding of both the agreements and conflicts of current management thought. This course will give a brief historical perspective to modern management to emphasize the interdependencies of social values and management practices.

Text: To be selected.

**Mgt. 472. Management of Industrial Research and Development Programs**

3-0-3. Prerequisite: Mgt. 320.

An analysis of the fundamental concepts underlying effective management of research and development programs within the industrial environment. Attention is directed to such problem areas as the role and integration of research and development in the industrial organization, project proposal and evaluation, staffing and organizing the project team, project administration, and transition of projects from development in production and marketing.

Text: To be selected.

**Mgt. 475. Contemporary Research in Management**

3-0-3. Prerequisites: Mgt. 320, Psy. 401/410, and Mgt. 322.

After a brief introduction summarizing the historical development of management research and approaches to the study of management based on it, the course will require students to investigate, analyze, and report on current research orientations and their significance to the understanding of management processes.

Text: None.

**Mgt. 480. Analysis of Consumer Behavior**

3-0-3. Prerequisite: Mgt. 311 (Marketing II).

A course designed to stress the importance of consumer behavior on the marketing function of a firm. Analysis of buyer behavior as a prime determinant of marketing strategy and demand analysis.

Text: To be selected.

**Mgt. 491. Seminar**

1-0-1. Prerequisite: Junior standing.

This course consists primarily of lectures, and question and answer periods with prominent business, government, labor and educational leaders concerned with aiding the student in making career decisions and preparing him for adjustment to the industrial world. The course is offered winter quarter only.

**Mgt. 493. Individual Research in Industrial Management**

Credit to be arranged.

This course is designed to pursue a particular line of inquiry, either not covered or not covered in desired depth, by studying books and articles independently and by reviewing the learning experience with a faculty member. Students will be permitted to register for this course only upon obtaining a pro-
fessor’s approval in writing of a research proposal.

Mgt. 496, 497, 498. Special Topics in Industrial Management
2-0-2. Prerequisite: Consent of the instructor.

A course designed to permit groups of students to pursue a common, specialized interest in an area of industrial management which is not extensively treated in the offerings of the College, or to engage in minor research or special problems involving analytical or experimental investigations.

Text: Selected readings.

Mgt. 499. Industrial Management Honors Seminar
3-0-3. Prerequisite: Last or next to last quarter seniors by invitation of the faculty of the College of Industrial Management.

This course is designed to give a selected group of outstanding seniors in the College of Industrial Management an opportunity to research, analyze, and discuss current management and economic problems with specialists in the various areas.

Text: Selected readings.

Management Science

2-3-3. Prerequisite: Sophomore standing.

The objective of this course is to provide (1) the technical foundation for the development of computer-based management systems and (2) the competence to successfully use the computer in subsequent courses. Computing concepts, programming, time-sharing and other information technology developments applicable to business are presented. Assignments involve use of the computer for the solution of problems in economics, statistics, and the functional areas of management.

Text: To be selected.

M.Sci. 301. Introduction to Quantitative Methods
3-0-3. Prerequisites: Math. 236. Not open to I.M. or M.Sci. students.

The objective of this course is to provide an introduction to the formulation and application of deterministic quantitative models to managerial decision processes. Major emphasis is in the use of basic linear programming and its specialized applications to production and scheduling type problems and in the optimization of general models of one variable in such areas as inventory control and investment analysis.

Text: To be selected.

M.Sci. 311. Management Science I
3-0-3. Prerequisites: Math. 407 or equivalent.

Applications of linear programming to the analysis of managerial problems. Topics include duality, transportation problems, network flows, postoptimality analysis, and decomposition. Emphasis is placed on the application of these analytical methods to significant managerial and economic problems.

Text: To be selected.

M.Sci. 312. Management Science II
3-0-3. Prerequisite: Math. 415.

This second course in the methodology and application of management science is concerned with the development and use of stochastic models in the analysis of managerial and economic decisionmaking. Included are utility theory, introduction to the theory and use of games, Bayesian decision principles, queueing problems and inventory theory. Even though the course is primarily devoted to developing the basic concepts underlying these topics, comprehensive examples of application will be included.

Text: To be selected.
M.Sci. 323, 324. Statistics I, II
3-0-3. Prerequisite: Junior standing and must have completed differential and integral calculus.

The first course deals with statistical descriptions and probability models. The second course covers statistical inference, regression and correlation, time series, introduction to multivariate analysis and sampling with applications to industry and business.

Text: To be selected.

M.Sci. 330. Decision Analysis in Management
3-0-3. Prerequisite: Math. 236.

An introduction to decision models for management situations under risk and uncertainty. The fundamental economic concepts of a theory of rational choice are developed, examined, and applied to decision situations of managerial and/or economic interest. Topics include the basic structure of decision problems under risk and uncertainty, expected monetary value, elementary utility theory, the use of judgmental probability, the normal form of analysis, the economics of sampling, and risk sharing and group decisionmaking.

Text: Howard Raiffa, *Decision Analysis*.

M.Sci. 390. Survey of Statistics
3-0-3. Prerequisite: Math. 236. (Not open to M.Sci. and I.M. students.)

A survey of discrete statistics with special emphasis on economic and business applications. Includes sampling, the normal distribution, hypothesis testing, linear regressions and correlation, time series, and index numbers.

Text: To be selected.

3-0-3. Prerequisites: M.Sci. 323 and Math. 236.

This sequence of courses is an introduction to analytical models and their use in industrial management. The first course is concerned with decision models and optimization theory in general. Specific topics include linear programming models, the simplex method, transportation problems, and sensitivity analysis. The second course includes introductions to the theory and applications of dynamic programming, integer programming, and nonlinear programming. Emphasis in both courses is on the solution of managerial problems.

M.Sci. 415. Automation and Management
3-0-3. Prerequisite: M.Sci. 210 or equivalent and senior standing.

The objective of this course is to establish and apply the principles of analysis and design of computer-based management systems. Case studies are employed to illustrate the current and potential applications in industry of system development concepts — particularly the concept of the integrated or "total information system." Assignments involve the application of optimization techniques in system design, simulation by computer, computer time-sharing and other information technology developments.

Text: To be selected.

M.Sci. 419. Production Management, II
3-0-3. Prerequisites: M.Sci. 410 and Mgt. 418.

A course requiring students to apply quantitative and non-quantitative analytical methods to production management case problems.

Text: To be selected.

M.Sci. 430. Introduction to Sampling
3-0-3. Prerequisites: M.Sci. 390 or equivalent.

Will emphasize and use illustrations from surveys of human populations, but will consider inanimate as well. The methods will be developed as tools to substantive research problems. Formulas will be given, but the underlying assumptions and theory as well as limitations will not be neglected. It is anticipated that the student will actually design and draw a sample, possibly in conjunction with one of his concurrent courses.

Text: Leslie Kish, *Survey Sampling*, (or equivalent).
M.Sci. 436. Nonparametric Statistics
3-0-3. Prerequisites: M.Sci. 390 or equivalent.

Particularly in the behavioral areas, many of the assumptions necessary to classical statistical analyses are either violated or not verifiable and therefore there has been a recent growth of methods not dependent upon these restrictions. This course will offer a survey of some of the more widely used techniques, primarily from an applied point of view, although the underlying theories will not be altogether neglected. The student will be expected to gather and analyze actual data from the Tech community.


M.Sci. 473. Statistical Analysis
3-0-3. Prerequisite: Graduate standing.

An analysis of statistical principles. The course has been planned for students who come from different schools with different undergraduate degrees. The course covers probabilities, distributions, estimation, and test of hypotheses with emphasis on decisionmaking. Also included in the syllabus are linear regression and analysis of variance. *Enrollment only by permission of the College of Industrial Management*.

Text: To be selected.

M.Sci. 481, 482. Readings in Management Science
3-0-3. Prerequisite: Consent of instructor.

These two courses provide an opportunity for the student to study and report on applications of management science reported in the current literature. Readings will be structured in such a way as to provide comprehensive coverage of such topics as investment analysis, scheduling methods, media selection and other substantive areas in which management science has been applied. Also included will be case studies which may be analyzed by use of both quantitative and qualitative techniques.

Text: Selected readings.

M.Sci. 490. Special Project
6-0-6. Prerequisite: Consent of instructor.

The special project is designed to permit the student an opportunity to apply his full training to the solution of an applied or theoretical problem. The problem will generally be selected by the individual student, and his progress will be monitored by an individual faculty member. Typical problems could consist of the simulation of a complex industrial system, extension of an algorithm, creation of a new algorithm or research into an unsolved problem.

Text: None.

Economics

Econ. 201, 202, 203. Economic Principles and Problems
3-0-3. Prerequisite: Sophomore standing or permission of instructor.

This three-course sequence begins with an examination of the scope and method of economics. It continues with a study of the theory of markets and distribution. It concludes with an examination of national income theory and international trade.


Econ. 204. Survey of Principles of Economics
3-0-3. Prerequisite: Sophomore standing. Not open to College of I.M. students.

A survey and an introduction to economics. It includes an examination of the two major areas of economics: national income and employment theory, and the theory of markets, distribution, and the behavior of the firm.

Text: To be selected.

Econ. 328. Econometrics I
3-0-3. Prerequisites: Economics 202, M.Sci. 324 or equivalent.

The objective for this course is to introduce methods of estimating the quantitative relationships among economic variables. The course will be concerned with problems of specification, estimation, prediction and verification. Tools used will include single equation linear regression models, simultaneous linear equation
models and nonlinear models.

Text: To be selected.

**Econ. 331, 332, 333. Intermediate Economics, I, II, III**

3-0-3. Prerequisites: Econ. 203 and Math. 208.

This three-course sequence consists of advanced economic theory for those in the economics option. The sequence begins with a theoretical analysis of the determination of prices and quantities sold of both commodities and factors of production under alternative market structures. The sequence continues with a concentration of aggregate economic theory. It stresses relationships between income, consumption, investment, employment, interest, credit, and the general price level in the context of classical models, Keynesian models, Chicago models, and growth models. Successful completion of the sequence should permit a critical analysis of public policy.

Text: To be selected.

**Econ. 340. Money and Banking**

3-0-3. Prerequisites: Econ. 203.

This course is concerned with the nature of money, its creation by banks, and the monetary history of the United States, with emphasis on the Federal Reserve System and the instruments of monetary policy. Treasury debt operations and the significance of non-bank financial intermediaries for policy are also discussed.

Text: To be selected.

**Econ. 345. Public Finance**

3-0-3. Prerequisites: Econ. 201, 202, and 203.

An analysis of the decisionmaking procedures relating to government expenditures and revenue collection. Principal topics include government fiscal policy, tax theory, the budgeting process and income redistribution.

**Econ. 350. The Process of American Industrial Development**

3-0-3. Prerequisite: Econ. 203.

This course is designed to acquaint the student with the forces, unique characteristics, and problems associated with the American industrialization experience. Special attention will be given to technological progress, concomitant changes in the form of business organization, and the transformation of basic economic institutions.

Text: To be selected.

**Econ. 352. Industrial Economic Analysis**

3-0-3. Prerequisite: Econ. 203.

An advanced course in microeconomics, concerned with the scope and methods of economics, production and distribution theory, and the structure of markets, with emphasis on managerial applications of economic theory. Not open to economics majors.


**Econ. 361. Financial Management**

3-0-3. Prerequisites: Econ. 203 and Mgt. 216 (Acct. II).

The objectives of this course are to introduce the concepts of financial management and provide experience in financial decisionmaking. The course acquaints the student with the long term sources of funds, including long term debt, equity instruments and financial leasing. Concepts of corporate valuation and modifications in the capital structure are also studied. Analysis of alternative security issues and the bargain for funds are studied through the use of the case method.

Text: To be selected.

**Econ. 365. Capital Budgeting**

3-0-3. Prerequisite: Mgt. 361.

The development and application of analytical techniques pertaining to the capital budgeting decision of the firm, including the theory of cost of capital, measurement of investment profitability, and a treatment of uncertainty.

Text: To be selected.

**Econ. 371. Economic Development**

3-0-3. Prerequisite: Econ. 203.
A survey of theories of economic development, an analysis of factors contributing to the development of a national economy, and an examination of economic development policy and planning techniques currently adopted by the developing nations. Students will be required to write a paper on a development problem of a given nation.

Econ. 411. History of Economic Thought
3-0-3. Prerequisites: Economics 333 or consent of instructor.

A historical survey of schools of economic thought. A brief introduction to Greek and Roman thought is followed by a review of the early stages of capitalism. The main body of the course is concerned with classical, neoclassical, Keynesian, and modern economic thought.


Econ. 429. Economics of the Labor Market
3-0-3. Prerequisite: Junior standing.

The application of microeconomic theory to the process of matching workers with jobs in the market place, under conditions of perfect and imperfect competition. By studying the level and composition of the labor force, as influenced by such institutional factors as minimum wages and various public and private programs of income maintenance, this course emphasizes the structural problems in achieving maximum employment and productivity.

Text: To be selected.

Econ. 454. Labor Relations Problems
3-0-3. Prerequisite: Mgt. 428.

An analysis of public policy in labor relations as reflected in legislative enactments, court decisions, and the common law. Emphasis will be given to management-labor problems arising out of strikes, labor injunctions, picketing, union security, contract negotiation, and other matters as affected by and related to recent laws such as the Norris-LaGuardia Act, Wage-Hour Act, Wagner Act, Taft-Hartley Act, and Landrum-Griffin Act.

Text: Beal and Wickersham, Collective Bargaining.

Econ. 458. Contemporary Unionism and Collective Bargaining
3-0-3. Prerequisite: Mgt. 428.

This is a study of the organization and structure of unions in the United States and includes such subjects as union policies and aims, the theory of collective bargaining, collective bargaining procedures and techniques, and analysis of union-management contracts with attention given to typical clauses such as provisions for grievance machinery, technological changes, lay-offs, and union security.

Text: Beal and Wickersham, Collective Bargaining.

Econ. 460. Econometrics II
3-0-3. Prerequisite: Econometrics I.

This course is concerned with analyzing properties of different estimation methods which include: direct least squares, two-stage least squares, three-stage least squares, limited information and full information maximum likelihood. Also discussed are data problems (such as auto-correlation and heteroscedasticity) and methods of adjusting inadequate data (such as pooling of cross-section and time series data, Monte Carlo method of generating random variates from an hypothesized disturbance distribution). The course also introduces spectral analysis as a method of analyzing time series data.

Text: To be selected.

Econ. 470. Mathematical Economics
3-0-3. Prerequisite: Consent of instructor.

This course translates economic problems and relationships into mathematical terms. The mathematics involve calculus, vectors and matrices, linear programming, difference and differential equations. Topics include: The multiplier, the accelerator, business cycles, input-output analysis, allocation techniques (linear programming), competitive strategy (game theory), and economic regulation (control systems).
Econ. 474. Industrial Development in Latin America
3-0-3. Prerequisites: Econ. 203 or Econ. 204; knowledge of Spanish; and consent of the instructor.

A course designed to acquaint the student with the latest theories and principles of industrial development in developing countries. The student will prepare an analysis of the problems and opportunities in industrial development in a specific Latin American country.

Text: Powelson, Latin America.

Econ. 478. International Economics
3-0-3. Prerequisite: Restricted to majors in economics unless with consent of instructor.

This course is an introduction to the theory of international economic relations. It is concerned primarily with the pure theory of international trade and the interdependencies that exist between a country’s foreign and domestic economic policies.

Text: To be selected.

Econ. 480. Economic Forecasting
3-0-3. Prerequisites: Econ. 203 and senior standing.

This course reviews the theories of macroeconomics in terms of the national economic structure, changes in it, and trends in major industries. The strength of factors causing change in the national income sectors are assessed and economic forecasts prepared for 2-4 quarters in the future, and the implications of the economic outlook analyzed for management decisionmaking in industry and business.

Text: To be selected.

Econ. 485. International Trade
3-0-3. Prerequisite: Econ. 203 or equivalent.

This course deals with the foreign exchange market, foreign trade and commercial policy, international finance and the achievement of equilibrium in the balance of payments and current problems of international economics.

Text: To be selected.

Econ. 486. National Income and Fiscal Policy
3-0-3. Prerequisite: Econ. 203. Not open to majors in economics.

An intermediate macroeconomic theory course designed to develop the student's understanding of the national economic environment within which the firm operates. Principal topics are: analysis of the national income model and its components, and contemporary fiscal and monetary theory.

Text: To be selected.

Econ. 487. Comparative Economic Systems
3-0-3. Prerequisite: Econ. 203 or equivalent.

A critical study is made of the methods by which various economic systems meet common fundamental problems in production, exchange, and distribution, consumption, and capital formation. Comparative analyses of the major theories underlying these methods are undertaken and their efficacy considered in the light of modern technology.

Text: Selected readings.

Econ. 488. Economics of Industrial Competition
3-0-3. Prerequisite: Senior standing.

A study of the competitive structure of industry in terms of theoretical models and contemporary business organization, alternative public policy goals, and a critical review and appraisal of antitrust legislation.


Econ. 489. Economics of Regulated Industries
3-0-3. Prerequisite: Econ. 203.

The purpose of this course is to introduce the students to the special characteristics and problems of public utility
industries. The economic characteristics of public utilities industry will be presented and the development of the public utility concept and the commission form of regulation will be traced. Special emphasis will be given to the current problems and controversy in the regulated industry.

Text: To be selected.

**Econ. 490. Seminar in Economic Policy**

3-0-3. Prerequisite: Limited to economics majors.

This seminar is the capstone course for majors in economics. The topics for discussion will be chosen to encourage the student to focus his understanding of economic theory acquired in his undergraduate program on a substantive problem.

**Econ. 493. Individual Research in Economics**

Credit to be arranged.

This course is designed to pursue a particular line of inquiry, either not covered or not covered in desired depth in other courses, by studying books and articles independently and by reviewing the learning experience with a faculty member.

Text: None.

**Graduate Courses Offered**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Econ. 602</td>
<td>Regional Economics</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 603</td>
<td>Economics of Industrialization</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Econ. 604</td>
<td>Developmental Finance</td>
<td>2-0-2</td>
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<tr>
<td>Econ. 606</td>
<td>Research Methods in Development</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 624</td>
<td>Economics of Production</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 626</td>
<td>Development of Economic Thought</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 653</td>
<td>Industry and Government</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 660</td>
<td>Economic Forecasting</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 663</td>
<td>Financial Management and Economics of Nuclear Power</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 671</td>
<td>Labor and the Economy</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 672</td>
<td>Manpower Legislation</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 673</td>
<td>Macroeconomic Analysis</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 687</td>
<td>Wage and Employment Theory</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 707</td>
<td>Development Seminar I</td>
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<td>Course Code</td>
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<tr>
<td>Econ. 708</td>
<td>Development Seminar II</td>
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<tr>
<td>Econ. 724</td>
<td>Microeconomic Analysis</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 725</td>
<td>Seminar in Microeconomics</td>
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<tr>
<td>Econ. 730</td>
<td>Econometrics</td>
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<tr>
<td>Econ. 735</td>
<td>Seminar in Econometrics</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 773</td>
<td>Advanced Macroeconomic Analysis</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 775</td>
<td>Seminar in Macroeconomics</td>
<td>3-0-3</td>
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<tr>
<td>Econ. 800</td>
<td>Doctor's Thesis</td>
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<tr>
<td>Mgt. 613</td>
<td>Management Systems Analysis</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Mgt. 618</td>
<td>The Law of Market</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 620</td>
<td>The Theory of Industrial Organization</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 622</td>
<td>Development of Management Thought</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Mgt. 630</td>
<td>Production Management</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 634</td>
<td>Management Control</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 635</td>
<td>Managerial Accounting</td>
<td>3-0-3</td>
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<td>Mgt. 636</td>
<td>Problems in Accounting Control</td>
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<td>Mgt. 640</td>
<td>Analysis and Budgeting for Management Control</td>
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<td>Mgt. 649</td>
<td>Financial Management I</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 650</td>
<td>Financial Management II</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 654</td>
<td>Personnel Administration</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 656</td>
<td>Administrative Practices in Human Relations</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 657</td>
<td>Marketing Management</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 658</td>
<td>Cases in Marketing Management</td>
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<tr>
<td>Mgt. 659</td>
<td>Marketing Research and Analysis</td>
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<tr>
<td>Mgt. 667</td>
<td>Labor Problems</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 680</td>
<td>Executive Development and Motivation</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 681</td>
<td>Management Policy in a Dynamic Environment</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 685</td>
<td>Multinational Business</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 698</td>
<td>The Entrepreneur, Innovation and Change</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 700</td>
<td>Master's Thesis</td>
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<tr>
<td>Mgt. 701,2,3</td>
<td>Seminar ..................................................</td>
<td>1-0-0</td>
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<tr>
<td>Mgt. 704,5,6</td>
<td>Industrial Management Research .....................</td>
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<tr>
<td>Mgt. 709</td>
<td>Seminar in Management Research Methods</td>
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<tr>
<td>Mgt. 713</td>
<td>Seminar on Psychology and Management</td>
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<td>Mgt. 723</td>
<td>Seminar in Management Systems Theory</td>
<td>3-0-3</td>
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<tr>
<td>Mgt. 791</td>
<td>Seminar in Management and Economic Research</td>
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<td>Mgt. 800</td>
<td>Doctor's Thesis</td>
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<tr>
<td>M.Sc. 612</td>
<td>Computer Simulation of Management Problems</td>
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<tr>
<td>M.Sc. 614</td>
<td>Analytical Methods in Management</td>
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<tr>
<td>M.Sc. 632</td>
<td>Manufacturing Management Problems</td>
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<tr>
<td>M.Sc. 676</td>
<td>General Decision Theory</td>
<td>3-0-3</td>
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<td>M.Sc. 678</td>
<td>Applications of General Decision Theory in</td>
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<td>Management and Economics</td>
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<tr>
<td>Course Code</td>
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<tr>
<td>M.Sci. 681</td>
<td>Applications of Regression Analysis to Management</td>
<td>3-0-3</td>
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<tr>
<td>M.Sci. 714</td>
<td>Mathematical Programming in Management and Economics</td>
<td>3-0-3</td>
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<tr>
<td>M.Sci. 715</td>
<td>Seminar in Mathematical Programming for Management</td>
<td>3-0-3</td>
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</tbody>
</table>
SCHOOL OF INFORMATION AND COMPUTER SCIENCE
(Established in 1963)

Director-Academic—Vladimir Slamecka; Professors—Lucio Chiaraviglio, James Gough, Jr., Edward G. Roberts, Miroslav Valach; Associate Professors—Philip J. Siegmann, Pranas Zunde; Assistant Professors—John J. Goda, Jr., William I. Grosky, John M. Gwynn, Jr., Michael D. Kelly, David H. Kraus, David E. Rogers, Robert M. Siegmann; Senior Research Engineer—Alton P. Jensen; Assistant Research Engineers—Philip C. Hankamer, Charles H. Hooper; Administrative Specialist—Edmond F. Rumiano; Principal Secretary—Mrs. Adele L. Champaign; Secretary—Miss Judith K. Childs; Report Typist—Mrs. Linda D. Pefley.

General Information

The School of Information and Computer Science expects to offer a full undergraduate program in the near future, and potential students are invited to inquire with the School about the status of this program and its curriculum. Subject to appropriate approvals, the School plans to implement the junior/senior year program in fall 1972, and accept freshmen for fall 1973.

Meanwhile, the School offers two types of non-degree programs for the Undergraduate Division of the Institute. The programs provide the equivalent of, respectively, a “minor” and “major” in these fields. Either program is open to undergraduate students registered in any degree granting department of the Institute who have completed ICS 151—Digital Computer Organization and Programming (or an equivalent course), and secured the approval of their departmental advisors.

The “Minor” in Information and Computer Science. This program is designed flexibly to serve two categories of students: (a) those interested in information/computer science as a formal discipline of study; and (b) those interested in information processing and computing techniques and their application to other fields of knowledge or professions. The academic program recommended for the first type of student is shown below; it consists, in addition to ICS 151, of eight 3-hour courses providing a balanced treatment of the formal core of this science. The second category of students, interested in techniques and applications of ICS to their disciplines and professions, should substitute ICS 325, 342, 406, and 410 with 12 hours of electives appropriate to their objectives. These electives may be in areas such as systems analysis; computer programming; numerical analysis; computing applications in management, engineering process control, or automation; switching theory, logic design and hardware architecture; or others. While the School of Information and Computer Science offers courses in several of these areas, students may pursue elective courses offered by their departments.
**Recommended “MINOR” in Information/Computer Science**

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarter</th>
<th>Course</th>
<th>Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>F</td>
<td>ICS 151 Digital Computer Organization and Programming (or equivalent)</td>
<td>2-3-3</td>
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<tr>
<td></td>
<td>W</td>
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<td></td>
<td>SP</td>
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<tr>
<td>Sophomore</td>
<td>F</td>
<td>ICS 256 Computer and Programming Systems</td>
<td>3-0-3</td>
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<td></td>
<td>W</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>SP</td>
<td>Math 239 Introduction to Set-Theoretic Concepts</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Junior</td>
<td>F</td>
<td>ICS 325 Introduction to Cybernetics</td>
<td>3-0-3</td>
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<tr>
<td></td>
<td>W</td>
<td>ICS 310 Computer-Oriented Numerical Methods</td>
<td>2-3-3</td>
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<tr>
<td></td>
<td>SP</td>
<td>ICS 355 Information Structures and Processes</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Senior</td>
<td>F</td>
<td>ICS 342 Introduction to Semiotics</td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>ICS 406 Computing Languages</td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>ICS 410 Problem Solving</td>
<td>3-0-3</td>
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</tbody>
</table>

The Undesignated B.S. in Information and Computer Science. The Institute offers experimentally an undesignated baccalaureate degree, which permits certain students to virtually major in information/computer science. Interested and qualified students should arrange an interview with the Director of the School of Information and Computer Science prior to seeking a formal approval of such a program by the Curriculum Committee.

While neither of these undergraduate programs is intended to be a prerequisite for admission to graduate study in information and computer science, students successfully completing either of the above options may consider themselves well prepared for pursuing graduate work in this discipline. Inquiries concerning these programs should be addressed to Undergraduate Advisor, School of Information and Computer Science, Georgia Institute of Technology, Atlanta, Georgia 30332.

At the graduate level, the School of Information and Computer Science offers several types of advanced programs, such as corporate information systems, command/control systems, biomedical systems, and learning systems. These programs lead to the degrees of Master of Science and Doctor of Philosophy.

Students' preparation for graduate work in information and computer science should include, as a minimum, substantial work in mathematics, at least through calculus, differential equations, introductory modern algebra, and some probability. Entering graduate students are also expected to have knowledge of computer programming at the level of ICS 151, 256, and 355.
Courses of Instruction

NOTE: 3-0-3 means 3 hours class, 0 hours laboratory, 3 hours credit.

ICS 110. Information, Computers and Systems: An Introduction
3-0-3.

An introductory overview of the concepts and branches of the information, computer and system sciences, their place and function in the realm of science and society, and their impact on man. The course serves as a basic orientation to the discipline of information/computer science, its professions, and its education.

ICS 151. Digital Computer Organization and Programming
2-3-3. Prerequisite: Entrance algebra and trigonometry.

Algorithmic processes of problem solving; concept and properties of algorithms. Organization and characteristics of digital computers; concept and properties of machine and problem-oriented languages. Development of computational algorithms for elementary numerical and non-numeric problems; pseudo-machine and problem-oriented language (ALGOL) programming for computing equipment currently available at Georgia Tech.

ICS 215. Technical Information Resources
1-0-1.

An introduction to information sources of science, engineering, and management. The Georgia Tech Library as an information system. Planning and methodology of carrying out various types of information searches.

ICS 251. Automatic Data Processing
2-3-3. Prerequisite: ICS 151 or equivalent training in programming.

An introduction to computer file structures (tables, arrays, matrices; linear, inverted, and list structures) and their handling in conventional operations (searching, sorting, maintenance, etc.) on different types of memory devices. Criteria of efficiency in file systems design. COBOL and other problem-oriented languages for non-numeric applications.

ICS 256. Computer and Programming Systems
3-0-3. Prerequisite: ICS 151 or equivalent.

This course is designed to provide a broad understanding of analog and digital computer systems, with emphasis on the latter. The internal characteristics of computers and peripheral devices are reviewed and placed in perspective with the problem of programming. Software devices are examined and related to both machines and problems. The complex relationships between hardware, software and machine operations are reviewed in terms of cost and organizational goals.

ICS 310. Computer-Oriented Numerical Methods
2-3-3. Prerequisite: ICS 151 or equivalent, Math. 208.

An introduction to computer-oriented numerical methods for error analysis, evaluation of functions, integration, solution of equations, systems of linear equations, matrices, curve-fitting, interpolation, numerical differentiation, and solution of ordinary differential equations. Emphasis is placed on methods of proven value in computer solution of present-day problems in engineering science and on the efficient use of existing computer facilities.

ICS 325. Introduction to Cybernetics
3-0-3. Prerequisite: Math. 239.

The objective of this course is to introduce the history and branches of cybernetics. The fundamental cybernetic concepts of structure, system, modeling, information communication, and control are treated with respect to both natural and artificial systems. Self-organizing and cognitive systems are surveyed, and the impact of cybernetics discussed.

ICS 336. Introduction to Information Engineering
3-0-3.

An introduction to the fundamentals, methodology, products and implications
of information engineering. Topics covered include: the nature and properties of information; the structure and uses of the "information utility"; information-based models of problem solving and communication processes; the methodology of information system design; and social and other implications of information engineering.

ICS 342. Introduction to Semiotics
3-0-3. Prerequisite: Math. 239.

Semiotics is the study of signs and sign processes and basic semiotic concepts that have important application to the understanding of artificial and natural information processors. The course brings together a number of concepts that are fundamental to logic, epistemology, grammar, theories of automata and machines, and theories of information. The concepts surveyed, their illustration, and the discussion on their interrelation are designed to give the beginning students a fundamental orientation in the field of computer and information science.

ICS 355. Information Structures and Processes
3-0-3. Prerequisites: Math. 239, ICS 256 or concurrent registration in ICS 458.

Introduction to information structures and processes. Logical data structures. Processes on data structures including scanning, searching, sorting and stressing list processing techniques. Machine representation of data structures. File structures and processes. Data management systems.

ICS 401, 402. Languages for Science and Technology
3-0-3, 3-0-3.

A survey of the principal languages in which scientific and technical literature is published. Emphasis is on the orthography, phonology, basic grammatical structure, and technical bibliographic vocabulary of German, French, Russian, with limited examination of other important languages.

ICS 404. Topics in Linguistics
3-0-3.

A general treatment of morphology, syntax and lexicology of natural language, with emphasis on generative grammar.

ICS 406. Computing Languages
3-0-3. Prerequisites: ICS 355 or permission of instructor.

This course develops a formal definition of programming languages and a system for their classification. Algorithmic language structures are examined to develop an understanding of statement types, the scope of declarations, and their relationship to resource allocation, and the relationships of hardware and software. The structure of non-algorithmic languages is also examined with emphasis on simulation and list processing. Interactive languages are considered relative to on-line information processes.

ICS 410. Problem Solving
3-0-3. Prerequisites: Math. 239 or equivalent.

The purpose of this course is to present a descriptive and a formal approach to problem-solving in science. The course is structured around the use of the scientific method in problem-solving, and around the understanding of formal theories as well as heuristic approaches to problem-solving.

ICS 415. The Literature of Science and Engineering
2-3-3. Prerequisite: Senior standing or consent of instructor.

Study of the reference and bibliographic sources of scientific and engineering literature, stressing strategies of searching. Major search project in student's field of study.

ICS 423. Mathematical Techniques for Information Science
3-0-3. Prerequisite: Graduate standing.

Mathematical techniques of relevance in information/computer science which are not explicitly included in the required core program are presented with emphasis on numerical solution procedures. Primary areas of study include abstracts from modern algebra, vectors and vector spaces,
matrices, countability, classical optimization theory, and topics related to linear differential equations and their solution.

ICS 424. Elements of Information Theory
3-0-3. Prerequisites: Math. 205 or 415, or equivalent training in probability.

A mathematical approach to information theory primarily through probability on finite spaces; the uniqueness and basic properties of the information function; transmission rate, channel capacity, coding theorem for discrete memoryless channel; decision schemes and data processing; applications.

ICS 436. Information Systems
3-0-3. Prerequisite: Senior (or higher) standing.

The course is based on the concept of a general abstract information system and related notions such as general systems theory and information flow. From this foundation, the following real-world systems are discussed as information systems; computers, companies, and humans. Each system is investigated from the point of view of (1) structure, (2) control mechanism, (3) types of input and output information, and (4) information networks. Emphasis is placed on the discussion of corporate information systems.

ICS 445. Logistic Systems
3-0-3. Prerequisite: Math. 239 or equivalent.

The course is an introduction to logistic systems and their metatheory. Stress is placed on understanding the basic concepts of logic and their place in the computer and information sciences. Axiomatic formulation of the propositional calculus, predicate calculus, and set theory are presented briefly. The major metatheorems are described and interrelated. Extensive sketches of the proofs of Post's completeness theorem for the propositional calculus, Gödel's completeness theorem for the predicate calculus, and Gödel's incompleteness theorem for arithmetic are given. Church's and Turing's theses and the role of the limitation theorems are described. The course presupposes that the student has developed a reasonable set of skills in logical technique and symbol manipulation.


ICS 452. Logic Design and Switching Theory
3-0-3. Prerequisites: ICS 151 or equivalent, ICS 445 or training in Boolean algebra.

Theory of computer circuit design is introduced together with its application. Boolean functions and relations are presented as structures in logic space. Combinatorial and sequential circuit design methods are introduced as two basic methods of computer logic design. In addition, time functions, simultaneous Boolean equations and design automation problems are used to show the trends in theory and technology of computer logic design.

ICS 458. Computer Systems
5-3-6. Prerequisite: ICS 151 or equivalent. Prerequisite or Co-requisite: ICS 355.

An intensive introduction to computer organization, assembly language programming, and systems programming concepts. Topics include computer structure, machine language, characteristics of peripheral devices, language translators, program segmentation and linkage, recursion, macros, dynamic storage allocation, and operating systems. Laboratory work emphasizes programming and use of available computer systems.

Graduate Courses Offered

Applications for admission to the graduate programs in information and computer science will be considered from qualified students with undergraduate backgrounds which included substantial training in mathematics (at least
through calculus and differential equations). With the approval of their advisor and the director of the School of Information and Computer Science, students in their senior undergraduate year may also take a graduate course in information and computer science. The following graduate level courses will be offered in 1972-73:

ICS 607 Communication and Control of Information 3-0-3
ICS 608 Syntax of Natural Languages 3-0-3
ICS 609 Mathematical Linguistics 3-0-3
ICS 612 Graph Theory 3-0-3
ICS 616 Information Control Methods 3-0-3
ICS 621 Theory of Communication 3-0-3
ICS 625 Cybernetics 3-0-3
ICS 626,627 Information Processes I, II 3-0-3, 3-0-3
ICS 628 Theory of Models 3-0-3
ICS 629 Information Measures 3-0-3
ICS 632 Equipment of Information Systems 3-0-3
ICS 636,637 Information Systems Design I, II 3-0-3, 3-0-3
ICS 638 Problems in Systems Design 0-6-2
ICS 642 Advanced Semiotics 3-0-3
ICS 645 Advanced Logic 3-0-3
ICS 646 Philosophy of Mind 3-0-3
ICS 647 Artificial Intelligence 3-0-3
ICS 652 Advanced Computer Organization 3-0-3
ICS 653 Computer Techniques for Information Storage and Retrieval 2-2-3
ICS 656 Computer Operating Systems 3-0-3
ICS 657 Design of Computer Operating Systems 3-0-3
ICS 658 Evaluation of Computer Systems 2-3-3
ICS 661 Computer Language Design 3-0-3
ICS 673 Organization and Management of Information Industry 3-0-3
ICS 682,683 Systems Theory I, II 3-0-3, 3-0-3
ICS 700 Master's Thesis
ICS 701,2,3 Seminar
ICS 704,5,6 Special Problems in Information and Computer Science

Hours, Credit to be arranged
ICS 704 Combinatory Logic and the Calculi of Lambda-Conversion (Special Problems Course) 3-0-3
ICS 706 Pattern Recognition (Special Problems Course) 3-0-3
ICS 706 Management Information Systems Design (Special Problems Course) 3-0-3
ICS 710 Philosophy of Language 3-0-3
ICS 726 Theory of Automata 3-0-3
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ICS 736</td>
<td>Information Systems Optimization</td>
<td>3-0-3</td>
</tr>
<tr>
<td>ICS 738</td>
<td>Advanced Systems Design</td>
<td>3-0-3</td>
</tr>
<tr>
<td>ICS 761</td>
<td>Syntax-Directed Compilation</td>
<td>3-0-3</td>
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<tr>
<td>ICS 799</td>
<td>Ph.D. Dissertation Preparation</td>
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<tr>
<td>ICS 800</td>
<td>Doctor's Thesis</td>
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</tr>
</tbody>
</table>
SCHOOL OF MATHEMATICS
(Established in 1952)


General Information

The School of Mathematics has two functions: (1) to train students in basic mathematics and in its use as an effective tool in engineering, the sciences, and management; (2) to provide more advanced mathematical training for those who plan to make mathematics their profession.

In addition to the usual undergraduate service courses, programs of study are offered which lead to the degrees of:

- Bachelor of Science in Applied Mathematics
- Master of Science in Applied Mathematics
- Doctor of Philosophy

Numerous advanced undergraduate and graduate courses are offered which may be used as electives by students in the schools of engineering and the sciences. Close cooperation is maintained with the staff of the Rich Electronic Computer Center, which is located on the campus.

Students of especial ability are invited to participate in an Honors Program which extends through a large part of the freshman and sophomore years.

The requirements for the B.S. in Applied Mathematics are listed on the following pages; the requirements for the graduate degrees may be found in the Graduate Bulletin.

Departmental Degree Requirements

The following institutional regulation concerning degrees is quoted from the publication Undergraduate Student Rules and Regulations as revised in 1971:
"To be a candidate for a degree, a student must have passed all courses required for the degree, must have a scholastic average for his entire academic program of at least 2.0 and must have done creditable work in his departmental courses as to merit the recommendation for the degree by the director of his school and by the dean of the undergraduate division. (X, A2, p. 13)."

The School of Mathematics interprets "creditable work in departmental courses" to mean a minimum grade of C in each mathematics course required in the curriculum. In cases where this rule appears to work unreasonably or unjustly, exceptions may be made by the Director or Associate Director of the School of Mathematics.

### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math.</td>
<td>107-8-9</td>
<td>Calculus I, II, III</td>
<td>5-0-5</td>
<td>5-0-5</td>
<td>5-0-5</td>
</tr>
<tr>
<td>Chem.</td>
<td>104-5*</td>
<td>Inorganic Chemistry</td>
<td>4-3-5</td>
<td>4-3-5</td>
<td>.......</td>
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<tr>
<td>Engl.</td>
<td>107-8-9</td>
<td>Intro. to Literature</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>P.T.</td>
<td>100**</td>
<td>Physical Training</td>
<td>0-4-1</td>
<td>0-4-1</td>
<td>0-4-1</td>
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<tr>
<td>Gen.</td>
<td>101</td>
<td>Orientation</td>
<td>1-0-0</td>
<td>.......</td>
<td>.......</td>
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<tr>
<td>Phys.</td>
<td>227</td>
<td>Physics</td>
<td>.......</td>
<td>.......</td>
<td>4-3-5</td>
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<tr>
<td>Electives***</td>
<td></td>
<td></td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
</tr>
</tbody>
</table>

**Totals** 16-7-17 15-7-17 15-7-17

NOTE: Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.

*Chem. 104-5 is a terminal sequence. Those desiring Chemistry beyond the freshman level may replace this sequence by Chem. 111-112-209, considering the extra hours as elective credit.

**The three physical training courses required during the freshman year may be met as follows:

1. All students who are physically qualified will be required to take P.T. 101 (swimming) and any other two courses from the remaining three offered (P.T. 102, 104, 105).
2. Students with an exemption from all or any one of P.T. 101, 102, or 105 will be required to take P.T. 104.
3. A maximum of 3 hours credit in P.T. will be allowed in degree programs.

***ROTC is an optional requirement and those students not scheduling ROTC courses are required to earn 6 credit hours in elective courses as a substitute. Up to 6 credit hours in basic ROTC, and a maximum of 9 hours of advanced ROTC, may be used as elective credit in this program. If ROTC is elected by the student, it must be scheduled beginning the first quarter the student is enrolled.
Sophomore Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 207-8</td>
<td>Calculus IV, V</td>
<td>5-0-5</td>
<td>5-0-5</td>
<td>......</td>
</tr>
<tr>
<td>Math. 209</td>
<td>Differential Equations</td>
<td>......</td>
<td>......</td>
<td>5-0-5</td>
</tr>
<tr>
<td>Physics 228-9</td>
<td>Physics</td>
<td>4-3-5</td>
<td>4-3-5</td>
<td>......</td>
</tr>
<tr>
<td>Math. 315</td>
<td>Probability-Statistics</td>
<td>......</td>
<td>......</td>
<td>5-0-5</td>
</tr>
<tr>
<td>ICS 151</td>
<td>Computer Programming</td>
<td>2-3-3</td>
<td>......</td>
<td>......</td>
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<tr>
<td>Math. 309</td>
<td>Linear Algebra</td>
<td>......</td>
<td>3-0-3</td>
<td>......</td>
</tr>
<tr>
<td>Hum./S.S./M.L.*</td>
<td>Humanities/Social Sciences/Modern Language</td>
<td>3-0-3</td>
<td>3-0-3</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>......</td>
<td>......</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>14-6-16</td>
<td>15-3-16</td>
<td>16-0-16</td>
</tr>
</tbody>
</table>

*The program must include a total of 42 hours in humanities and social sciences, so chosen as to (1) include either a year sequence in a modern language or nine (9) hours of English beyond Engl. 107-8-9, and (2) satisfy, with regard to 36 of the 42 hours, the humanities-social sciences requirement for undergraduate degree programs in the General College, as listed in the current General Catalog.

Junior-Senior Years

1. The junior-senior year program must include the following courses:
   - Math. 413.................................................................................... 3 hours
   - Math. 450-451-452.................................................................... 12 hours
   - Math. 460.................................................................................... 4 hours
   - Math. 461................................................................................... 4 hours
2. Science-Technology Requirement
   Physics 301, and at least six (6) additional hours of junior or senior level courses in the engineering, physical, economic, or biological areas, which involve substantial applications of mathematics. Selections are subject to approval by the School of Mathematics.
3. (A) A total of at least 20 hours of 400-level mathematics courses must be taken beyond the specific requirement listed in (1), including at least two sequences (2 or 3 courses in one subject area), and subject to the requirement 3B below.
   (B) Applied Mathematics Requirement
   Of the requirement in 3A at least ten (10) hours, including one sequence, must include courses from at least two of the following areas:
   - Probability, statistics, and stochastic processes
   - Ordinary and partial differential equations
   - Numerical analysis and mathematical optimization
   - Mathematical models in the physical, economic, and biological areas
4. Humanities and Social Science electives — 24 hours.
5. Free electives — 19 hours.
Courses of Instruction

Math. 100. College Algebra and Trigonometry
5-0-5. Prerequisite: Entrance algebra. (No credit toward graduation for engineering or science degrees.)

The function concept; exponential, logarithmic, and trigonometric functions; theory of equations including trigonometric equations.

Math. 105. Calculus for Management I
5-0-5. Prerequisite: Math. 100.

Background for calculus; the limit concept; the derivative; techniques and applications of the derivative.

Math. 106. Calculus for Management II
5-0-5. Prerequisite: Math. 105 or Math. 107.

The definite integral; calculus of trigonometric functions; the partial derivative functions.

Math. 107. Calculus I
5-0-5. Prerequisite: Entrance algebra and trigonometry.

Inequalities; absolute values; conic sections; functions, continuity and limits; derivatives of rational and trigonometric functions; mean value theorem; introduction to antiderivatives; applications of derivatives.
Text: Wilcox, Buck, Jacob, Bailey, *Introduction to Calculus I and 2*.

Math. 108. Calculus II
5-0-5. Prerequisite: Math. 107.

Definite integral; logarithmic and exponential functions; techniques of integration; application of definite integrals; inverse functions; improper integrals.
Text: Wilcox, Buck, Jacob, Bailey, *Introduction to Calculus I and 2*.

Math. 109. Calculus III
5-0-5. Prerequisite: Math. 108.

Simpson's method, L'Hospital's rule, infinite series; parametric equations, polar coordinates; introduction to differential equations.
Text: Wilcox, Buck, Jacob, Bailey, *Introduction to Calculus I and 2*.

Math. 117, 118, 119. Honors Calculus I, II, III
5-0-5.

A course sequence for students with superior mathematical ability and training. Although the topics covered parallel those in Math. 107-108-109, the treatment of the subject matter is more intensive and rigorous. Participation is by invitation of the School of Mathematics.

Math. 205. Elementary Statistical Analysis
3-0-3. Prerequisite: Entrance algebra.

Construction of consistent probability measures for finite sequences of statistical experiments; independent trials; random variables, their means, variances and distributions; sampling; estimation and testing of hypotheses; nonparametric tests of association. Entire development restricted to finite sample spaces.
Text: Kurtz, *Basic Statistics*.

Math. 206. Elementary Statistical Analysis
3-0-3. Prerequisites: Math. 205; Math. 108 or concurrently.

Motivation and definition of random variables with continuous distributions; normal distribution and the Central Limit Theorem; nonparametric tests; estimation and testing hypotheses in normal distributions; simple regression and correlation.
Text: Kurtz, *Basic Statistics*.

Math. 207. Calculus IV
5-0-5. Prerequisite: Math. 109.

Linear algebra; vectors in n-space; vector functions and their derivatives.
Text: To be selected.

Math. 208. Calculus V
5-0-5. Prerequisite: Math. 207.
Partial differentiation; multiple integrals; vector analysis; line integrals.

Text: To be selected.

Math. 209. Differential Equations
5-0-5. Prerequisite: Math. 208.


Math. 217, 218. Honors Calculus IV, V
5-0-5.


Math. 236. Finite Mathematics
5-0-5. Prerequisite: Math. 105 or Math. 107.


Math. 239. Introduction to Set-Theoretic Concepts
3-0-3. Prerequisite: Math. 108.

Set operations, set identities, cartesian product, relations, equivalence classes, functions, mappings, sequences, cardinality of sets.

Text: To be selected.

Math. 309. Introduction to Higher Algebra
3-0-3. Prerequisite: Math. 207.

Vectors, vector spaces, matrices, systems of linear equations, transformations of coordinates in a vector space, quadratic forms, diagonalization, characteristic values.

Text: Shields, *Elementary Linear Algebra*.

Math. 315. Problems in Probability and Statistics
5-0-5. Prerequisite: Math. 208 or consent of instructor.

An introduction to basic concepts in probability models and statistical methods through problems which are selected to illuminate subject and illustrate techniques of model formulation in areas of application.

Text: To be selected.

Math. 400. Special Topics
3-0-3. For example Math. 400 could be Optimization Techniques, a companion course to Math. 407.

This course enables the School of Mathematics to comply with requests for courses in selected topics. Given on demand.

Math. 401. Introduction to Analysis
3-0-3. Prerequisite: Math. 209 or concurrently.

The first of four courses on fundamentals of analysis, real and complex number systems, normed linear and metric spaces, stressing Euclidean, completeness, compactness, connectedness, continuous functions, limits.

Text: Lang, *Analysis I*.

Math. 402. Introduction to Analysis
3-0-3. Prerequisite: Math. 401.

Differentiation, Taylor's theorem, Riemann integration, series, sequences, and series of functions, uniform convergence and basic applications.

Text: Lang, *Analysis I*.

Math. 403. Introduction to Analysis
3-0-3. Prerequisite: Math. 402.

Improper integrals, uniform convergence of improper integrals, with applications, contraction maps, with applications,
polynomial approximation results, introduction to differentiation of mappings between Euclidean spaces, derivative as a linear map, chain rule.

Text: Lang, *Analysis I.*

**Math. 404. Introduction to Analysis**
3-0-3. Prerequisite: Math. 403.

Chain rule and applications, higher order derivatives, Taylor formula, inverse function and implicit function theorems, multiple integrals, Jordan measurable sets, change of variables, introduction to differential forms.

Text: To be selected.

**Math. 405. Modern Algebra**
3-0-3. Prerequisite: Math. 309.

A survey of modern algebraic systems including groups, rings, fields, and finite-dimensional vector spaces.


**Math. 407. Linear Programming**
3-0-3. Prerequisite: Math. 208 or concurrently.


Text: Smythe and Johnson, *Introduction to Linear Programming.*

**Math. 409. Fundamental Concepts in Mathematics.**
3-0-3. Prerequisite: Differential equations or consent of instructor.

A course designed for mathematics majors and beginning graduate students. Unifies and extends certain basic notions of college mathematics.

Text: To be selected.

**Math. 411. Advanced Engineering Mathematics**
3-0-3. Prerequisite: Math. 209 or concurrently.

The Laplace transformation and its properties. Elementary applications to physical systems involving the solution of ordinary and partial differential equations.


**Math. 412. Advanced Engineering Mathematics**
3-0-3. Prerequisite: Math. 209 or consent of instructor.

Fourier series, Bessel functions, partial differential equations.


**Math. 413. Advanced Engineering Mathematics**
3-0-3. Prerequisite: Math. 209 or consent of instructor.

Topics from complex function theory including conformal mapping and contour integration.

Text: Levinson and Redheffer, *Complex Variables.*

**Math. 414. Modern Algebra**
3-0-3. Prerequisite: Math. 405.


**Math. 415. Introduction to Probability**
3-0-3. Prerequisite: Math. 208 or concurrently.

An introduction to probability theory and its applications; discrete and non-discrete probability distributions; laws of large numbers.


**Math. 416. Mathematical Statistics**
3-0-3. Prerequisite: Math. 415.

A general study of discrete, continuous, and limiting distributions with emphasis on the normal distribution and the central limit theorem; exact sampling distributions, selected topics in estimation and testing hypotheses.

Math. 417. Mathematical Statistics
3-0-3. Prerequisite: Math. 416.
A continuation (from Math. 416) of estimation and of testing hypotheses; regression theory, design of experiments, analysis of variance, distribution-free methods.

Math. 418. Probability with Applications
3-0-3. Prerequisite: Math. 208.
An introduction to random processes with the necessary preliminary study of discrete sample spaces, combinatorial analysis, and basic laws of probability.

Math. 419. Probability with Applications
3-0-3. Prerequisites: Math. 418; Math. 309 or concurrently.
Text: To be selected.

Math. 420. Vector Analysis
3-0-3. Prerequisite: Math. 209 or consent of instructor.
Vector algebra; vector calculus; line and surface integrals; divergence and curl and their invariant definitions; theorems of Green, Gauss, and Stokes; applications.
Text: Davis, *Introduction to Vector Analysis*.

3-0-3. Prerequisite: Math. 208.
Organization and characteristics of digital computers; development of algorithms for elementary numerical methods; natural language and problem oriented language programming for machines currently available at the Rich Electronic Computer Center; the digital computer as a tool for experimental analysis.
Text: To be selected.

Math. 426. Computer Programming and Coding
3-0-3. Prerequisites: Math. 425, 443; Math. 444 or concurrently or consent of instructor.
Application of the digital computing equipment currently available at the Rich Electronic Computer Center to implement and investigate methods studied in numerical analysis.
Text: To be selected.

Math. 427. Seminar
2-0-2. Prerequisites: Math. 309, 402, and 209.
Study and discussion intended to enhance investigative independence and expository skill. Content varying from year to year, usually beginning with solution of a series of related problems.

Math. 428. Seminar
2-0-2. Prerequisite: Math. 427.
A continuation of Math. 427 with greater emphasis on individual study. Oral and written presentation of results.

Math. 429. Seminar
2-0-2. Prerequisite: Math. 428.
Individual investigations of problems of moderate difficulty with a suitable account of results.

3-0-3. Prerequisite: Math. 208.
An elementary tensorial treatment of various geometric and mechanical concepts needed in the study of hydrodynamics, elasticity, and plasticity.

Math. 431. Introductory Topology
3-0-3. Prerequisite: Math. 401 or Math. 450 or consent of instructor.
Math. 434. Differential Geometry
3-0-3. Prerequisite: Math. 208.

The theory of curves and surfaces, including the first and second fundamental forms of a surface and topics related to them.

Text: To be selected.

Math. 435. Elements of Information Theory
3-0-3. Prerequisite: Math. 205 or 415 or equivalent training in probability.

A mathematical approach to information theory primarily through probability on finite spaces; the uniqueness and basic properties of the information function; transmission rate, channel capacity, coding theorem for discrete memoryless channel, decision schemes and data processing; applications.

Text: Ash, Information Theory.

Math. 436. Elementary Decision Theory
3-0-3. Prerequisite: Math. 205 or 415 or equivalent training in probability.

A mathematical approach to the concepts of decision theory based primarily on probability for finite spaces: loss and risk functions and expectations; bayesian and minimax strategies in response to statistical uncertainty; the special cases of classical statistics; applications.

Text: Weiss, Statistical Decision Theory.

Math. 437. Introduction to Stochastic Processes
3-0-3. Prerequisite: Math. 415 or equivalent level of probability.

Description of a process by means of probability laws; the Wiener and Poisson processes; tools from conditional probability theory; mean and covariance of a process; stationarity; normal processes; Markov processes; applications.

Text: Parzen, Stochastic Processes.

Math. 438. Mathematical Logic
3-0-3. Prerequisite: Math. 208 or consent of instructor.

An introductory course in the basic topics of set theory, the statement calculus, the restricted predicate calculus. Additional topics considered to the extent that time permits include the relationship of logic to the foundations of mathematics, recursive functions (Turing machines), formal languages, extended predicate calculus, decision problems.


Math. 441. Theory of Groups
3-0-3. Prerequisite: Math. 309.

An introductory course in group theory suitable for students of mathematics, chemistry, and physics.

Text: Barnes, Introduction to Abstract Algebra.

Math. 443. Numerical Analysis I
3-0-3. Prerequisite: Math. 208.

Numerical solutions of systems of linear and nonlinear equations; interpolation and approximation of functions; finite difference calculus.

Text: To be selected.

Math. 444. Numerical Analysis II
3-0-3. Prerequisites: Math. 209; Math. 443 or consent of instructor.

Numerical differentiation, numerical integration; difference equations; numerical solutions of ordinary differential equations.

Text: To be selected.

Math 445. Numerical Analysis III
3-0-3. Prerequisite: Math. 444 or consent of instructor.

Numerical approximation of solutions of integral equations and partial differential equations; eigenvalue problems; selected topics of current interest.

Text: To be selected.

Math. 446. Introduction to Game Theory
3-0-3. Prerequisites: Math. 236 or 309 or 407 or consent of instructor.

An introduction to game theory with
emphasis on zero-sum two-person games. Military, economic, and recreational illustrations. Discussion of connections with linear programming and decision functions.

Text: Dresher, *Games of Strategy*.

3-0-3. Prerequisite: Math. 209.

The one-dimensional wave equation; characteristics; classification of second-order linear differential operators; properties of elliptic and parabolic equations; the method of separation of variables; Fourier series; methods for solving non-homogeneous problems including, for example, Green's function.


Math. 448. Introduction to Partial Differential Equations
3-0-3. Prerequisite: Math. 447.

Sturm-Liouville theory, general Fourier expansions (eigenvalues and eigenfunctions, Bessel functions, Legendre polynomials); elementary theory of analytic functions of a complex variable and applications to Laplace's equation and the evaluation of improper integrals.


Math. 449. Introduction to Partial Differential Equations
3-0-3. Prerequisite: Math. 448.

Theory and application of the Fourier and Laplace transforms; methods of approximating solutions.


Math. 450. Introduction to Analysis I
3-2-4. Prerequisite: Math. 209 or equivalent.

The first of three courses on fundamentals of analysis: real number system, functions, continuity, normed linear and metric spaces-stressing completeness, compactness and connectedness.

Text: Lang, *Analysis I*.

Math. 451. Introduction to Analysis II
3-2-4. Prerequisite: Math. 450.

The second of three courses on fundamentals of analysis: differentiation, sequences and series, Taylor's theorem, Riemann and Stieltjes integrals, differentiation and integration of series, improper integrals.

Text: Lang, *Analysis I*.

Math. 452. Introduction to Analysis III
3-2-4. Prerequisites: Math. 450 and Math. 460.

The third of three courses on fundamentals of analysis: differentiation in \( \mathbb{R}^n \), gradient, maximum and minimum problems, inverse and implicit function theorems, multiple integrals, Jacobians, differential forms.

Text: Lang, *Analysis I*.

Math. 460. Introduction to Linear Algebra
3-2-4. Prerequisite: Math. 309.

Vector spaces, linear transformations, decomposition of spaces, various canonical forms, algebras, inner product spaces.

Text: Halmos, *Finite-Dimensional Vector Spaces*.

Math. 461. Introduction to Modern Algebra
3-2-4. Prerequisite: Junior standing or consent of instructor.

Basic properties of sets, relations, and maps. Elementary theory of groups, including homomorphisms, quotient groups, direct products. Elementary theory of rings, domains, and fields.


Math. 491. Topics from Advanced Calculus I
3-0-3. Prerequisite: Math. 208.

Partial differentiation; applications of partial differentiation; limits and indeterminate forms; infinite series; improper integrals; uniform convergence.
Math. 492. Topics from Advanced Calculus II

3-0-3. Prerequisite: Math. 491.

Continuation of Math. 491. Main topic is integration and applications. Also, Riemann, Stieltjes, multiple, line and surface integrals, and the gamma function.


Graduate Courses Offered

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 600</td>
<td>Special Topics</td>
<td>3-0-3</td>
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<tr>
<td>Math. 601,2,3</td>
<td>Methods of Applied Mathematics</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Math. 604,5,6</td>
<td>Modern Abstract Algebra I, II, III</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Math. 607,8,9</td>
<td>Ordinary Differential Equations</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Math. 624</td>
<td>Harmonic Analysis</td>
<td>3-0-3</td>
</tr>
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<td>Math. 631,2,3</td>
<td>Functions of a Real Variable</td>
<td>3-0-3</td>
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<tr>
<td>Math. 634,5,6</td>
<td>Functions of a Complex Variable</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Math. 637,8,9</td>
<td>Partial Differential Equations</td>
<td>3-0-3</td>
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<tr>
<td>Math. 641,2,3</td>
<td>Mathematical Statistics</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Math. 644,5,6</td>
<td>Functional Analysis I, II, III</td>
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NOTE: For requirements for the graduate degree in Mathematics, consult the Graduate Bulletin.
SCHOOL OF MECHANICAL ENGINEERING
(Established in 1888)

Director and Professor—Stothe P. Kezios; Professor and Director Emeritus—Homer S. Weber; Professor Emeritus—Richard A. Trotter; Fuller E. Callaway Professor—Novak Zuber; Regents' Professor—Mario Goglia; Professors—Samuel C. Barnett, Arthur E. Bergles, Walter O. Carlson, William R. Clough, William A. Hinton, Thomas W. Jackson, Miodrag M. Novakovic, Ward O. Winer; Associate Professors—William Z. Black, Gene T. Colwell, Prateen V. Desai, Stephen L. Dickerson, Pandeli Durbetaki, A. Louis Holliman, Harold L. Johnson, John H. Murphy, Kadaba V. Prasanna, Wolfgang Wulff; Assistant Professors—James M. Bradford, Jr., Robert B. Evans, William D. McLeod, David M. Sanborn, Samuel V. Shelton, J. Richard Williams, Kent C. Williams, Wendell M. Williams; Visiting Scientist—J. M. Delhaye; Research Associates—Mamoru Ishii, Gunol Kocamustafaogullari; Administrative Specialist—T.D. Ashworth; Auditorium Manager—Billy H. Allen; Engineering Lead Technician—John W. Davis; Mechanical Technician—Joseph G. Doyal; Mechanical Technician—Louis A. Cavalli; Mechanical Technician—Clifford R. Bannister; Electronics Technician—T. E. Clopton; Machinist—Harry J. Carr, Bobby L. Wallace; Principal Secretary—Mrs. Lucille Whitt; Secretaries—Mrs. Sharon Butler, Mrs. Lallias Hodge, Miss Donna Walls; Clerk-Typists—Mrs. Vicki Clopton, Mrs. Pauline Murphy, Mrs. Julie Pugh.

General Information

As one of the broader engineering disciplines, Mechanical Engineering embraces such diverse activities as the science and art of the generation, conversion, transmission, and utilization of thermal and mechanical energy; the design and the production of tools and machines and their products; the consideration of the fundamental characteristics of materials as applied to design; the synthesis and analysis of mechanical, thermal and fluidic systems and their individual components, including feedback and control. Design, production, operation, administration, economics, and research are functional aspects of this branch of professional engineering.

The course of study is designed to cover the fundamental aspects of the field of Mechanical Engineering, to impress basic principles upon the student, and to educate him in the use of these principles in reaching solutions to engineering situations and problems through optimal design. Specific design subject matter and materials are drawn from such newer engineering activities as oceanography and bio-mechnaical systems, as well as from the more traditional areas of the field.

Emphasis, in the freshman and sophomore years, is placed on mathematics, chemistry, and physics and, in the junior and senior years, on the strength and the metallurgy of materials, applied mechanics, thermodynamics, heat transfer,
and fluid mechanics, and the application of those fundamental subjects to the
diverse problems of mechanical engineering.

Satisfactory completion of the curriculum leads to the degree, Bachelor of
Mechanical Engineering.

Optional Programs

While the curriculum is designed and structured to meet the general educational
goals of the majority of mechanical engineering students, the School regularly
considers and approves major modifications of the basic program to allow a
student with certain well-defined educational objectives to pursue minor fields
within the School or within Georgia Tech while earning a degree in Mechanical
Engineering. In this way a student may achieve his basic engineering degree in
Mechanical Engineering while minoring in any one of a large number of other
fields. Aside from the broad flexibility afforded by such special programs, a
student following the regular M.E. curriculum takes a number of electives as well
as special problems and projects, all of which allow latitude in pursuing his
educational goals and special interest areas.

Graduate Programs

The School of Mechanical Engineering has a rapidly expanding and vigorous
graduate program which encompasses advanced study and research in the areas
of automatic controls, bioengineering, combustion, complex systems design,
controlled machine tools, dynamics and vibration, energy conversion, engineering
design, environmental quality control, flammability, fluid mechanics, fluidics
and fluid power, heat transfer, high temperature design, lubrication, magneto-
gasdynamics, materials processing, materials science and engineering, mecha-
nisms (syntheses and analysis), power and propulsion, thermal systems (analysis
and design), thermodynamics (equilibrium and irreversible), transport processes,
and two-phase flows.

Graduate programs are based on the areas listed above, leading to the degrees
of Master of Science in Mechanical Engineering, Master of Science, and Doctor
of Philosophy, for qualified graduates having backgrounds in engineering,
mechanics, mathematics, physical sciences, and biological sciences.

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<tr>
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## Freshman Year (Cont.)

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## Sophomore Year

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### Senior Year

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†See page 38 of the catalog for engineering electives.

*These free elective courses may be taken at any time during the course of study. If ROTC is elected by the student these 6 credit hours may be applied for basic ROTC, which must be scheduled beginning the first quarter the student is enrolled.

**Nine hours of technical electives chosen from the list of M.E. Interest Area Courses shown below. Courses other than these may be selected from mathematics, physics, chemistry, biology, another field of engineering, or graduate courses. A student who wishes to take courses not listed below must so notify the Director of his choice and obtain approval at advance registration for the first quarter of his senior year.

A student completing his junior year with a grade average of 2.5 or higher may elect one technical elective from the Special Problem courses M.E. 496-6-8-9. (The particular course selected depending on the number of hours of credit needed.) This student will follow a course of individual study under the guidance of a faculty member with the approval of the School Director.

***Nine hours of electives may be replaced by advanced ROTC.

****For selection of acceptable courses see page 37 in this catalog.
M.E. Interest Area Courses

Listed below are elective courses in various topical areas of interest to mechanical engineers:

M.E. 383 Rational Descriptions and Engineering Design  
M.E. 403 Metal Cutting Principles  
M.E. 420 Internal Combustion Engines  
M.E. 421 Heating, Ventilating, and Air Conditioning  
M.E. 422 Power Plant Engineering  
M.E. 423 Engineering Acoustics and Noise Control I  
M.E. 424 Engineering Acoustics and Noise Control II  
M.E. 425 Engineering Analysis  
M.E. 426 Principles of Turbomachinery  
M.E. 427 Combustion and Flames  
M.E. 428 Elements of Rocket Systems  
M.E. 429 One-Dimensional Compressible Flow  
M.E. 431 Refrigeration  
M.E. 439 Gas Turbines  
M.E. 443 Heating, Ventilation, and Air Conditioning Design  
M.E. 447 Elements of Nuclear Engineering  
M.E. 448 Fluidics  
M.E. 449 Numerical Control of Machine Tools  
M.E. 456 Energy Conversion Engineering  
M.E. 462 Analytical Instrumentation in Materials Engineering  
M.E. 463 Mechanical Testing of Materials  
M.E. 465 Materials Science and Engineering  
M.E. 485 Mechanics of Machines  
M.E. 486 Bio-Mechanical Design  
M.E. 487 Kinematic Design  
M.E. 488 Cams and Gears

Course of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

M.E. 101. Introduction to Mechanical Engineering  
1-0-1. Prerequisite: Math. 107.

Mechanical Engineering is briefly surveyed to acquaint the student with the profession. What it is, what its functions are, what its working tools are, and what must be studied and learned to practice mechanical engineering successfully are the major topics.

Text: Smith, Engineering as a Career, 2nd Ed.; Florman, Engineering and the Liberal Arts.

M.E. 110. Creative Decisions and Design  
2-3-3. Prerequisite: None, may be scheduled during any quarter of the freshman year.

Basic concepts of engineering problem-solving and design are presented. Introduction of concepts in decision theory and material on design method and individual
creativity. Laboratory periods expose students to practicing engineers and their problems and accomplishments. Exposure to engineering practice is augmented with films and field trips in the Atlanta area.

The course E.Gr. 171 is the alternative offering to M.E. 110, and both carry freely transferable credit within the engineering college.

M.E. 212. Materials Science
3-0-3. Prerequisites: Math. 209 or concurrent, and Physics 229 or concurrent.

The course emphasizes those principles which relate the properties and behavior of different classes of materials to their structure and environment.

M.E. 312. Materials Technology
3-3-4. Prerequisite: M.E. 212.

Discussion of the mechanical and physical properties of metallic and nonmetallic materials and the relationship of these properties to behavior under service conditions.

M.E. 313. Mechanisms, Analysis and Synthesis
3-0-3. Prerequisite: ESM 309.

Analysis of the motion of linkages, cams and gears by graphical and analytical methods. Inertia in linkages, forces, and driving torques.

Text: Shigley, Kinematic Analysis of Mechanisms.

M.E. 316. Mechanical Engineering Computer Applications
2-3-3. Prerequisite: Math. 209 or concurrently.

An introduction to the organization and application of digital and analogue computers. Batch and remote processing. Representative mechanical engineering problems are solved through appropriate numerical techniques. Basic electrical analogues and circuits are used to solve initial value problems and to simulate engineering systems.

M.E. 320. Thermodynamics
4-0-4. Prerequisites: Physics 229 or concurrently; Math. 208 or concurrently.

The fundamentals of engineering thermodynamics. The properties of fluids, energy equations, and practical applications.

Text: Reynolds, Thermodynamics.

M.E. 322. Thermodynamics
3-0-3. Prerequisites: Physics 229 or concurrently; Math. 208 or concurrently.

A study of the fundamental laws of engineering thermodynamics and the properties of systems. Processes in the perfect gas.


M.E. 323. Thermodynamics
3-0-3. Prerequisite: M.E. 322.

A continuation of M.E. 322 including semi-perfect gases, real gases, vapors, mixtures, solutions, and general thermodynamic relations.

Text: Wark, Thermodynamics.

M.E. 324. Thermodynamics
3-0-3. Prerequisite: M.E. 323.

A continuation of M.E. 323 including power and refrigeration cycles, combustion, introduction to phase and chemical equilibrium.

Text: Wark, Thermodynamics.

M.E. 326-7. Thermodynamics
4-0-4, 3-0-3. Prerequisites: Physics 229 or concurrently; Math. 209 or concurrently.

The concepts, basic definitions and principles of classical equilibrium thermodynamics are introduced and discussed in view of state and path functions. The macroscopic formalism is introduced along with some equations of state for pure and ideal substances; this is applied to processes involving gases, liquids, and solids. Phase transitions are studied.

Some molecular models are studied with classical and quantum mechanical considerations. Appropriate statistics are used for the predictions of thermo-
dynamic properties. Partition functions are derived for systems of independent particles, and thermodynamic properties are calculated for monatomic gases, monatomic solids and polyatomic gases.

Text: Reynolds, *Thermodynamics*.

**M.E. 334. Mechanical Equipment of Buildings**
3-0-3. Prerequisite: Physics 229 or 213.

Principles of water supply, plumbing, and heating are studied. Design features of various types of heating systems are considered.


**M.E. 335. Mechanical Equipment of Buildings**
2-3-3. Prerequisite: M.E. 334.

Principles of air conditioning are studied. Application of heating and air conditioning principles to practical design problems is carried out during the laboratory period.


**M.E. 342. Transport Phenomena I**
3-0-3. Prerequisites: Math. 209, M.E. 322 or concurrently.

Introduction to conductive heat transfer, steady one-dimensional conduction, two- and three-dimensional steady-state conduction, conduction of heat in the unsteady state, and kinematics of fluid flow.


**M.E. 343. Transport Phenomena II**
3-0-3. Prerequisites: M.E. 342, ESM 205 and concurrently M.E. 323.

One-dimensional energy equation, fluid statics, Euler and Bernoulli equations, momentum equation, introduction to compressible flow, nozzles and shocks.


**M.E. 344. Transport Phenomena III**
3-3-4. Prerequisites: M.E. 343, and concurrently M.E. 324 and M.E. 355.

Radiation heat transfer, fluid properties and flow characteristics, incompressible and compressible flow in ducts, flow over immersed bodies.


**M.E. 353. Materials Laboratory**
0-3-1. Prerequisites: ESM 334 or ESM 343 or concurrently.

Basic methods of determining and evaluating phenomenological properties of engineering materials are experimented with. Stress analysis instrumentation is introduced.

Text: Course notes.

**M.E. 355. Experimental Methodology**
1-3-2. Prerequisites: Math. 209 and M.E. 322.

Three major areas are considered: the calibration of instruments for meaningful experimental data; the interpretation of collections of data, to demonstrate the role of random error and the importance of confidence levels; and the response of physical systems, to correlate the measurements taken with the dynamic behavior of instruments.


**M.E. 383. Rational Descriptions and Engineering Design**
3-0-3. Prerequisite: Junior standing in Engineering.

An elementary treatment of engineering design in both the substance and values of the alternative solutions to design problems. Application of probability-utility analyses to the design of mechanical, thermal, and electrical components and systems.

**M.E. 403. Material Removal Principles**
2-3-3. Prerequisites: M.E. 412, ESM 334.
The following topics are studied: Mechanics, mechanism and metallurgy of chip formation; lubrication, wear and cutting fluids, grinding, electrical machining processes, temperatures in metal cutting, economics. Experiments concerned with a study of chip formation, the effect of speed, feed, and rake angle on tool forces, tool temperature, lubrication and wear are performed.


**M.E. 412. Material Processes**
3-3-4. Prerequisite: M.E. 312.

Fundamentals of the various techniques used in working materials. Casting, metal forming, extrusion, metal joining, and metal cutting are topics.

**M.E. 413. Dynamics of Machinery**
3-0-3. Prerequisites: M.E. 313, Math. 209.

A continuation of the study of mechanism analysis and synthesis. Single position force analysis of mechanisms is covered in both the static and dynamic cases. The effects of friction are treated. Continuous positional analysis of rotating and reciprocating systems, including balancing, is also studied.

Text: Phelan, *Dynamics of Machinery*.

**M.E. 414. Heat Transfer**
3-0-3. Prerequisite: M.E. 327.


**M.E. 416. Thermal System Analysis I**
3-0-3. Prerequisites: M.E. 324 and M.E. 444 or concurrently.

The application of the principles of thermodynamics and transport phenomena to the analysis of thermal systems. Typical thermal systems such as steam power plants, internal combustion engines, refrigeration, nuclear power, and direct energy conversion are analyzed.


**M.E. 417. Thermal System Analysis II**
2-3-3. Prerequisite: M.E. 416.

Continuation of the work of the prerequisite course. In the laboratory the student will attempt to verify experimentally the analytical predictions of system performance.


**M.E. 420. Internal Combustion Engines**
3-3-4. Prerequisites: M.E. 324 and M.E. 343.

The mechanical construction, engine cycles, ignition, fuels, fuel feeds, combustion, and performance of internal combustion engines, with reference to aeronautical, automotive, and industrial use. The laboratory is devoted to experimental study of engines and their component parts.

Text: Obert, *Internal Combustion Engines*.

**M.E. 421. Heating, Ventilating, and Air Conditioning**
3-3-4. Prerequisites: M.E. 324; M.E. 344 or concurrently.

The theory of heating, ventilating, and air conditioning and its application to engineering systems. The laboratory work includes tests on equipment and materials pertinent to the field.

Text: Carrier, Cherne, Grant and Roberts, *Modern Air Conditioning, Heating and Ventilating*.

**M.E. 422. Power Plant Engineering**
3-3-4. Prerequisite: M.E. 324 and 444 or consent of instructor.

Modern power plant cycles, pumps, piping, fans, fuels, steam generators, boiler auxiliaries, heat exchangers and the economics of power plants are studied. The
laboratory work consists of tests of equipment pertaining to the subject.

Text: To be selected.

**M.E. 423. Engineering Acoustics and Noise Control I**

3-0-3. Prerequisite: Consent of instructor.

A study of acoustics related to noise and its control. Acoustic terminology, propagation of waves, particular solutions to the wave equation, acoustic resonance, instrumentation and its use in the solution of noise problems, legislation in regard to acceptable noise levels and noise exposure.


**M.E. 424. Engineering Acoustics and Noise Control II**

3-0-3. Prerequisite: Consent of instructor.

A continuation of M.E. 423 with the emphasis on the effects of sound on hearing and typical solutions to problems. Typical problems; machines, sonic booms, vehicles. Discussion of dissipative and reactive mufflers, special topics.


**M.E. 425. Engineering Analysis**

3-0-3. Prerequisite: Consent of instructor.

Emphasis is placed on well-ordered analytical thought processes required in the application of familiar fundamental principles of engineering sciences to the analysis of unfamiliar engineering situations.

**M.E. 426. Principles of Turbomachinery**

3-0-3. Prerequisite: M.E. 344 or consent of instructor.

Principles underlying all forms of turbomachinery are studied. Application of these principles is made to give a unified treatment of pumps, compressors, and turbines.

Text: Shepherd, *Principles of Turbomachinery*.

**M.E. 427. Combustion and Flames**

3-0-3. Prerequisite: M.E. 324 and M.E. 444 or consent of instructor.

Stoichiometric and thermochemical analysis of the principal fuel air reactions are examined. Concepts of modern theories of combustion and flame propagation are presented.

**M.E. 428. Elements of Rocket Systems**

3-0-3. Prerequisite: M.E. 444 or parallel.

Basic elements, ballistics, and technical problems associated with the design of propulsion systems for solid and liquid propellant rockets are studied.

**M.E. 429. One-Dimensional Compressible Flow**

3-0-3. Prerequisite: M.E. 444 or concurrently.

An intermediate study of various one-dimensional compressible flow systems relevant to mechanical engineering.


**M.E. 431. Refrigeration**

3-0-3. Prerequisite: M.E. 324.

A study of the compressor, condenser, piping and accessories of the refrigeration plant, and other practical applications of the principles of refrigeration.

Text: Jordan and Priester, *Refrigeration*.

**M.E. 439. Gas Turbines**

3-0-3. Prerequisites: M.E. 324 and M.E. 344.

The theory and design of gas turbines and jet engines and the various applications of these engines.

**M.E. 443. Heating, Ventilation, and Air Conditioning Design**

3-0-3. Prerequisite: M.E. 421.

A continuation of M.E. 421. The subject matter emphasizes the design of vari-
ous systems, including automatic controls, and the selection of equipment.


**M.E. 444. Transport Phenomena IV**
3-0-3. Prerequisites: M.E. 344.

Free and forced convection on immersed bodies, dimensional analysis, forced convection in ducts, heat transfer with phase changes, heat exchangers.


**M.E. 445. Principles of Automatic Control**
3-0-3. Prerequisite: Math. 209.

Fundamental principles and generalized behavior of closed loop linear systems are examined. Classical techniques based on the frequency response and eigenvalue analysis are presented as well as state variable approaches in the time domain. Examples are drawn from hydraulic, thermal, pneumatic, mechanical, and electrical applications to physical systems.


**M.E. 447. Elements of Nuclear Engineering**
3-0-3. Prerequisites: Physics 209 and Math. 209.

A study of characteristics of nuclear power systems. Nuclear physics and nuclear reactions will be used for establishing some reactor principles and reactor types.

**M.E. 448. Fluidics**
3-3-4. Prerequisites: M.E. 343 and M.E. 445 or concurrently.

The fluid mechanics of fluidic devices are presented. Digital proportional, diaphragm, and vortex devices in fluidics and their characteristics are studied. Fluid-electrical analogs are introduced. Aspects of line dynamics are treated. Engineering applications of fluidic systems are examined with reference to power economy, reliability, staging, and interconnections.

**M.E. 449. Numerical Control of Machine Tools**
3-0-3. Prerequisite: M.E. 445 or concurrently.

A study of the design and the operation of typical digital control systems for machine tools. The flow and manipulation of control signals is followed and studied as they progress through the system from the tape input to the machined-part output.


**M.E. 455. Experimental Engineering**
1-3-2. Prerequisites: M.E. final quarter standing.

Engineering situations involving various disciplines are solved by experimental means. Students must seek understanding of the purpose of experimentation, plan the experiments, and gather and interpret the results.


**M.E. 456. Energy Conversion Engineering**
3-0-3. Prerequisite: M.E. 320 or equivalent. Also listed as E.E. 440 and N.E. 440.

Treatment of advanced energy conversion techniques being developed for the generation of electric power. Principles of operation and engineering aspects of conversion devices and their present state of development, including their operating characteristics. Topics include energy sources, basic principles of energy conversion, semiconductors, thermoelectric converters, photovoltaic generators, thermionic systems, magnetohydrodynamics, fuel cells, and applications of these devices for power generation.

**M.E. 462. Analytical Instrumentation in Materials Engineering**
3-0-3. Prerequisite: M.E. 412.

M.E. 463. Mechanical Testing of Materials
3-3-4. Prerequisites: Met. 402 or M.E. 312 or consent of instructor.

Destructive and non-destructive test methods are treated for both metallic and non-metallic materials. The emphasis will be on the significance of results and the choice of materials based on test data. Effects of strengthening mechanisms will be considered.

M.E. 465. Materials Science and Engineering
3-0-3. Prerequisite: M.E. 312.


M.E. 481. Machine Elements
3-3-4. Prerequisites: ESM 334 and M.E. 312.

Principles of design (synthesis and analysis); the application of engineering mechanics to the design and selection of machine elements. Component design projects are undertaken in the laboratory.


M.E. 483. Design Theory
3-0-3. Prerequisite: M.E. 481 or concurrently.

The design process including decision theory, creativity concepts, human factors, systems engineering, optimization techniques, reliability and ethics is studied. Some case studies analyzed to illustrate application and the professional approach.

Text: Middendorf, Engineering Design.

M.E. 484 Design Engineering
0-6-2. Prerequisite: Final quarter standing.

The design process is applied to the team solution of real multidisciplinary engineering problem situations.

M.E. 485. Mechanics of Machines
3-3-4. Prerequisites: M.E. 413, Math. 209.

A continuation of M.E. 413 with emphasis on advanced analytical and graphical techniques for the dynamic analysis of machines. Coincident point acceleration analysis; energy balance analysis, and equivalent mechanism analysis are featured. Effects of rotational and translational friction are considered. Analog computer simulation of the dynamic response of a kinematic chain is covered.

M.E. 486. Bio-Mechanical Design
3-3-4. Prerequisite: Consent of instructor.

Optimal utilization of human operator capabilities in design; effects of the neuro-anatomical system parameters on the man-machine interface; biological system in terms of structure, power sources and information systems; dynamic modeling of the human operator. Optimal utilization of the human operator using knowledge of the capabilities and limitations of the biological system. The course is designed to help the engineer deal with the problems of design which include a human operator as integral part of the system.

M.E. 487. Kinematic Design
2-3-3. Prerequisites: M.E. 313 or consent of instructor; and M.E. 316.

Topics in kinematics most useful for the design of mechanisms to generate required point paths, functions, or transformation between modes of motion, translation to rotation; graphical, analytical, and computer-aided design methods are shown. Each student is required to design and construct a mechanism model conforming to a given set of specifications.


M.E. 488. Cams and Gears
3-4-4. Prerequisites: M.E. 313 or equivalent.
Selection of gears for standard applications and design of a gear for special applications are covered; spur, bevel, helical, and worm gearing are treated, including analyses of the forces and torques, as well as gear trains. Design of cams. Common motion types are covered; the less common forms such as trapezoidal, combined motions, high-speed polynomial forms, with recommendations concerning specific applications.


**M.E. 491. Seminar**
1-0-1. (Winter quarter only). Prerequisite: Senior standing in Mechanical Engineering.

Civic and professional responsibilities and opportunities are brought to students by leaders in engineering, business, and community affairs.

**M.E. 496-7-8-9. Special Problems in Mechanical Engineering.**

0-9-3, 0-6-2, 0-3-1, 0-12-4, respectively. Prerequisite: Senior standing in Mechanical Engineering.

These courses are for the student interested in creative work.

### Graduate Courses Offered

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<th>Units</th>
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<td>M.E. 627</td>
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<td>M.E. 630</td>
<td>Heating, Ventilation, and Air Conditioning</td>
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<td>M.E. 649</td>
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<td>M.E. 659</td>
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<td>M.E. 662</td>
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<td>M.E. 663</td>
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<td>M.E. 722</td>
<td>Thermodynamics of Irreversible Processes I</td>
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<td>M.E. 723</td>
<td>Thermodynamics of Irreversible Processes II</td>
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<td>M.E. 735</td>
<td>Numerical Methods in Heat Transfer</td>
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<td>M.E. 736</td>
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<td>M.E. 738</td>
<td>Advanced Topics in Heat Transfer</td>
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<td>M.E. 763</td>
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<td>Fracture of Materials II</td>
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*Also taught as A.E. 645, 655, 656; and E.E. 654, 655, 656, respectively.

**Also taught as A.E. 711, 712, 713, and 714, respectively.

(Complete details about these courses are in the Graduate Bulletin, which is available upon request.)
DEPARTMENT OF MILITARY SCIENCE
(Established in 1917)

Commandant and Professor of Military Science—Colonel Andrew J. Waldrop; Assistant Professors—Lieutenant Colonels William E. Branch, Marion F. Meador; Majors David A. Cunningham, James C. Fargo, Donald M. Harris, Richard T. Holder, Robert L. Philbrook, Thurman O. Sturdivant, Robert B. Williams; Captains Ignazio J. Licata, John F. Lukas, James W. Rundquist; Instructors—Sergeant Major Billy G. Warren; Master Sergeant Clifford M. Manning; Sergeants First Class Joseph Bullard, Harvey A. Genske, Carl E. Mattson; Staff Sergeants Tony L. Foster, Daniel Ortiz, Roger W. Wilf; Specialist 4 Thomas L. Prickett; Secretaries—Josephine P. Hodges, Thelma Kitchens, Kathleen W. Porte.

Reserve Officers' Training Corps

The U.S. Army offers instruction at the Georgia Institute of Technology, a Senior Division of the Army Reserve Officers' Training Corps, in the two- and four-year programs.

The purpose of the Senior Division, Army ROTC Program is to select for commissioning in the Reserve or Regular components of the Army of the United States, college students who achieve a baccalaureate or higher degree and successfully complete a course of instruction in Military Science.

The course of instruction of the Army ROTC is divided into two parts, the basic and advanced courses, each of two year's duration. Both courses are voluntary and may be chosen as an elective.

The ROTC program emphasizes instruction in military leadership, subjects common to all branches of the Army, and branch-related subjects.

The two-year program is open to both undergraduates and graduate students who elect to take the advanced course, but who cannot complete the basic course in the required time. Prior to enrollment in the advanced course, the student must attend a six weeks basic summer camp to cover those subjects otherwise required in the freshman and sophomore years of basic ROTC.

Academic Credit

Academic credit is granted for the completion of Military Science Courses as indicated in the sections that follow. However, not more than 6 hours credit in basic ROTC courses and not more than 9 hours credit in advanced ROTC courses may be applied toward a degree.

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<th>2nd Q.</th>
<th>3rd Q.</th>
<th>Credit Hrs.</th>
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<td>Basic 1st year</td>
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<td>2</td>
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<td>Advanced 2nd year</td>
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<td>Total Academic Credit</td>
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</table>
Uniforms

Basic course cadets are furnished the ROTC uniforms by the United States Army on a loan basis. A $25.00 deposit must be paid by the cadet to the school cashier before the uniform is issued. The cadet bears the expense of maintaining the uniform while it is in his possession, and must return it to the Army ROTC Supply Room upon termination of Military Science or upon leaving school for any period in excess of one quarter.

The $25.00 deposit, less charges for any uniform items negligently lost or destroyed, will be refunded after return of the uniform. Students who fail to return the uniform within academic quarters of nonparticipation in the program will forfeit the deposit.

On entering the advanced course, the Georgia Institute of Technology will purchase for the cadet's use a new ROTC uniform. He will be allowed to retain this uniform upon completion of the advanced course or upon disenrollment without prejudice.

Texts and Equipment

The necessary equipment and textbooks are furnished by the Department of the Army.

Scholarship Program

The United States Army offers financial assistance in the form of one, two, three, and four year scholarships for outstanding students who are interested in a career as an Army officer. Each scholarship provides for free tuition, textbooks, laboratory fees, and supplies in addition to subsistence pay of $100.00 per month for the period the scholarship is in effect.

Applications for the four-year scholarships will be submitted to the appropriate Army headquarters. Recipients of the four-year scholarships may attend the Georgia Institute of Technology if accepted for enrollment by the school.

Applications for the one, two, or three-year scholarships may be submitted to the Professor of Military Science at Georgia Tech by anyone who is enrolled in the ROTC program. Additional information may be obtained from the Professor of Military Science (PMS).

The Basic Course Curriculum

The basic course is a systematic study of military leadership and the exercise of command. Students enrolled in the basic course will follow a curriculum of six sequential Military Science (M.S.) courses, M.S. 110, M.S. 120, M.S. 104, M.S. 210, M.S. 220, and M.S. 230. Students will attend class and drill weekly in all courses except M.S. 104, which is a drill only course (Leadership Development) normally completed the third quarter of the freshman year. All quarters include
instruction and practical work in Leadership, Drill, and the exercise of Command to provide for leadership training and the development of initiative and self-confidence through progressive training. Normally, selection of students eligible for enrollment in the advanced course will be made during the sophomore year.

**Basic Course Offerings**

**NOTE:** 1-1-1 indicates 1 hour class, 1 hour Leadership Development (Drill) and 1 hour credit.

**M.S. 110. Orientation: The Military Role in Perspective**

1-1-1.

Detailed orientation for first quarter freshmen on the ROTC program beginning in the specific context of the Georgia Tech community; concept of the citizen soldier; the role of the military officer; the role of military force as a component of national security; civilian control of military forces; Department of Defense mission, organization, and objectives. Preparation for practice in leadership.

**M.S. 120. Terrain Analysis and Land Navigation**

1-1-1.

A study of military maps and aerial photographs as basic intelligence documents for terrain analysis, land navigation, position finding, and fire direction. A study of military symbology and its use in conjunction with maps for operational planning. Preparation for practical exercises in land navigation to be conducted during field exercises.

**M.S. 104. Leadership Development**

0-1-0. Prerequisite: At least one quarter of basic ROTC or permission of the PMS.

A one hour weekly period devoted to furtherance of basic military skills, leadership, drill, and command. Command voice and individual execution of above are stressed.

**M.S. 210. Analysis of Command and Leadership**

2-1-2.

A study of group dynamics, individual motivation, and the function of leadership at the small unit level. Application of leadership principles to the solution of problems using extensive case studies, individual presentations, and repetitive critiques. Examination of peer group relations as a special leadership problem.

**M.S. 220. Seminar in Communications and Instructional Methods**

2-1-2.

An intensive analysis of effective instruction as a necessary skill for military officers. Studies in fundamental techniques and methods of instruction with emphasis on individual presentation, group conferences and critiques. Subjects researched and presented are selected to augment learning objectives of other Military Science courses.

**M.S. 230. Military History**

3-1-3.

Studies of U.S. military history with emphasis on the principles of war and their interactions with decision making, leadership, and management. Consideration of political, economic, social, and technological factors as inseparable components of military history. Student class participation is stressed, requiring individual research and presentations.
ADVANCED COURSES

Objectives

The advanced course is a systematic study of leadership and the exercise of command and management at the professional level. Particular emphasis is placed on the technical and human resource factors that influence the exercise of command by military leaders.

Enrollment

Those applicants who have demonstrated a high leadership potential and meet the following requirements may be selected by the Professor of Military Science for enrollment in the advance course: (1) completed the basic course or basic summer camp; (2) passed the ROTC Qualifying Examination; (3) passed the officer physical examination (given by the U.S. Army at no cost to the applicant); (4) normally have six quarters of academic training remaining; (5) be recommended by a Board of Officers; (6) and if selected, enlist in the enlisted reserves.

The student when selected must sign a written contract agreeing to meet certain requirements as to completion of the course and hours devoted to it, including one summer training camp and acceptance of a commission, if tendered.

Branch Selection

The advance course curriculum of the Army ROTC at Georgia Tech offers instruction in six branches of the Army. These branches are Air Defense, Chemical Corps, Corps of Engineers, Infantry, Ordnance, and Signal Corps. Army ROTC students select the branch in which they desire to be commissioned, from the six offered, and if qualified, pursue the branch-material curriculum. Final branch selection must be made by mid-quarter of the first academic quarter’s enrollment in the advanced course.

Subsistence Allowance

Students formally enrolled in the ROTC and pursuing the advanced course will receive a subsistence allowance of a hundred (100) dollars a month, which is nontaxable.

Advanced Summer Camp

Members of the advanced course are required to attend advanced summer camp, normally between the junior and senior years. All students going to summer camp receive mileage for the round trip at the rate of six (6) cents per mile and are provided meals, housing, uniforms, and given medical and dental attention at government expense while attending camp. Students will receive pay at the rate of 50% of the base pay of a second Lieutenant or currently $267.00 per month.
The duration of summer camp approximates six weeks, beginning about June 15 each year.

**Commissions**

Upon graduation, students who satisfactorily complete the advanced course, including advanced summer camp, and are qualified for appointment as Second Lieutenants prior to reaching 28 years of age, are offered Commissions by the President of the United States as Second Lieutenants, United States Army Reserve.

ROTC graduates who meet special requirements may select direct Regular Army appointment or may volunteer for extended active duty tours with a view to being selected for regular Army appointment.

**Active Duty Obligations**

Reserve Officers serve either three to six months or two years of active duty. This obligation is one to three years less than required by the other uniformed services. Educational delays to pursue a graduate degree may be granted on application depending upon needs of the service.

**The Curriculum**

The advance course curriculum consists of six sequential Military Science courses and one of the three elective political science courses presented by the Department of Social Sciences.

Four of the Military Science courses (M.S. 310, M.S. 304, M.S. 410, and M.S. 404) comprise a core curriculum and must be completed by all students enrolled in the advanced course. The remaining two Military Science courses are selected from the Branch-Material course offerings and will be appropriate to the branch in which the commission is sought.

All students enrolled in the advanced course must satisfactorily complete either Political Science 353, Political Science 354, or Political Science 356 prior to commissioning. These are three credit hour courses presented by the Department of Social Sciences and may be applied against the humanities and Social Science requirements in all curricula leading to an undergraduate degree. Prerequisites for each course will be waived by the Social Sciences Department for Advanced ROTC Cadets.

Students enrolled in M.S. 310 and the Branch Material courses will attend three hours of class and one hour of drill (Leadership Laboratory) each week. Students enrolled in M.S. 410 will attend two hours of class and one hour of drill each week. Military Science 304 and 404 are drill only (Leadership Laboratory) courses and are attended during one quarter each of the junior and senior years.
ADVANCED COURSE OFFERINGS

NOTE: 3-1-3 means 3 hours class, 1 hour drill, 3 hours credit.

Required Courses

M.S. 310. Problem Solving for Military Operations
3-1-3.
A study of five functions of land combat (fire, maneuver, intelligence, logistics and communications/command/control) applied to the solution of tactical problems at the small unit level. Practical exercises in the logic and formats required to estimate, plan, and execute these tactical solutions.

M.S. 304. Leadership Development
0-1-0. Prerequisite: Advance ROTC standing.
A one hour weekly period devoted to furtherance of intermediate leadership and management skills. Leadership and management applications through effective oral communications and instructions are stressed.

M.S. 410. Military Administrative Operations
2-1-2. Prerequisite: Advanced ROTC standing.
A study of the basic concepts and fundamentals of military administration and military justice.

M.S. 404. Leadership Development
0-1-0. Prerequisite: Advanced ROTC standing.
A one hour weekly period devoted to furtherance of advanced leadership and management skills. Cadets apply and extend their skills by assuming full responsibility for the planning, leadership, and execution of the entire leadership development program.

BRANCH MATERIAL COURSE OFFERINGS

Each student should apply for his desired branch of instruction (and commission) as early as possible. Acceptance will be based on the student’s academic standing and major field of study. Since branch selections must be completed not later than mid-quarter of the student’s first academic quarter in the advanced course, care must be taken to insure that the student selects the appropriate branch material course offered in succeeding quarters.

Air Defense Artillery

M.S. 313. Forward Area Air Defense
3-1-3. Prerequisite: First year in advanced ROTC.
A study of air defense problems from intercontinental ballistic missiles to conventional aircraft and defense systems with emphasis on equipment and tactics for close-in defense of field units.

M.S. 413. Air Defense Operations
3-1-3. Prerequisite: Second year in advanced ROTC.
A study of Air Defense operations with practical exercises in selected duties of the air defense officer, including the managerial functions of logistics, training, and administration.
Chemical Corps

M.S. 323. Chemical Corps Tactics and Techniques
3-1-3. Prerequisite: First year in advanced ROTC.

A study of the mission, organization, and functions of the Chemical Corps in the tactics and techniques of chemical, biological, and radiological (CBR) Operations, to include CBR employment, detection, defense, decontamination, and application.

Corps of Engineers

M.S. 333. Combat Engineering
3-1-3. Prerequisite: First year in advanced ROTC.

A study of military engineering performed in a combat environment. Emphasis is placed on military structure to include military fixed and floating bridges; characteristics and use of U.S. military explosives; characteristics and employment of barriers and obstacles.

M.S. 433. Military Construction Management

Infantry

M.S. 343. Tactics and Techniques of Small Unit Operations and Employment
3-1-3. Prerequisite: First year in advanced ROTC.

A study of the fundamentals and principles of offensive, defensive, patrolling, retrograde, and counterinsurgency tactics on a small unit level. The study encompasses the organization of Infantry units to include battalion, brigade, and division. Staff and command estimate and orders are provided through a series of practical situation applications, which require the student to participate in problem solving processes.

M.S. 443. Advanced Infantry Tactics and Techniques; Planning and Functions in the Employment of the Combined Arms Team
3-1-3. Prerequisite: Second year in advanced ROTC.

A study of staff organizations, functions, responsibilities, and relationships to command requirements for unit employment. It combines staff and command actions, estimates, and orders in the employment of Infantry units and supporting elements from other branches and services under the combined arms concept. Practical application is provided in situation requirements involving student interchange of ideas and solutions.

M.S. 423. Management of CBR Offensive and Defensive Systems
3-1-3. Prerequisite: Second year in advanced ROTC.

An analysis of chemical biological, and radiological (CBR) weapons employment as it affects management/command decisions. A study of CBR protective measures and equipment available to commanders, as well as an analysis of the special logistical requirements needed in a CBR environment.
Ordnance Corps

M.S. 353. Ordnance Tactics and Techniques

3-1-3. Prerequisite: First year in advanced ROTC.

An analysis of materiel influences on logistics management by a survey of mobility and weapons systems. Emphasis is placed on studies of engineering principles, capabilities, and trends of combat materiel, including vehicles, weapons, explosives, guided missiles, and nuclear weapons.

Signal Corps

M.S. 363. Tactical Communications-Electronics Systems

3-1-3. Prerequisite: First year in advanced ROTC.

A study of Signal field communications system engineering and communications control in the brigade, division, corps, field Army, and theater Army; introduction to wire, radio, and multi-channel communications systems to include telephony, telegraphy, carrier, HF radio, VHF radio, and microwave systems. An introduction to the global communications network of the U.S. Army.

M.S. 453. Logistics Management

3-1-3. Prerequisite: Second year in advanced ROTC.

An analysis of the influence of human factors on logistics management by a survey of management concepts, practices, and techniques, and their application to Army management structures. Emphasis is placed on studies of management functions, human relations, Army management systems, and management aspects of automatic data processing. Instruction will be by conference and practical exercise.

M.S. 463. Strategic Communications-Electronics Systems

3-1-3. Prerequisite: Second year in advanced ROTC.

An analysis of critical components of Signal Communications, emphasizing: applications of automatic data processing; developmental trends in communications-electronics; human and technical engineering problems encountered by Signal Corps Officers in the planning, execution, and maintenance of strategic communications systems and facilities. A study of administrative and logistical requirements to support effective Signal operations.
DEPARTMENT OF MODERN LANGUAGES


General Information

The Department of Modern Languages seeks to give the student sufficient mastery of a foreign language to enable him to read and understand with reasonable facility the scientific and technical literature of that language. Further, it seeks to inform the student, through the medium of the foreign language, of the civilization and literature of the countries where that language is spoken. In order to attain these goals the Department reserves the right to section, according to ability and/or preparation, its first-and/or second-year students of those languages which attract enrollments either large enough to support such sectioning or specifically qualified to do so.

A student taking a language in which he has two or more years of high school credit is encouraged to register initially for a course not lower in number than the first course of the 200 series in that language. However, if such a student is convinced that his knowledge of the language in question is inadequate for successful participation in this 200 series course, then he may register for any less advanced course in the same language which is available and to which his preparation is believed to be equal. Beginning with that less advanced course, he may then take, for full credit toward graduation, the entire complement of language courses approved for his program of study. A student who elects to take courses in his native language must schedule, as his first course, one not lower in number than Fren. 401, Ger. 211, Russ. 301, or Span. 401. Otherwise the student in either of these situations may schedule the beginning course of another language.

Note: In response to sufficient demand, special instructional sections for students who speak the language in question as a native language may be made available on any level above the 100-level in any of the languages offered.

A student may take any course for which he has the prerequisites. Credit will be given on a quarterly basis, as specified in the catalog description. However, students are urged to plan at least a three-quarter sequence in a language in order to achieve a minimum level of proficiency.

Since the enrollment in German is larger than that in any of the other languages, all three regular elementary German courses (Ger. 101-102-103) are normally available each quarter. Consequently, students who are enrolled only every other quarter can easily complete the first year of their language study in German but might do so only with great loss of time in the other languages.
Placement examinations are not required but are available in French, German, and Spanish. Students whose high schools do not provide such examinations may take those provided by this Department as a means of determining their proper course level. Students whose high schools do provide such examinations are encouraged to have the results of those examinations sent to the Department well before their registration at Georgia Tech. The departmentally administered placement examinations are held at the beginning of each fall quarter during orientation week.

All programs of study leading to undergraduate degrees require the completion of 18 quarter hours in both humanities and social sciences subjects for a total of 36 quarter hours. Certain courses taught by the Department of Modern Languages satisfy the humanities division of this requirement and others taught by the Department satisfy the social sciences part. The foreign-language courses in each group are identified on p. 37 of the General Catalog.

**College Credit for High School Study**

Those students:

1. Who have two or more years of high school credit (or the equivalent) in a language offered by the Department of Modern Languages at Georgia Tech;
2. Who do not speak the language in question as a native language;
3. Who do not have college credit anywhere for the 100-level series of courses in that language; and
4. Who complete, as their first foreign-language course series taken at Georgia Tech, a 200-*, 300- or 400-level series of 3 courses (in Russian, 2 courses) in the same language with an average grade of at least “C”

are automatically granted 9 quarter hours of Georgia Tech elective credit for the 100-level series in that language (in Russian, 12 quarter hours).

*Note:* The 9 or 12 quarter hours of credit for the 100-level series are not applicable toward the above mentioned 36-hour social sciences and humanities requirement; credit for the 200-, 300-, or 400-level series is applicable toward this requirement.

*In German, the 200-level series must be German 201-202-203.*

**Courses of Instruction**

*Note:* 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

**Chinese**

In the Department’s program of instruction in Mandarin Chinese, an effort is made to prepare the student in both the spoken and written language well enough to enable him to continue his study without professional assistance after
he completes the program. This effort is naturally facilitated by the admission of chiefly those students who have had such formal language training as that prescribed in the course descriptions below and who have demonstrated in that training innate ability for language study. However, those students who do not have these formal prerequisites but who possess exceptional specific motivation are also admitted.

**Chin. 101. Introduction to Chinese**

3-2-4. Prerequisite: One year college-level foreign language study or equivalent and permission of instructor.

Emphasis on the spoken language; during three class hours (to be scheduled at registration) conventional study and testing of grammar; during two laboratory hours (to be scheduled after registration) intensive study of spoken language patterns.

**Chin. 102. Introduction to Chinese**

3-2-4. Prerequisite: Chin. 101 or equivalent.

Continuation of Chin. 101; introduction to the Chinese writing system.

**Chin. 103. Introduction to Chinese**

3-2-4. Prerequisite: Chin. 102 or equivalent.

Continuation of Chin. 102; proportionately more emphasis on written Chinese.

**French**

Both students with two years of high school training in French and those with more than two are encouraged to register initially for a course not lower in number than Fren. 201. The gradation of the series Fren. 201-202-203 and the instructional variety within that series enable qualified students from both groups to profit from the courses.

With permission of the instructor, exceptionally well prepared freshmen who have had three or more years of high school training in the language may be admitted to the series Fren. 301-302-303 or even to the series Fren. 401-402-403. These series are intended primarily, however, for students who have completed respective minima of two and three years of college training or the equivalent.

**Fren. 001. Elementary French for Graduate Students**

5-0-0. Prerequisite: None. (Available in summer quarter only.)

Pronunciation; minimum grammar; acquisition of vocabulary, both basic and scientific, from appropriate reading; translation of scientific literature into English. This course prepares the student in one quarter for admission into the first course of the second-year series, Fren. 201, thus shortening the period of time normally required for his preparation for the Ph.D. reading-knowledge examination.

**Fren. 101. Elementary French**

3-0-3. Prerequisite: None.

Essential principles of French grammar; acquisition of vocabulary through simple conversational exercises and the reading of simple selections.

**Fren. 102. Elementary French**

3-0-3. Prerequisite: Fren. 101 or equivalent.

Continuation of Fren. 101; extension of the survey of French grammar; acquisition of a large general vocabulary through
conversation and the reading of texts containing the most frequently occurring words and idioms.

Fren. 103. Elementary French
3-0-3. Prerequisite: Fren. 102 or equivalent.

Reading of selected texts; composition; completion of the survey of French grammar.

Fren. 201. French Civilization from the Beginning to 1700
3-0-3. Prerequisite: Fren. 103 or equivalent.

History of France with emphasis upon social conditions and changes, and upon the psychology which resulted in France's contribution to civilization in numerous areas, including architecture and other fine arts.

Fren. 202. French Civilization from 1700 to 1800
3-0-3. Prerequisite: Fren. 201 or equivalent.

Continuation of Fren. 201 with emphasis upon France's contribution to the democratic ideal and to the fine arts. Readings from political scientists and philosophers, such as Montesquieu, Voltaire, and Rousseau.

Fren. 203. French Civilization from 1800 to the Present
3-0-3. Prerequisite: Fren. 202 or equivalent.

Continuation of Fren. 202. Readings from authors identified with the progress of democratic ideals and the scientific awakening.

Fren. 301-302-303
Survey of French literature from circa 1800 to the present.

Class and collateral study of prose, drama, and lyric poetry by representative authors through indicated literary movements: course conducted in French.

Fren. 301. Period: c. 1800-1850. Romanticism: The Reappearance of Lyric Poetry; The Importance of the Individual, as Opposed to Classical Anonymity
3-0-3. Prerequisite: Fren. 203 or equivalent.

3-0-3. Prerequisite: Fren. 203 or equivalent.

Fren. 303. Period: c. 1900—. Exploration of Currents in Modern Prose, Poetry, and Drama
3-0-3. Prerequisite: Fren. 203 or equivalent.

Fren. 401. Seventeenth Century French Prose and Poetry
3-0-3. Prerequisite: Fren. 303 or equivalent.

Introduction to French classical theory; study of the literary transition from the 16th to the 17th century; reading selections from Malherbe, Descartes, Pascal, La Rochefoucauld, La Fontaine, and La Bruyère; preparation for the study of French classic drama; term report.

Fren. 402. Classic French Drama
3-0-3. Prerequisite: Fren. 303 or equivalent.

A brief survey of French drama from its origins in the Middle Ages up to the seventeenth century; reading of the major works of Corneille, Molière, and Racine; emphasis on the seventeenth century or "Classic Age" of French drama; brief survey of later developments in French drama; reading of selected works of Beaumarchais and Voltaire; term report.

Fren. 403. The French Novel
3-0-3. Prerequisite: Fren. 303 or equivalent.

A brief survey of the development of French prose; the development of the novel in the seventeenth century; influence of the picaresque novel; the classic nineteenth-century novel; modern developments in the novel; term report.
German

Those students who have completed Ger. 101 with distinction will be offered the opportunity to participate in a special honors program comprised of the two courses Ger. 105-106. Participants in this program complete their study of elementary German under instruction which is more direct in presentation, more intensive in character, and more comprehensive in content than in the regular series of courses. This honors program is offered during the winter and spring quarters of each academic year in which there is sufficient demand and participation is completely voluntary on the part of the student.

Students who have two or more years of high school credit are encouraged to register initially for a course in either of the two series Ger. 201-202-203 and Ger. 211-212-213. Students interested in acquiring an active knowledge of the language for use not merely as a tool of research but also as a medium of cultural development should register for the series Ger. 201-202-203. Those who are interested in acquiring a passive knowledge of the language for use as a tool of research only are advised to register for the series Ger. 211-212-213. Each of these two series may be taken for full credit toward graduation, and either series may be taken first. Both series offer excellent preparation for graduate reading-knowledge examinations.

Matriculating freshmen who have three or more years of high school credit, or who have participated in special programs of German study in the United States, or who have studied in one of the German-speaking countries of the world are invited to apply for admission to 300- or 400-level courses. Recommendations will be made on the basis of the individual student's level of achievement — and in consultation with the instructor of the course in question. Other interested students who have had some special form of preparation in German are urged to discuss their particular situations with the appropriate staff members of the Department in order that the most advantageous class assignments may be made.

Ger. 001. Elementary German for Graduate Students
5-0-0. Prerequisite: None. (Available in summer quarter only.)

Pronunciation; skeletal presentation of German grammar; translation of scientific literature into English. (By preparing the student in one quarter for admission into the first course of the appropriate second-year series — normally Ger. 211 — this course affords him an opportunity to shorten his preparation time for the Ph.D. reading-knowledge examination.)

Ger. 101. Elementary German
3-0-3. Prerequisite: None.

Pronunciation; essential principles of German grammar; rapid acquisition of vocabulary by the reading of simple selections; elementary composition.

Ger. 102. Elementary German
3-0-3. Prerequisite: Ger. 101 or equivalent.

Continuation of Ger. 101.

Ger. 103. Elementary German
3-0-3. Prerequisite: Ger. 102 or equivalent.

Reading of general German material and the acquisition of a large vocabulary; continued study of German grammar; composition.

Ger. 105. Intensive Elementary German
3-1-3. Prerequisite: Departmental selection
on the basis of achievement in Ger. 101.

Essentially the same course as Ger. 102 with intensification, acceleration, regular practice in conversation, and a weekly one-hour laboratory requirement.

**Ger. 106. Intensive Elementary German**

3-1-4. Prerequisite: Ger. 105.

Continuation of Ger. 105.

**Ger. 201. Introduction to Modern German Culture I**

3-0-3. Prerequisite: Ger. 103, Ger. 106, or equivalent.

Selected readings in German on the contributions to the development of modern thought by such major German figures as Marx, Nietzsche, Freud, Einstein, and Spengler. Class discussion of reading material. Review of grammar.

**Ger. 202. Introduction to Modern German Culture II**

3-0-3. Prerequisite: Ger. 201 or equivalent.

Continuation of Ger. 201.

**Ger. 203. Introduction to Modern German Culture III**

3-0-3. Prerequisite: Ger. 202 or equivalent.


**Ger. 211. Intermediate German (Scientific)**

3-0-3. Prerequisite: Ger. 103 or equivalent.

Reading of German scientific and technical material; individual problems to conform, whenever possible, with the student's special field of study.

**Ger. 212. Intermediate German (Scientific)**

3-0-3. Prerequisite: Ger. 211 or equivalent.

Continuation of training given in Ger. 211.

**Ger. 213. Intermediate German (Scientific)**

3-0-3. Prerequisite: Ger. 212 or equivalent.

Reading of German prose in support of the development achieved in Ger. 211 and 212.

**Ger. 301. Introduction to German Literature I**

3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.

Development of a critical appreciation of German literature through the study of selected masterpieces in the language from medieval times to the present day. Class and collateral study of prose, drama, and lyric poetry by representative authors in various literary movements. Period covered during the first term: Middle Ages to c. 1750.

**Ger. 302. Introduction to German Literature II**

3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.

Continuation of Ger. 301. Period covered: c. 1750-1840.

**Ger. 303. Introduction to German Literature III**

3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.

Continuation of Ger. 302. Period covered: c. 1840-present.

**Ger. 401. German Writers of the 20th Century I**

3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.

A study of the leading German authors from Naturalism to c. 1920. Collateral and class readings; lectures; class discussion. Course conducted in German.

**Ger. 402. German Writers of the 20th Century II**

3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.

A continuation of the material under study in Ger. 401, with emphasis on authors and works from c. 1920 to the present time. Course conducted in German.

**Ger. 403. Modern German Drama**

3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.
A study of the leading German dramatists from the period of Naturalism to the present time. Lectures; parallel readings; discussions. Course conducted in German.

Ger. 421. The Age of Goethe I
3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.

The rise of German literature in the eighteenth century to the time of Goethe and Schiller. Collateral and class readings; lectures; class discussions. Course conducted in German.

Ger. 422, The Age of Goethe II
3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.

A continuation of Ger. 421. The mature works of Goethe and Schiller. Course conducted in German.

Ger. 423. Selected Readings in German Literature
3-0-3. Prerequisite: Ger. 203, Ger. 213, or equivalent.

Reading and discussion of selected authors, movements, genres, and forms in German literature. Topics presented will vary from year to year. Parallel readings, reports, and papers may be required.

Russian

Only a select few of the students indicating interest in the study of elementary Russian are admitted to the course, necessarily restricted in number by the prerequisites for admission which the exacting limits of the program in Russian impose. As a result, the competition which the students naturally afford each other makes the Russian program intensive in character.

Russ. 101. Elementary Russian
3-2-4. Prerequisite: For matriculating freshmen at least two years of high school training in any foreign language(s), ancient or modern. For all other students, college credit for at least one year's study of a foreign language. For all students, selection on the basis of departmentally established criteria. Exceptions at the discretion of the staff.

During three class hours (to be scheduled at registration) conventional study of grammar and illustrative reading. During two laboratory hours (also scheduled at registration) intensive familiarization with recorded study material.

Russ. 102. Elementary Russian
3-2-4. Prerequisite: Russ. 101 or equivalent.

Continuation of Russ. 101; introduction of additional reading material as progress of class permits.

Russ. 103. Elementary Russian
3-2-4. Prerequisite: Russ. 102 or equivalent.

Continuation of Russ. 102; emphasis on the reading of simple prose.

Russ. 201. History and Culture of Russia I
3-0-3. Prerequisite: Russ. 103 or equivalent.

Reading of selected materials in Russian on highlights of Russian history and culture. Period of history: ninth century to eighteenth. Review of grammar; oral practice.

Russ. 202. History and Culture of Russia II
3-0-3. Prerequisite: Russ. 201 or equivalent.

Continuation of Russ. 201. Period of history: eighteenth century to 1917.
Russ. 203. History and Culture of Russia III
3-0-3. Prerequisite: Russ. 202 or equivalent.

Continuation of Russ. 202. Period of history: 1917–.

Russ. 301-302-303
Survey of Russian Literature from 1800 to the Present
Class and collateral study of prose, drama, and poetry by representative authors, according to the indicated time periods and literary movements; readings in Russian.

Spanish
Students are encouraged to select their courses according to the following plan: those who have credit for two years of high school study should enroll initially in a 200-level course; those who have credit for three years, in a 300-level course; and those who either have credit for as many as four years or who possess native or almost native proficiency in the language should enroll in one of the 400-level courses. The staff is readily available to counsel the student for proper placement. No student will be required to take courses which are too advanced for his preparation.

Span. 101. Elementary Spanish
3-0-3. Prerequisite: None.

Pronunciation; grammar; reading; composition, simple conversational exercises.

Span. 102. Elementary Spanish
3-0-3. Prerequisite: Span. 101 or equivalent.

Continuation of Span. 101; increased emphasis on reading and conversation.

Span. 103. Elementary Spanish
3-0-3. Prerequisite: Span. 102 or equivalent.

Continuation of Span. 102; completion of fundamentals of Spanish grammar.

Span. 201. Cultural History of Spain I
3-0-3. Prerequisite: Span. 103 or equivalent.

Cultural development of Spain from prehistoric times through the Middle Ages. Linguistic exercises, lectures, discussions.

Span. 202. Cultural History of Spain II
3-0-3. Prerequisite: Span. 201 or equivalent.

Cultural development of Spain from 1450-1700. Linguistic exercises, lectures, discussions.

Span. 203. Cultural History of Spain III
3-0-3. Prerequisite: Span. 202 or equivalent.

Cultural development of Spain since 1700. Linguistic exercises, lectures, discussions.

Span. 301. Spanish-American Literature Before 1895
3-0-3. Prerequisite: Span. 203 or equivalent.
An introduction to Spanish-American civilization as reflected in representative literary works. Introduction to literary criticism. Lectures; discussions. Conducted in Spanish.

**Span. 302. Spanish-American Literature Since 1895**
3-0-3. Prerequisite: Span. 203 or equivalent.
Continuation of Span. 301.

**Span. 303. Introduction to Spanish Literature**
3-0-3. Prerequisite: Span. 203 or equivalent.
The cultural heritage of Spain in the Americas as reflected in representative European and Spanish-American literary works. Conducted in Spanish.

**Span. 304. Cultural History of Mexico**
3-0-3. Prerequisite: Span. 203 or equivalent.
Readings from representative authors. Vocabulary building; lectures; discussions; conversation and composition.

**Span. 305. Contemporary Latin America**
3-0-3. Prerequisite: Span. 203 or equivalent.
Selected contemporary essays, speeches, and diverse documents reflecting social, economic, and political problems. Conducted in Spanish.

**Span. 306. Intensive Grammar Review and Composition**
3-0-3. Prerequisite: Span. 203 or equivalent.
Grammar review through conversational drills in language laboratory; composition.

**Span. 401. Spanish Drama Before 1700**
3-0-3. Prerequisite: Span. 306 or equivalent.
Emphasis on Lope de Vega and Calderón; contributions to Western literature. Conducted in Spanish.

**Span. 402. Spanish Drama Since 1700**
3-0-3. Prerequisite: Span. 306 or equivalent.
Emphasis on Lorco and Casona; continuation of Span. 401.

**Span. 403. Spanish Prose Before 1700**
3-0-3. Prerequisite: Span. 306 or equivalent.
Emphasis on the Celestina; contributions to Western literature. Conducted in Spanish.

**Span. 404. Spanish Prose Since 1700**
3-0-3. Prerequisite: Span. 306 or equivalent.
Emphasis on the generation of 1898; continuation of Span. 403.

**Span. 407. Spanish Historical Linguistics**
3-0-3. Prerequisite: Span. 306 or equivalent.

**Span. 408. Libro de buen amor**
3-0-3. Prerequisite: Span. 407 or equivalent.
Detailed linguistic and literary analysis of the Ruiz masterpiece as the vortex of Spanish medieval literature. Conducted in Spanish.

**Span. 409. Don Quijote, Part I**
3-0-3. Prerequisite: Span. 306 or equivalent.
Detailed study of Cervantes' masterpiece as the vortex of Spanish literature, the prototype of the modern novel, and the essence of Renaissance and Baroque literature. Conducted in Spanish.

**Span. 410. Don Quijote, Part II**
3-0-3. Prerequisite: Span. 306 or equivalent.
Continuation of Span. 409.
STUDY ABROAD PROGRAMS OF THE UNIVERSITY SYSTEM OF GEORGIA

Ger. 491-492-493. GERMAN STUDY ABROAD. 5-0-5 each.  
Span. 494-495-496. SPANISH STUDY ABROAD. 5-0-5 each.  
Fren. 497-498-499. FRENCH STUDY ABROAD. 5-0-5 each.

These courses are catalog courses only and are never staffed or taught at Georgia Tech. Their only purpose is that of a bookkeeping device which facilitates the recording of credit earned by successful participation in the Study Abroad Programs of the University System of Georgia — fifteen (15) quarter-hours credit for each summer course.

Linguistics

The courses listed below are offered as a contribution to further development of a rising student interest in the science of linguistics.

**Ling. 201. Introduction to Language I**
3-0-3. Prerequisite: None.
Survey of major language families of the world and relationships within language families; comparison of dialects and “standard” languages.

**Ling. 202. Introduction to Language II**
3-0-3. Prerequisite: Ling. 201 or permission of the instructor.
Survey of the types of linguistic change and development; comparison of generic and genetic linguistic relationships; linguistic borrowing.

**Ling. 203. Introduction to Language III**
3-0-3. Prerequisite: Ling. 202 or permission of the instructor.
Survey of the universal structural units of language; survey of major writing systems and the principles of the graphological representation of languages; introduction of the methods of descriptive linguistics.

**Ling. 301. Introduction to Articulatory Phonetics**
3-0-3. Prerequisite: Note.
General introduction to phonetics, both acoustic and articulatory; study of the physiology of the organs used in the production of speech sound; presentation of the methodology for scientific analysis of human speech sound; examination of data from English and other natural languages such as French, German, Spanish, Russian, and Chinese; emphasis on the practical ability to record in phonetic script and to reproduce various possible types of human speech sound. Collateral readings; term report.

**Ling. 302. Introduction to Structural Linguistics I**
3-0-3. Prerequisite: Ling. 301 or permission of instructor.
Presentation of methodology for scientific analysis of language; examination of data from hypothetical languages of increasing complexity prior to examination of natural languages; emphasis on phonetics and phonemics. Collateral readings; reports.

**Ling. 303. Introduction to Structural Linguistics II**
3-0-3. Prerequisite: Ling. 302 or permission of instructor.
Continuation of Ling. 302 with emphasis on morphology and syntax. Collateral readings; reports.

**Ling. 401. History of Linguistics**
3-0-3. Prerequisite: Prior study of linguistics or permission of instructor.
Survey of the theoretical developments in linguistic science, with major emphasis on the developments of the nineteenth and early twentieth centuries.

**Ling. 402. Current Developments in Linguistics**

3-0-3. Prerequisite: Prior study of linguistics or permission of instructor.

Live issues in the field, and approaches favored by various contemporary schools.

**Ling 403. Semantics and Linguistic Structure**

3-0-3. Prerequisite: Prior study of linguistics or permission of instructor.

Various approaches to the problem of dealing with meaning in linguistic analysis.

**Ling. 421. Contrastive Language Systems**

3-0-3. Prerequisite: Ling. 301-302-303 or permission of the staff.

An examination of five major languages – Russian, Sanskrit, Chinese, Japanese, and Hebrew – and the manner in which they differ from English with respect to: sounds and organization of sounds; written representation; grammatical and semantic categories; and syntactic organization and the semantic functions of syntax.
Department of Music

Department Chairman and Director of Bands—Ben Logan Sisk; Assistant Professor and Director of Glee Clubs—Jerry L. Black; Assistant Director of Bands—C. Lloyd Tarpley.

General Information
Musical activities at Georgia Tech are taking an increasingly important place in the school. Courses are offered for academic credit to Band and Glee Club participants.

The Band is nationally known through television performances at both bowl and regular season football games. During the winter and spring quarters, the band functions as a symphonic organization doing considerable sightreading as well as performing quality band literature.

The Glee Club, with a history of several trips abroad and two appearances on the Ed Sullivan Show, annually performs at a number of girls' colleges in the Southeast and in numerous local concerts.

Courses of Instruction

Music 201. Choral Music—History
1-2-1. Prerequisite: 1. Satisfactory completion of three quarters in Glee Club; 2. Approval of the Glee Club Director.

Course will consist of two hours practical and laboratory work, rehearsing and performing choral music. Third hour will be given to study of the history and development of choral music, from Gregorian chant through Palestrina and Bach to the present.

Text: Stringham, Listening to Music Creatively.

Music 202. Choral Music—Conducting
1-2-1. Prerequisites: 1. Satisfactory completion of three quarters in Glee Club; 2. Approval of the Glee Club Director.

Laboratory work will consist of rehearsal or performance of choral music. Third hour will include practice conducting by the students.

Text: Bauman, Elementary Musicianship.

Music 203. Choral Music—Appreciation
1-2-1. Sophomore, junior or senior year, spring quarter. Prerequisites: 1. Satisfactory completion of three quarters in Glee Club; 2. Approval of the Glee Club Director.

The theoretical material of this course is a study of the operas presented during the spring quarter in Atlanta by the Metropolitan Opera Association, which can be attended free of charge by the Glee Club members.

Music 301. Marching Band
0-3-1. Junior or senior year, fall quarter. Prerequisites: 1. Satisfactory completion of three quarters participation in band as a freshman or sophomore; 2. Approval of the Band Director.

Precision drilling, special maneuvers, military parade procedure. (Students completing this course are expected to be able to direct as well as participate in these routines).

Text: Dvorak, "The Marching Band."

Music 302. Concert Band
0-3-1. Junior or senior year, winter quarter. Prerequisites: 1. Satisfactory completion of three quarters participation in band as freshman or sophomore; 2. Approval of the Band Director.

Performance and appreciation of concert music, Baton technique and student
conducting. Radio and television broadcasting techniques.

Text: "National School Band Manual."

**Music 303. Concert and Marching Band**

0-3-1. Junior or senior year, spring quarter. Prerequisites: 1. Satisfactory completion of three quarters participation in band as a freshman or sophomore; 2. Approval of the Band Director.

Continuation of all procedures listed under Music 302 plus a continuation of the marching drill and performance in Music 301.


**Music 401. Marching Band**

0-3-1. Senior year, fall quarter. Prerequisites: Satisfactory completion of Music 303, and approval of the Band Director.

A continuation of the 300-series music courses.

**Music 402. Concert Band**

0-3-1. Senior year, winter quarter. Prerequisites: Satisfactory completion of Music 401 and approval of the Band Director.

A continuation of the 300-series music courses.

**Music 403. Concert Band**

0-3-1. Senior year, spring quarter. Prerequisites: Satisfactory completion of Music 402 and approval of the Band Director.

A continuation of the 300-series music courses.
Department of Naval Science  
(Established in 1926)

Commanding Officer and Professor of Naval Science—Captain Forrester C. Auman, USN; Associate Professor—Commander William B. Wright, USN; Assistant Professors—Major Alton L. Amidon, USMC; Lieutenant Commander Richard C. Albright, USN; Lieutenant Commander Richard H. Schmidt, USN; Lieutenant Thomas C. Kildebeck, USN; Lieutenant Albert M. Mangin, USN; Lieutenant John E. Monroe, USNR; Instructors—Master Sergeant William R. Morningstar, USMC; Chief Gunner’s Mate (Technician) James H. Ansley; Chief Quartermaster Milan C. Harring; Chief Yeoman Harold Anderson; Chief Storekeeper Louis T. Charles; Secretaries—Mrs. F. Inez Hale, Mrs. Virginia M. McDonald.

General Information

Naval ROTC students are enrolled for the full-four-year period. Students desiring commissions in the Marine Corps follow a different curriculum during the junior and senior years. Students may apply for flight or nuclear power training or for a commission in the Civil Engineer Corps, Supply Corps, or for the Unrestricted Line during the senior year. A government financed Flight Indoctrination Program consisting of ground and flight training is conducted by a civilian flying school during the junior or senior year for qualified students. Successful completion of this program leads to the granting of a private pilot’s license. The NROTC is composed of two types of students: Scholarship and College program.

Note: The Two-Year College Program may be reinstated by September 1972. This program would be open to beginning juniors in good standing. Contact the NROTC Unit for further details.

Scholarship Students

These students are appointed Midshipman, USNR, after nation-wide competition. They have their tuition, fees and textbooks paid for by the Navy for a period not exceeding four years, are uniformed at government expense, and receive retainer pay at the rate of $100.00 per month. Students in this classification will not be entitled to receive simultaneous education benefits under the G.I. Bill. They must obligate themselves to complete the prescribed Naval Science curriculum, to make a cruise of from six to eight weeks each summer, to accept a commission as Ensign, USN, or Second Lieutenant, USMC, upon graduation, and to serve on active duty for four years after commissioning unless earlier released by the Navy Department. At the end of this period their active duty obligation to the Navy or Marine Corps is fulfilled. If they do not desire to remain on active duty in the Regular Navy or Marine Corps, they are ordered to inactive duty in the Naval or Marine Corps Reserve.
College Program Students

These students are enrolled under the provision of Public Law 88-647. They are uniformed at government expense and during their junior and senior years are paid retainer pay of $100.00 per month. They must obligate themselves to complete the prescribed Naval Science curriculum, to make a summer cruise of approximately six weeks during the summer after the junior year; and to accept a commission on graduation as Ensign, USNR or Second Lieutenant, USMCR.

In consideration for the benefits accrued by reason of membership in the NROTC College Program, the student is required to enlist in the U.S. Naval Reserve for a period of six years prior to starting the junior year. These students are deferred from the draft, but must agree to serve on active duty for not less than three years after appointment to commissioned rank in the U.S. Naval Reserve or Marine Corps Reserve and to retain their commission until the sixth anniversary of receipt of original commission. After receiving their commissions, application may be made for commission in the Regular Navy or Marine Corps. Students receiving these benefits may receive them in addition to G.I. benefits to which they are entitled.

Naval Science Students

Any regularly enrolled undergraduate student may enroll as a Naval Science student. Normally these students are potential replacements for vacancies among College Program students. Those enrolled as Naval Science students take Naval Science courses as electives and have no contract with the Navy. They have no assurance of ultimate commissioning nor do they derive any of the financial benefits available to Scholarship and College Program students. They have no draft deferments.

Selection Procedure

Scholarship students are selected in nation-wide competitive examinations. The NROTC at Georgia Tech has no part in this selection, although information about the Scholarship Program is available. In addition, the Professor of Naval Science may annually nominate several College Program students to the Chief of Naval Personnel for a scholarship.

To apply for the College Program, a student must:

1. Be enrolled in Georgia Tech, or attending an accredited college or university in the near vicinity.
2. Be at least 17 and not over 21 years of age.

Applicants are selected to fill the quota based on:

1. Physical qualifications.
2. Interview by Naval officers.
3. Score on SAT.
4. High school record.
Applicants for the College Program should apply at the Naval Armory during the designated days of Freshman Orientation Week for the fall quarter.

Three candidates may be nominated each year by the President of the Georgia Institute of Technology for competitive examinations for entrance to the United States Naval Academy. These nominations are normally made during the winter quarter. Both Scholarship and College Program students are eligible.

**Curriculum**

All NROTC students follow the same curriculum during their freshman and sophomore years, attending two hours of Naval Science class and one hour of associated laboratory or drill each week.

Junior and senior Line students attend three hours of Naval Science class and one or two hours of associated laboratory and drill each week.

Junior and senior Marine option students attend three hours of Naval Science class and two hours of associated laboratory and drill each week of the fall and winter quarters. Junior and senior marine option students attend two hours of laboratory and drill each week of the spring quarter. In addition, during each of the junior and senior years, the Marine option will be required to take a three or four credit course selected from the following areas of study and approved by the Professor of Naval Science: Sociology, English, Systems Engineering, Information Science, Psychology, Philosophy and History of Science, Industrial Engineering, Industrial Management, Modern Languages, History, Political Science.

In addition to the required Naval Science courses, the NROTC student must successfully complete the following courses which are civilian-taught catalog courses with full credit:

- Math. 107, 108 or Math. 105, 106
- Phys. 211, 212, 213 or Phys. 227, 228, 229 or Chem. 104, 105
- P.T. 101
- ICS 151 or Math. 425 or I.M. 210, or any other PNS approved computer course.
- Pol. 353, 354, 361 (any 2 of these 3 courses may be taken).

These specific course requirements may be varied as course offerings vary.

No more than six hours of credit in basic Naval Science courses and no more than nine hours of credit in advanced Naval Science courses may be applied toward a degree.

**Courses of Instruction**

**NOTE:** 3-2-3 means 3 hours class, 2 hours laboratory, 3 hours credit.

<table>
<thead>
<tr>
<th>N.S. 111. Naval Organization and Sea Power</th>
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<td>2-1-2. Prerequisite: None.</td>
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Introduction to the structure and principles of the organization of the Navy, including analysis of its mission, traditions, customs, and the duties of midship-
men. Included are a series of discussions of the nature of sea power and maritime affairs and the relationship of these to the Navy.


**N.S. 112. Naval Ships Systems I**

2-1-2. Prerequisites: None.

Introduction to the types, structure and purpose of naval ships, including ship design and construction, ship propulsion, and supporting subsystems.


**N.S. 113. Naval Ships Systems II**

2-1-2. Prerequisites: NS 112 or consent.

Continuation of N.S. 112 which covers shipboard electrical and communications systems, damage control, nuclear power plants, and new developments in naval engineering.

Text: *Principles of Naval Engineering.*

**N.S. 211. Naval Management**

2-1-1. Prerequisite: None.

Introduction to the principles of organization and management. The relationship and applicability of these fundamentals to naval organization and management is stressed. The course is based on the concept that management is a process applicable to many enterprises including the military. Included are human relations, management functions, supervision and subordinate evaluation with their military applications.

Text: To be announced.

**N.S. 212. Naval Administration.**

2-1-1. Prerequisites: N.S. 211 or consent.

The broad area of naval administration is presented. Emphasis is placed on naval correspondence format, the directive and filing systems, enlisted personnel matters, and those administrative areas of knowledge necessary for effective officer performance.

Text: To be announced.

**N.S. 213. Military Law**

2-1-1. Prerequisites: N.S. 211 and N.S. 212 or consent.

Those aspects of military law essential for effective naval officer performance are covered. Emphasis is placed on the areas of military law that are peculiar to the naval service, concentrating on elements wherein newly commissioned officers will be actively involved. International law, especially that pertinent to maritime affairs, and the Code of Conduct are also covered.


**N.S. 347. Navigation I**

3-2-3. Prerequisites: None.

Procedures and mathematical techniques involved in determining position at sea through the use of navigational aids, instruments and tables. Areas of emphasis are: dead reckoning, piloting, and U.S. regulations governing waterborne traffic.


**N.S. 348. Navigation II**

3-2-3. Prerequisites: N.S. 347 or consent.

The science of celestial and electronic navigation. Application of the theory and principles of nautical astronomy and spherical trigonometry is emphasized in celestial navigation. Coverage extends to nautical astronomy, star identification, the navigational triangle, celestial coordinate systems, concepts of time, and plotting celestial lines of position.

Electronic navigation stresses practical application of loran, radar, inertial, and satellite navigation.


**N.S. 349. Naval Operations and Analysis**

3-2-3. Prerequisites: None.

Elements and principles of operations at sea designed to provide an understand-
ing of command responsibility and to develop command capabilities. Emphasis is placed on current tactical doctrine, relative movement problems, and tactical communications. Naval applications of probability theory and game theory are included as an introduction to naval operations analysis.

Text: To be announced.

N.S. 411. Naval Weapons Systems I
3-1-3. Prerequisites: None.

Concepts of weapons systems and the systems approach are explored. Techniques of linear analysis of ballistics and weapons are introduced. The dynamics of the basic components of weapons control systems are investigated and stated as transfer functions. A basis is provided for further development of students' understanding of principles that underlie all modern naval weapons systems.


N.S. 412. Naval Weapons Systems II
3-1-3. Prerequisites: N.S. 411, Calculus, College Physics.

Principles of selected phases of the weapons control problem, including propulsion systems, trajectories, flight paths and damage criteria. Investigation of design and testing of weapons components including warheads, fuses, guidance and control. Includes procedures for evaluating weapons, system effectiveness and kill probability.

Texts: Principles of Naval Ordnance and Gunnery; Principles of Guided Missiles and Nuclear Weapons; Weapons Systems Fundamentals (Three volumes).

N.S. 413. Naval Personnel Administration
3-1-3. Prerequisites: N.S. 211, N.S. 212.

Broad areas of personnel administration and management are covered including recruitment, selection, training, placement, promotion, evaluation, and remuneration. A comparison is made between civilian industrial practices and naval methods in the same areas. Emphasis is placed on the topics most directly applicable to the naval profession.


MARINE CORPS OPTION

N.S. 362, 363. Evolution of Warfare I and II
3-2-3.

This two quarter sequence explores the forms of warfare practiced by great peoples in history and thus formulates the senses of continuity and of change in the evolution of warfare; develops a basic sense of strategy; demonstrates the alternatives of possible military actions; discovers the ingredients of success in the great captains; and explores the impact of historical precedent of military thought and action. Selected campaigns and classic battles are studied with emphasis on the principles of war, the impact of leadership, and the evolution of tactics and weaponry.

N.S. 361. Naval Science Laboratory
0-2-0.

Marine Corps laboratory exercises and military drill, emphasizing leadership. No preparation is required and no tests will be given. The grade of "S" will be given for satisfactory completion of this course. Aptitude marks will be assigned. This course must be taken by all junior Marine Corps Option Midshipmen during the spring quarter.

N.S. 461, 462. Amphibious Warfare I and II
3-2-3.

This two quarter sequence is designed to be a study of the projection of sea power ashore, with special emphasis on the evolution of amphibious warfare in the 20th century. Strategic concepts and current doctrine are discussed.

N.S. 466. Naval Science Laboratory
0-2-0.

Marine Corps laboratory exercises and military drill, emphasizing leadership to prepare the senior Marine option for com-
missioning, and to establish a basis for subsequent professional development. The grade of “S” will be given for satisfactory completion of the course.

**N.S. 491, 492, 493. Special Problems in Naval Science**

Hours: To be arranged.

Prerequisites: Submission of a 500 word statement detailing the expected area of study to the Professor of Naval Science; permission from the Professor of Naval Science to enroll.

These courses are designed for, but not limited to the naval-career oriented student who desires to pursue creative research in a specialized area of naval science. Each student accepted into the course will be assigned to the supervision of a Naval Science staff officer whose career specialty is in the field to be studied. Professional papers of appropriate depth and of publishable quality will be sought. Expected areas of study include naval aviation, oceanography and ocean engineering, logistics, submarine systems, operations analysis of surface warfare problems, and amphibious warfare.

Students electing this course will have the option of studying for 1, 2, or 3 credit hours per quarter, and of pursuing their study for 1, 2, or 3 quarters of the academic year.

Text: To be announced.
SCHOOL OF NUCLEAR ENGINEERING
(Established in 1962)

Acting Director—G. G. Eichholz; Professors—J. D. Clement, D. S. Harmer, G. W. Leddicotte, C. J. Roberts; Associate Professors—F. W. Chambers, Jr., W. W. Graham, J. H. Rust, R. J. Johnson, J. M. Kallfelz; Assistant Professors—J. R. Williams, D. E. Wrege; Collaborating staff members of other schools and departments—H. M. Neumann, Chemistry; R. H. Fetner, Applied Biology; L. J. Gallaher, Rich Electronic Computer Center; T. F. Craft, Nuclear and Biological Sciences, EES; Secretary—Mrs. Phyllis Frost; Electronic Technician—B. D. Statham; Machinist—J. M. Burke.

General Information

Nuclear technology is an important aspect of our civilization and its impact on society is increasing daily. Students are invited to consider nuclear engineering electives in order to strengthen their technical background in areas such as energy production or to broaden their appreciation of the societal implications of technology. Undergraduates also may wish to elect nuclear engineering courses as an introduction to graduate study in the field. Many opportunities exist for undergraduates to undertake independent study or research directed by a member of the N.E. faculty. Academic credit is available as N.E. 454, Special Problems.

The School offers a number of courses in support of the B.S. health physics option in the School of Physics. This curriculum is intended to prepare students for careers related to the environmental protection and public health aspects of technology.

Undergraduates may also choose to study for an undesignated B. S. degree in some field of nuclear engineering. A number of typical curricula have been prepared and can be administered by the School. Some of these programs are oriented directly toward the nuclear power field, while others have been designed to provide meaningful combinations of courses for students who desire to emphasize interdisciplinary subject areas rather than conventional, professionally oriented course programs. Such curricula have been prepared in the following areas: Energy Engineering; Environmental Sciences (NE); Radiation Protection; Reactor Technology; Reactor Operations; Nuclear Science; Nuclear Materials; and Nuclear Analytical Chemistry. Programs in other related areas can be developed in consultation with the faculty.

At the graduate level, the School administers programs leading to degrees of Master of Science and Doctor of Philosophy. Students with undergraduate degrees in engineering, science, or mathematics are eligible to apply for admission. These programs in nuclear engineering are designed to provide suitable educational experience to carefully selected students for careers which require a knowledge of nuclear energy and its applications. The programs at the M.S. level provide
five areas of emphasis—reactor engineering, radiation technology, radiological
science, reactor operations, and nuclear power management. The respective
curricula are constructed from various combinations of the graduate level
nuclear engineering courses listed below, supplemented with courses in other
departments as needed.

For students planning a career in electric utility management, a program in
nuclear power economics is offered in cooperation with the College of Industrial
Management. Courses leading toward an M.S. in Industrial Management or
Nuclear Engineering are taken in both departments.

Depending on the career objectives of the student, a thesis may be
encouraged as part of an M.S. program. When appropriate, approved courses and
research experience on a special problem or satisfactory performance at an
engineering practice school may be substituted for a thesis. Students also are
couraged to enroll in relevant non-technical elective courses as part of their
programs.

The Ph.D. program is designed with great latitude so as to capitalize on
variations in experience as well as interests of each student. The graduate
bulletin contains a large number of additional courses relevant to nuclear
engineering.

Facilities for the support of these graduate programs are unexcelled on any
campus. The Emerson Building (Radioisotope and Bioengineering Laboratory)
and the Frank H. Neely Nuclear Research Center provide Georgia Tech with
outstanding research capability in fields of interest to nuclear engineering.
Included are a heavy-water moderated, five-megawatt research reactor, a low
power training reactor, a sub-critical assembly, PDP-8 and -12 data acquisition
systems, hot cells for handling highly radioactive materials remotely, a 12,000
curie cesium-137 radiation source, a one-million-volt Van de Graaff accelerator,
and a californium-252 neutron source. Additional assets of importance are the
Price Gilbert Memorial Library, with its collection of Atomic Energy Com­

Undergraduate students contemplating a future academic program in nuclear
engineering are encouraged to take advanced mathematics, engineering thermo­
dynamics, and a course in modern physics, such as Physics 319. Their attention
is directed toward the pertinent senior-level electives, such as N.E. 420, N.E.
440, N.E. 447 or N.E. 411-2-3, Physics 404 or Met. 403. Those who are not
familiar with the use of digital computers will be expected to gain this
experience during their first quarter of graduate study.

For further information, please contact the Director, School of Nuclear
Engineering or the Dean, Division of Graduate Studies and Research.
Undergraduate Courses of Instruction

NOTE: 2-3-3 means 2 hours class, 3 hours laboratory, 3 credit.

N.E. 110. Energy and Engineers in Society 2-3-3

Deals with the concept of energy, society's requirements and the sources of supply, power generation methods, and related environmental influences. The course also will include public attitudes and legal, political, and ethical considerations involved in the production and use of energy in our society. The central theme will be the role of engineers as participants in future local and national decisions and accomplishments in the energy field.

N.E. 201, 202, 203. Introduction to Health Physics 1-0-1. Prerequisite: Sophomore standing.

A course designed to familiarize the student with the health physics profession. Objectives are to clarify the role of the health physicist in the industrial, medical, and public health environments, trace the development of the profession, and identify current problems in research and applied areas. The course will draw heavily on current literature including news media and on invited lecturers. Visits to radiological installations will be included.

N.E. 405, 406, 407. Health Physics Seminar 1-0-1. Prerequisite: N.E. 427 or consent of instructor.

This seminar is intended primarily for students who plan a career in health physics. The focus will be on current activities in this profession and in related fields. Students will review current literature and discuss their critiques with other participants.


The sequence N.E. 411-2-3 together constitutes a thorough, comprehensive course in nuclear reactor engineering. It is intended for the student of engineering or science whose career may involve the design, operation, evaluation or development of nuclear systems or components. Topics include nuclear reactions, radiation and its interactions, health physics, behavior of neutrons in matter, and steady state reactor theory.

Text: Glasstone and Sesonske, Nuclear Reactor Engineering.


Covers reactor kinetics, control of nuclear reactors, reactor materials and fuels, and nuclear radiation shielding. Laboratory experiments utilize a subcritical assembly and the critical reactors.


Emphasizes the reactor system as a whole. Topics include energy removal and conversion, reactor safeguards and siting, preliminary reactor design, reactor systems and nuclear power costs.

N.E. 415. Nuclear Engineering Calculations with Digital Computers I 2-0-1. Prerequisite: N.E. 411 or 671 concurrently or consent of instructor.

Computer programming with emphasis on solution of problems relevant to nuclear engineering. FORTRAN V for the UNIVAC 1108 is used.

Text: Programming guides to be selected.

N.E. 420. Nuclear Technology and the Environment 3-0-3. Prerequisites: Senior standing in science or engineering or consent of instructor.

A survey of those aspects of current nuclear technology that have an impact on the natural environment and of the techniques of analysis and tracer methodology that are of value in the study of pollution and ecosystems.

Text: To be selected.

This course provides the physical basis for understanding the effects of ionizing radiation on matter, for developing a philosophy of radiation protection for individuals and the environment (N.E. 426) and for implementing radiation protection programs (N.E. 427).

Text: Cember, *Introduction to Health Physics*.

**N.E. 426. Principles of Health Physics**

3-0-3. Prerequisite: N.E. 425 or consent of instructor.

As an introduction to the practice of health physics, this course emphasizes the biophysical basis of radiation protection and the development of protection criteria. It provides an understanding of the philosophy and methodology of applied health physics.

**N.E. 427. Applied Health Physics**

3-3-4. Prerequisites: N.E. 426 or consent of instructor.

This course is designed to acquaint the student with the practice of health physics in our society. Classroom description will be enhanced by laboratory practice simulating the control of radiation in industry and medicine. Topics covered include personnel monitoring, bioassay, air sampling and respiratory protection, radiation surveys of nuclear reactors, accelerators, radioisotope laboratories, and X-ray installations, emergency planning and control of emergency conditions, professional ethics and judgment, and governmental regulation of ionizing radiation.

**N.E. 430. Isotopic Tracer Methodology**

2-3-3. Prerequisites: Senior standing in science or engineering, or consent of the instructor.

This course will introduce the student to the use of isotopic tracer techniques for scientific research and technology in either the biological, physical, medical, or environmental sciences. The laboratory work is built about experiments that provide each student with the opportunity of developing techniques for applying isotopic tracers to problem areas in his own discipline.

Text: Selected references.

**N.E. 440. (E.E. 440) Energy Conversion Engineering**

3-0-3. Prerequisite: Thermodynamics.

This course is intended to familiarize students with advanced energy conversion techniques, the principles of operation and engineering aspects of energy conversion devices, their present state of development, and their operating characteristics. Topics include energy sources, basic principles of energy conversion, semiconductors, thermoelectric converters, photovoltaic generators, thermionic systems, magnetohydrodynamics, fuel cells, and applications of these devices for power generation.

**N.E. 447. Elements of Nuclear Engineering**

3-0-3. Prerequisites: Math. 207, Phys. 209.

An introductory course which presents a general survey of radiation, fission, fusion, and other nuclear transformations with examples of how these phenomena may be exploited in industrial and engineering applications. Material covered includes an engineering treatment of pertinent areas of nuclear physics, simplified reactor theory, and a survey of radiation, its measurement, associated hazards, and uses.

Text: Foster and Wright, *Basic Nuclear Engineering*.

**N.E. 454-455-456-457. Special Problems**

Credit to be arranged. Prerequisite: Consent of instructor.

An opportunity for the advanced undergraduate to undertake a nuclear engineering project appropriate to his capabilities. The student is encouraged to exercise his resourcefulness and originality in attacking a problem of special interest to himself and a member of the N.E. faculty.

**N.E. 494-495-496. Special Topics**

Credit to be arranged. Prerequisite: Consent of instructor.

The purpose of this course is to permit the School of Nuclear Engineering to offer formal courses on topics of special interest on an ad hoc basis.
Graduate Courses

N.E. 601,2,3 Reactor Technology ..................................................3-0-3
N.E. 606 Introduction to Nuclear Materials ................................ 3-0-3
N.E. 610 Radiation Detection ......................................................2-6-4
N.E. 611,12 Nuclear Engineering Laboratory ..................................1-6-3
N.E. 613 Radiation Technology Laboratory ....................................1-6-3
N.E. 615 Small Computer Interface Engineering ..............................2-6-4
N.E. 620 Nuclear Engineering Design .......................................2-6-4
N.E. 625 Nuclear Engineering Calculations ..................................3-0-3
N.E. 626 Monte Carlo Methods in Nuclear Engineering .......................3-0-3
N.E. 630 Reactor Control ..........................................................3-0-3
N.E. 632 Radioisotopes Engineering I .........................................3-0-3
N.E. 640 Radiation Protection ....................................................3-0-3
N.E. 641 Particle Accelerators ....................................................2-3-3
N.E. 647 Fundamentals of Nuclear Engineering ................................3-0-3
N.E. 663 Economics of Nuclear Power ..........................................3-0-3
N.E. 664 Nuclear Fuel Management ............................................3-0-3
N.E. 654,5,6,7 Special Problems in Nuclear Engineering .....................
N.E. 671,2,3 Reactor Physics ......................................................3-0-3
N.E. 679 Radiation Attenuation ..................................................3-3-4
N.E. 680 Advanced Reactor Theory ............................................5-0-5
N.E. 681 Environmental Surveillance and Radioactive Waste Disposal ....3-0-3
N.E. 690 Engineering with Nuclear Explosives ..............................3-0-3
N.E. 699 Preparation for Ph.D. Qualifying Examination ......................
N.E. 700 Master's Thesis ..........................................................1-0-0
N.E. 701,2,3 Seminar ....................................................................
N.E. 704,5,6,7 Special Topics ....................................................
N.E. 710 Advanced Radiation Detection ..........................................3-0-3
N.E. 721 Nuclear Reactor Safety ...................................................3-0-3
N.E. 730 Radiation Effects on Materials .........................................3-0-3
N.E. 732 Radioisotopes Engineering II ..........................................3-0-3
N.E. 740 Radiation Dosimetry ......................................................3-0-3
N.E. 741 Applied Radiological Physics ..........................................2-3-3
N.E. 751 Fast Reactor Physics .....................................................3-0-3
N.E. 752 Thermal Neutron Fields .................................................3-0-3
N.E. 780,1 Advanced Energy Conversion I ......................................3-0-3
N.E. 782 Aerospace Nuclear Propulsion .......................................3-0-3
N.E. 799 Preparation for Ph.D. Dissertation ...................................-
N.E. 800 Doctor's Thesis ............................................................
DEPARTMENT OF PHYSICAL TRAINING

Department Head—John McKenna; Associate Professors—Norris C. Dean, Byron Gilbreath, John D. Hyder, James H. McAuley, Tommy Plaxico; Assistant Professor—Bill Beavers, Douglas L. Fowlkes, David W. Houser; Instructor—Russell Polhemus; Secretary—Mrs. Joyce M. Stembridge.

General Information

NOTE: Physical training regulations as they appear in this catalog apply only to those students matriculating at Georgia Tech beginning with the summer quarter, 1972.

All male students entering Georgia Institute of Technology as freshmen are required to take Physical Training four hours per week, receiving one to three hours credit. The schedule will call for two, two-hour periods on alternate days; one hour for physical training, thirty minutes for dressing and thirty minutes for shower. Students may register for only one Physical Training course per quarter. Female students will not be allowed to register for Physical Training activity courses, but must register for P.T. 104, Health Education.

The following male students will be exempt from required Physical Training; Students twenty-one years of age, or over, on first admission to the Georgia Institute of Technology; and transfer students who shall receive one quarter exemption for each quarter as a full-time student at another institution.

The health information record (see page 20) will determine any exemptions from Physical Training activity courses. Students bringing certificates of disability from personal physicians must have the certificates endorsed by the Office of Student Health Services before they will be accepted by the Department. Students with an exemption from all or any one of the required activity courses (P.T. 101, 102, or 105) will be required to take P.T. 104, Health Education.

Students taking physical training will be required to purchase a standard uniform consisting of a sweat shirt, gym pants, athletic supporter, socks, and shoes. The uniform will be sold at cost and normally should not exceed $12. Locker facilities for those living neither on the campus nor in nearby fraternity houses may be secured by a two-dollar deposit with a refund of $1.50 at the end of the school year if the lock and locker are surrendered in good condition. Dressing room space, showers, and towels are provided all students free of charge.

Required Physical Training

The object of these courses is to give the student sound basic concepts regarding personal health, physical fitness, and water safety.

Three Physical Training courses are required during the freshman year. This requirement can be met as follows:
1. All students who are physically qualified will be required to take P.T. 101 (Swimming) and any other two courses from the remaining three offered (P.T. 102, 104 or 105).

2. Students who are exempt from all or any one of P.T. 101, 102, or 105 will be required to take P.T. 104.

**P.T. 101. Swimming**
0-4-1.

The primary objective of this course is survival, and it is designed to "drown-proof" our students. Emphasis is placed on developing the ability to successfully handle typical swimming emergencies, such as cramps, disabling injuries, and long submersion. The application of basic mechanical principles is stressed to make students think for themselves, rather than accept dogmatic statements.

**P.T. 102. Physical Fitness, Orientation, and Gymnastics**
0-4-1.

The purpose of the course will be to help orient the student through actual experience to some of the basic factors of physical fitness and to show how these factors tie in with greater achievement, not only in performing gymnastic movements, but with better all around physical performance and with higher social standards through life. Through the medium of 50 carefully chosen skills, it will be the goal to develop an appreciation of the significance of good cooperation, efficiency of movement, rhythm kinesthetic sense, confidence, courage, good form and team work, plus a wholesome, practical philosophy of the real value of exercise and of keeping physically fit.

**P.T. 104. Health Education**
3-0-3.

A personal health course designed to better acquaint the student with contemporary health problems including the primary degenerative and communicable diseases, alcoholism, drug addiction, sex education, physical fitness, diet and nutrition and mental health. Basic anatomy and physiology with major emphasis on the normal functioning of the major anatomical systems and the interdependence and interrelationships of the systems is included.

**P.T. 105. Aerobic Conditioning**
0-4-1.

A physical conditioning program where primary emphasis is placed on the improvement of endurance, and cardiovascular and respiratory system efficiency, through an individually tailored program of exercise involving running and participation in various recreational games. Students will be encouraged to exercise out of class in addition to their regular class participation so that maximal improvement can be realized. The physiological changes that occur during an exercise program and the desirability of regular exercise will be discussed.

**Elective Physical Training**

These are maintenance courses. The condition developed in the freshman year will be maintained and at the same time skills will be taught in games and other events that appeal to young men. One quarter will be devoted to indoor games, one to outdoor games and one to recreative sports.

**P.T. 201. Indoor Games**
0-4-1.

Basketball will be the game on which the majority of effort will be concentrated. As the physical training facilities are expanded other games may be added. The basic fundamentals of the games will be demonstrated and practiced. After the class has developed some skill,
teams will be organized for actual competition.

P.T. 202. Outdoor Games
0-4-1.

Softball, touch football, and soccer are the basic games for this course. This course is an exact parallel to the indoor games in the methods used and in the instruction and play arrangement.

P.T. 203. Recreational Sports
0-4-1.

The class will receive instruction in the fundamentals of tennis, volley ball, paddle ball, or bowling. The purpose of the course is to provide recreational exercise and to develop an appreciation of these carry-over sports as recreation and as a means of maintaining a moderate level of physical fitness.

The student shall be graded on the proficiency he demonstrates in these sports. Attendance, attitude, and effort—except when inadequate—shall be considered only to the extent that their diligent application invariably results in greater proficiency.
SCHOOL OF PHYSICS*
(Established in 1939)

Director—James R. Stevenson; Associate Director and Regents' Professor—Charles H. Braden; Regents' Professors—Harold A. Gersch, Earl W. McDaniel, L. David Wyly; Professors Emeritus—Earle E. Bortell, Walter P. Ewalt, Joseph H. Howey, Edward T. Prosser; Professors—R. Martin Ahrens, Harold R. Brewer, Vernon Crawford, Joseph Ford, Don S. Harmer, David W. Martin, Eugene T. Patronis, Jr., Edwin J. Scheibner, Henry S. Valk, Thomas L. Weatherly, Michael K. Wilkinson, J. Quitman Williams, R. A. Young; Associate Professors—Harry G. Dulaney, Martin R. Flannery, Ian R. Gatland, Augustus L. Stanford, Jr., James M. Tanner, Edward W. Thomas, Oscar B. Wike, LeRoy A. Woodward; Assistant Professors—Helmut Biritz, Ronald F. Fox, Nisbet S. Kendrick, Roger E. Little, Allan R. Oseroff, Donald C. O'Shea, William E. Woolf; Post Doctoral Fellows—Roger J. Bartlett, Donald A. McClure, George M. Thomson; Administrative Assistant—Jon C. Barbour; Laboratory and Demonstration Associate—Vincent de Paul Mallette; Academic Shop Foreman—Kelly B. Springfield; Senior Machinist—Donald J. Denmon; Machinist—Julian R. Bell; Assistant Research Scientist—Jerome T. Callahan; Research Technician—Mrs. Elizabeth P. Russell; Principal Secretary—Miss Anna Ruth Hale; Senior Secretary—Miss Wynette Wright; Secretary—Mrs. Debra Roe; Secretary-Receptionist—Miss Robbie Buffington.

General Information

Physics has been known primarily as a basic science. Today, fundamental research into the principles of physics continues to occupy the attention of many physicists, but, in addition, the study of physics has become increasingly important as a basis for fundamental research in interdisciplinary areas such as biophysics and chemical physics and as an applied science in government and industry. The increased complexity of much fundamental and applied research frequently dictates that scientists trained in many specialties work side by side; often physicists, mathematicians, chemists, psychologists, biologists, several kinds of engineers, and, perhaps, other kinds of scientists may be found working together towards a common goal. Furthermore, as society becomes more technically oriented a trend may be discerned in the direction of scientifically trained individuals assuming a more important role in management and administrative functions. Evidently, it is becoming increasingly important that scientific personnel have, in addition to a high degree of competence in their specialty, some competence in related fields in order that they may work effectively on problems that cut across traditional disciplines.

The School of Physics offers basic service courses to all sophomores, some advanced service courses for students of engineering, science, or mathematics, and advanced work leading to a bachelor's, master's, or doctor's degree in

*Refer to page 278 for information on the School's Pass-Fail Option.
physics. In order to enable students with a wide variety of interests to work out suitable programs of study leading to a bachelor's degree in physics, the School has restricted its required courses to the fundamental principles of physics and has provided a large number of elective hours in the junior and senior years. Furthermore, in order to enable students to concentrate their attention on a few subjects at a time, the requirements are such that only four subjects should be scheduled concurrently in most quarters during the junior and senior years. Accordingly, a high level of performance and substantial independent study will be expected in the junior and senior level physics courses.

A requirement for a bachelor's degree in physics is a point average of at least 2.0 in junior and senior physics courses.

**Freshman Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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<th>3rd Q.</th>
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<tbody>
<tr>
<td>Chem. 104, 105</td>
<td>General Chemistry</td>
<td>4-3-5</td>
<td>4-3-5</td>
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<tr>
<td>Physics 227</td>
<td>General Physics</td>
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<td>......</td>
<td>4-3-5</td>
</tr>
<tr>
<td>Math. 107-8-9</td>
<td>Calculus I, II, III</td>
<td>5-0-5</td>
<td>5-0-5</td>
<td>5-0-5</td>
</tr>
<tr>
<td>Engl. 107-8-9</td>
<td>Intro. to Literature</td>
<td>3-0-3</td>
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<tr>
<td>P.T.*</td>
<td>Physical Training</td>
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<tr>
<td>M.L.*</td>
<td>Modern Language or Social Science</td>
<td>3-0-3</td>
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<td>S.S.</td>
<td>Orientation</td>
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<td>Electives***</td>
<td>Orientation</td>
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<tr>
<td>Gen. 101</td>
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</tr>
</tbody>
</table>

*See p. 263 in this General Catalog for P.T. requirements and exemptions.
**It is recommended that students who intend to take graduate work schedule French, German, or Russian. The language may be scheduled in the Freshman year, or in any other year as an elective.
***These free elective courses may be taken at any time during a student's course of study. However, if six credit hours of basic ROTC are elected, then it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of the catalog.

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
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<tbody>
<tr>
<td>Physics 228, 229</td>
<td>General Physics</td>
<td>4-3-5</td>
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<tr>
<td>Engl. 201-2-3</td>
<td>Survey of the Humanities</td>
<td>3-0-3</td>
<td>3-0-3</td>
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<tr>
<td>Math. 207</td>
<td>Calculus IV</td>
<td>5-0-5</td>
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<td>......</td>
</tr>
<tr>
<td>Math. 208</td>
<td>Calculus and Linear Algebra</td>
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<td>5-0-5</td>
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</tbody>
</table>
Sophomore Year (Cont.)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
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</thead>
<tbody>
<tr>
<td>Math. 209</td>
<td>Ordinary Differential Equations</td>
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<td>.......</td>
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<tr>
<td>Electives*</td>
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</tbody>
</table>

† It is recommended that physics majors elect Physics 100 “Physics Orientation” during the Freshman year. Students should consider electing courses such as I.C.S. 151 or C.E. 211, E.Gr. 113 or 170, Physics 244, 245, 222, 340.

* See page 39 for the 36-credit hour, General College requirement in social sciences and humanities.

Junior and Senior Years. The minimum total number of credit hours required for a bachelor’s degree in physics is 196. The following list itemizes the courses required of all candidates for the degree, in addition to the courses which have been listed for the freshman and sophomore years. Prior to the senior year it is expected that each student, through courses or by independent study, will acquire the ability to program simple problems for one of the digital computers available on the campus.

Required Courses for Junior and Senior Years

Physics 301-2-3 Classical Mechanics, Electricity and Magnetism (5-0-5 each) ... 15 hrs.
Physics 321 Quantum Mechanics I ............................................................. 5 hrs.
Physics 309 Thermal Physics ........................................................................ 5 hrs.

Elective Physics courses, including at least three of the following courses—304, 316, 327, 329, 361, 370, 404, 433, 434, 435, 442, 458, 463, or other approved laboratory courses.................................................. 20 hrs.

Electives, to bring total hours to 196 (Not more than 9 hrs. in advanced ROTC)....... 43 hrs.

Total........................................................................................................ 88 hrs.

Note: See page 39 for the 36-credit hour, General College requirement in social sciences and humanities.

An undergraduate program with an emphasis in geophysics, biophysics, chemical physics, applied optics, oceanography, nuclear engineering, or health physics can be worked out within the Physics curriculum by a proper assignment of the elective courses. Programs with a major in Physics and with a minor in any of several other disciplines are also possible. A program is available for students interested in instrumentation and its application to experimental physics and industry.

Students preparing for graduate study in physics should elect more than the required 20 hours of physics courses and should also elect additional mathematics courses. These additional hours in physics and mathematics would count toward the required 43 hours of general electives. Students who take the minimum required work in physics and mathematics are not precluded from
pursuing graduate study in physics but they should be prepared to accept a prolongation of their graduate programs.

The following courses should be elected by a student who is preparing for graduate study in physics:

Physics courses: 304, 421; two of the following three courses (433, 434, 435); two of the following courses (423, 436, 441).

Mathematics courses: 309, 447, 448, 449; and nine additional hours of mathematics electives. Senior standing is recommended for 447-8-9.

**Health Physics Option**

If a student elects to take the Health Physics Option, the freshman and sophomore year requirements are the same as the regular physics option. The junior and senior year requirements are listed below.

<table>
<thead>
<tr>
<th>Junior Year††</th>
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</thead>
<tbody>
<tr>
<td><strong>Course No.</strong></td>
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<tr>
<td>Physics 301-2-3</td>
<td>Classical Mech., E and M</td>
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<tr>
<td>Physics 304</td>
<td>Electronics</td>
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<tr>
<td>N.E. 425</td>
<td>Radiation Physics</td>
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<tr>
<td>N.E. 426</td>
<td>Principles of Health Physics</td>
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<tr>
<td>N.E. 427</td>
<td>Applied Health Physics</td>
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<td>Biol. 429</td>
<td>Biol. Principles of Radiobiology</td>
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<tr>
<td>Electives*</td>
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<td></td>
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<tr>
<td>Electives*</td>
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<td></td>
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<td><strong>14-6-16</strong></td>
<td><strong>13-6-15</strong></td>
</tr>
</tbody>
</table>

††See restrictions on electives concerning P.T., ROTC, Social Sciences, and Humanities under the regular Physics option.

* 3 hours of electives must be taken in the area of data analysis.

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**Summer-Health Physics Internship**

<table>
<thead>
<tr>
<th>Senior Year</th>
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</thead>
<tbody>
<tr>
<td><strong>Course No.</strong></td>
<td><strong>Subject</strong></td>
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<td><strong>2nd Q.</strong></td>
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<tr>
<td>Physics 423</td>
<td>Nuclear Physics</td>
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<tr>
<td>Physics 309</td>
<td>Thermal Physics</td>
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<tr>
<td>Physics 321</td>
<td>Quantum Mechanics I</td>
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<tr>
<td>N.E. 494</td>
<td>Special Topics</td>
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Senior Year (Cont.)

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<td>Health Physics Seminar</td>
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<td>C.E. 683</td>
<td>Environmental Surveillance</td>
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</table>

4 Year Total—196

** A Summer-Health Physics Internship is expected to be developed during the next 2 years.

Biophysics Option†††

B.S. in Physics

Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>1st Q.</th>
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<tbody>
<tr>
<td>Math. 107-8-9</td>
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<tr>
<td>Chem. 111-112*-209</td>
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<td>P.T.</td>
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Sophomore Year

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<th>3rd Q.</th>
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<tbody>
<tr>
<td>Math. 207-8-9</td>
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<td>Physics 227-8-9</td>
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<td>Chem. 340, 341, 350</td>
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Junior Year

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<tr>
<td>Electives**</td>
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<tr>
<td><strong>Totals</strong></td>
<td>16-6-18</td>
<td>18-3-19</td>
<td>16-3-19</td>
</tr>
</tbody>
</table>

Senior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>1st Q.</th>
<th>2nd Q.</th>
<th>3rd Q.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 321</td>
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<td>Physics 463</td>
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<td>Bio. 334</td>
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<td>11-6-13</td>
<td>11-3-12</td>
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</tbody>
</table>

†††See restrictions on electives concerning P.T., ROTC, Social Sciences, and Humanities under the regular Physics option.

*Although Chem. 111-112 is recommended, Chem. 104-105 is acceptable.

**Six hours of these electives must include one physics and one biology course from the following groups:

| Physics 421 (QM II) | Bio. 415 (Radiation Biology) |
| Physics 438 (Vib. and Waves) | Bio. 310 (Bacteriology) |
| Physics 440 (Sp. Relativity) | Bio. 478 (Physical Biology) |
| Physics 441 (Mol. and Sol. St.) |

Nine (9) hours of the free electives must be taken in the humanities or social sciences to satisfy the Institute's requirement of 36 credit hours in this area.

***Physics 309 is recommended but not required in this option.

Note: The total number of credit hours required for the Biophysics Option is 196.

Courses of Instruction

**NOTE:** 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

**Physics 100. Physics Orientation**

1-0-1.

Introduction to the various possible career areas for physicists. The special opportunities available in the School of Physics are explained and the role physicists have in government, industry, and education is examined.

**Physics 211, 212, 213. Elementary College Physics**

4-0-4. Courses should be taken in sequence.

This sequence of courses is designed for students in the less technical curricula.

It includes a basic study of the physical principles of mechanics, sound, heat, electricity, light and modern physics. Mathematics below the level of calculus is used freely to provide practice in the use of mathematics in logical reasoning. The method of teaching and the subject matter are chosen to give an understanding of the scientific methods and to give a background of scientific information and terminology which is needed today to comprehend the commercial, cultural, and political significance of scientific progress.

Text: Bueche, *Principles of Physics*.

**Physics 222. Physics of the Weather**

3-0-3. Prerequisite: None.
An introductory treatment of the physics of the atmosphere illustrating the application of basic physical laws to the understanding of weather phenomena. The main weather features will be descriptively developed to aid in the understanding of their role in the complex problem of environmental pollution.


**Physics 227. Particle Dynamics**


Topics: classical kinematics, dynamics of a particle, energy, linear momentum, angular momentum, conservation principles (for particle systems). The generality of the Newtonian mechanics thus developed is demonstrated by a variety of applications. Relativistic kinematics of a particle is introduced, and the necessary modifications of the classical conservation laws are discussed. Facility with these concepts and principles is essential for an understanding of the material presented in Physics 228 and 229.

Empirical verification and utilization of the principles of particle dynamics are accomplished in the laboratory with “frictionless” surfaces and stroboscopic photographic equipment.

**Physics 228. Electromagnetism**

4-3-5. Prerequisites: Physics 207 or 227, Math. 109.

The interaction of charged particles through electric and magnetic fields is presented. Topics include electric field and potential, the magnetic field, and electromagnetic induction. Conservation principles presented in the preceding course are emphasized. Calculus and vectors are used freely.

The laboratory acquaints the students with the use of electrical instruments including oscilloscopes in the observation of fundamental electromagnetic phenomena.

**Physics 229. Optics and Modern Physics**

4-3-5. Prerequisites: Physics 208 or 228, Math. 109.


The laboratory is designed to illustrate the character of wave propagation. Visible light is used in the experiments on geometrical optics and atomic spectra. Microwave radiation is employed in the experiments on interference and diffraction.

**Physics 244. Introduction to Astronomy I**

3-0-3. Prerequisite: Math. 108.

A survey of astronomy with special emphasis on the applications of physics to astronomical problems. The nature and behavior of the earth and the other members of the solar system will be examined.

Text: Abell, *Exploration of the Universe*.

**Physics 245. Introduction to Astronomy II**

3-0-3. Prerequisite: Physics 244 or consent of instructor.

The nature and behavior of stars and galaxies will be examined.

Text: Abell, *Exploration of the Universe*.

**Physics 300. Special Problems**

(Credit to be arranged). Prerequisite: Consent of instructor.

The content of this course will vary and will allow the School of Physics to offer courses in special topics either on demand or on an experimental basis. Individual special problems may be arranged with the consent of a faculty member.

**Physics 301, 302, 303. Classical Mechanics, Electricity, and Magnetism**

5-0-5. Prerequisites: Physics 209 or 229 and Math. 209.

A sequence of courses in classical mechanics and electricity and magnetism. Dynamics of particles including oscillations and planetary motion; rotation of rigid bodies; impact; Lagrange's and Hamilton's Equations. Electric and magnetic fields; potentials; resistance, inductance, and capacitance, polarization,
magnetic materials; development of Maxwell's Equations and their application to the transmission of electromagnetic waves.


**Physics 304. Electronics**

5-6-7. Prerequisites: Physics 209 or 229 and Math. 209.

Basic principles of vacuum tube amplifiers, transistor amplifiers, and some a.c. circuit theory. Special attention is given to systems frequently encountered in experimental physics, such as timing, counting, switching, and shaping circuits.

Text: Korneff, *Introduction to Electronics*.

**Physics 307. Intermediate Mechanics**

3-0-3. Prerequisites: Physics 229 and Math. 209.

Mechanics of particles, rigid bodies, fluids, elastic media.

**Physics 308. Intermediate Electricity and Magnetism**

3-0-3. Prerequisites: Physics 208 or 228 and Math. 209.

For non-physics majors. Covers the basic concepts of electric and magnetic fields leading to the formulation of Maxwell's equations. These fundamentals treated with the free use of differential and integral calculus.

Text: Jifemenko, *Electricity and Magnetism*.

**Physics 309. Thermal Physics**

5-0-5. Prerequisites: Physics 209 or 229 and Math. 209.


Text: Sears, *Thermodynamics, the Kinetic Theory of Gases and Statistical Mechanics*.

**Physics 316. Vacuum Ultraviolet Optics**

1-3-2.

Laboratory and lecture concerned with sources, dispersion techniques, and detectors in the approximate wavelength region of 100 to 2000 Angstrom units.

**Physics 317. Introduction to Elementary Particle Physics**

3-0-3. Prerequisite: Physics 209 or 229.

Introduction to the phenomenology of elementary particle physics. Emphasis on the underlying physical ideas and not on special mathematical models. Topics include: historical introduction, list of particles, quantum numbers, symmetries, quark model, cross sections, S-matrix, quantum field theory, strong, electromagnetic, and weak interactions.

**Physics 319. Modern Physics for Engineers**

3-0-3. Prerequisites: Physics 207-8-9, or 227-8-9 with a minimum grade of C.

A study of the more recent developments of physics which are of particular importance for engineers. Includes the structure of bulk matter, the structure of atoms, the properties of elementary particles, the fundamentals of nuclear physics, and the interaction of radiation with matter.


**Physics 321. Quantum Mechanics I**

5-0-5. Prerequisite: Physics 301 or 307.

Historical introduction, postulational approach to wave mechanics. Discussion of the eigenfunction-eigenvalue problem and solutions to Schroedinger's equation; free particle, particle in a box, the square well, harmonic oscillator, rigid rotator, and hydrogen atom.

Text: Park, *Introduction to Quantum Theory*.

**Physics 322. Nuclear Astrophysics and Stellar Evolution**

3-0-3. Prerequisite: Physics 209 or 229.
A study of the nuclear energy generating processes in stars and stellar evolution. Nucleosynthesis and energy generation in stars, stellar models, the evolution of stars, the origin of the elements, nuclear reactions in main sequence stars, in red giants, and in supernovae, cosmic rays and cosmic neutrinos, neutrino astrophysics. Supermassive stars, quasars, extragalactic radio sources, and galactic explosions. Course is for non-physics majors as well as physics majors.


**Physics 326. Geometrical Optics**
3-0-3. Prerequisite: Physics 209 or 229, Math. 209.

Development of optical analysis of lenses and reflectors using matrix theory. Coverage includes image formation, stops, aberrations, photometry and analysis of typical optical systems.

Text: Klein, *Optics*.

**Physics 327. Optical Instruments Laboratory**
1-3-2. Prerequisites: Physics 326 or concurrent.

Use of optical instruments for purposes of observation and measurement. Instrumentation includes spectrometers, interferometers, polariscopes, microscopes and telescopes.

**Physics 328. Fourier Optics**
3-0-3. Prerequisites: Physics 209 or 229, Math. 209.

Two beam and multiple beam interference phenomena, derivation of the Fresnel-Kirchhoff integral to be applied to Fresnel and Fraunhofer diffraction using Fourier transforms. Abbe theory of image formation and spatial filtering. Application of these concepts to telescopes, microscopes, spectrometers, interferometers and holograms. Coherence, polarization of light and derivation of wave equation from Maxwell’s equations.

Text: Klein, *Optics*.

**Physics 329. Advanced Optical Physics Laboratory**
1-3-2. Prerequisites: Physics 328 or concurrent.

Optional laboratory taken with Physics 328. It consists of a small number of experiments designed to exemplify the material presented in the lecture course.

**Physics 330. Laser Physics**
3-0-3. Prerequisite: Physics 229. (Phys. 330 is the same as E.E. 438.)

Theory of stimulated emission and laser principles. Discussion of solid state, gas and dye lasers. The application of the laser to the fields of holography, nonlinear optics, metrology, information processing and spectroscopy will be covered in a series of survey lectures. Course is for non-physics majors as well as physics majors.

**Physics 340. Selected Problems in Physics**
1-6-3. Prerequisites: Physics 209 or 229, Math. 209 concurrent.

Through the study of problems selected from a variety of fields of physics (e.g. mechanics, electricity and magnetism, quantum theory, kinetic theory) the student’s experience in the application of physical principles and mathematical techniques will be extended to more realistic problems than could be considered in the General Physics courses. Emphasis will be placed on the numerical solution of problems. Digital computer facilities will be employed in order to introduce the student to the application of numerical methods for the solution of problems in physics, including the reduction of experimental data.

**Physics 350. Introduction to Acoustics**
3-0-3. Prerequisites: Sophomore mechanics and electricity.

An introduction to the art and science of acoustics for students of varied backgrounds and interests. The emphasis is on the basic physical mechanisms which underlie all acoustical phenomena. The topics of study include sound generation, sound measurement and control, sound propagation, the reproduction of music,
sound reinforcement, and the control of noise.

**Physics 360. Physical Measurements**
3-0-3. Prerequisite: Basic electronics.

A study of the theory and the techniques of the measurement of the fundamental electric and magnetic quantities under both static and dynamic conditions. Applications of electrical, electromagnetic, and electronic measuring apparatus in the measurement of other physical variables such as pressure, temperature, etc.

**Physics 361. Physical Measurements Laboratory**
0-3-1. Corequisite: Physics 360.

This laboratory is taken at the student's option with Physics 360. It consists of a set of laboratory exercises exemplifying and reinforcing the material presented in the lecture course.

**Physics 363. Biophysics I**
3-0-3. Prerequisites: Physics 209 or 229, Bio. 210-211.

An introduction to biophysical systems, first through selected studies of sensory systems in mammals, then through the study of physical properties of biological macromolecules.

Text: Ackerman, *Biophysical Science*.

**Physics 370. Interfacing Laboratory**
1-6-3. Prerequisite: Phys. 304 or equivalent.

An introduction to the interfacing of apparatus to computers in accord with current on-line use of small, digital computers in physics experiments. Laboratory work deals with the properties of digital logic elements and simple combinations of such elements followed by the design and assembly of necessary interfacing to operate selected experiments on-line. Apparatus available for the laboratory includes a variety of interfacing logic and a PDP-11 computer. Some prior experience with computer programming, e.g. ICS 151, is helpful although not essential.

**Physics 404. Electronic Instruments for Scientific Research**
2-3-3. Prerequisites: Physics 304 or E.E., 306, or equivalent.

An intermediate course in electronic instruments and instrumentation as employed in research and general laboratory measurements. Instruments employing both analog and digital techniques are treated from both the design and application points of view. The factors affecting precision, accuracy, resolution, and stability are discussed. Special emphasis is placed on the instruments of nuclear physics.

Text: The course will draw heavily from the following texts: Trimmer, *Response of Physical Systems*; Littauer, *Pulse Electronics*; Chase, *Nuclear Pulse Spectrometry*.

**Physics 410. Atomic Physics**
5-0-5. Prerequisite: Physics 321, or equivalent.

A basic course dealing primarily with the structure and spectra of atoms. A knowledge of the elementary principles of quantum mechanics is required, but familiarity with perturbation theory and variational methods is not assumed. Modern topics which are treated include rf beam spectroscopy, rf spectroscopy of stored ions, optical pumping, double resonance and level-crossing spectroscopy, mesic atoms and positronium, collisional studies of atomic structure, and lepton g-factor measurements.

**Physics 421. Quantum Mechanics II**
5-0-5. Prerequisite: Physics 321.

Introduction to perturbation theory, identical particles, spin, and semi-classical radiation theory. Applications to atomic physics.

Text: Park, *Introduction to Quantum Theory*.

**Physics 423. Nuclear Physics**
5-0-5. Prerequisite: Physics 321.

Basic properties of nuclei, interactions of radiation with matter, particle accelerators, radioactivity, nuclear reactions, models of nuclear structure, and properties of elementary particles. Physics 675 is a suitable alternate in the Health Physics Program.

At level of Leighton, *Principles of Modern Physics*. 

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Physics / 275
Physics 427. Elementary Quantum Mechanics
3-0-3. Prerequisite: Senior standing.


Physics 430. Special Problems
(Credit to be arranged). Prerequisite: Consent of instructor.

The content of this course will vary and will allow the School of Physics to offer courses in special topics either on demand or on an experimental basis. Individual special problems may be arranged with the consent of a faculty member.

Physics 432. Introductory Diffraction Theory
3-0-3. Prerequisites: Senior standing or consent of instructor.

Aspects of crystal symmetry and introductory theory common to electron, neutron, and X-ray diffraction are treated. The reciprocal lattice and geometric portion of the kinematic theory are developed from the Laue-Ewald point of view. Treatment of coherent scattering from continuous distributions is introduced.

Texts: Guinier, X-ray Diffraction; and Wilson, X-ray Optics.

Physics 433, 434, 435. Advanced Laboratory I, II, III

These courses may be scheduled in any order. Experiments of classical and contemporary importance selected from various fields of physics. The experiments frequently deal with topics that have not been treated in other courses; students will be expected to acquire an understanding of the significance of the experiments through independent study. Coding of simple problems for a digital computer may be required.

Physics 436. Plasma Physics
5-0-5. Prerequisites: Physics 303 and Physics 321.

A description and analysis of the plasma state of matter: definition of a plasma, orbit theory, collision phenomena in ionized gases, sheaths, the kinetic theory of ionized gases, oscillations and waves in plasmas, plasma instabilities, emission and absorption of radiation by plasmas, astrophysical and atmospheric phenomena.

Text: Holt and Haskell, Plasma Dynamics.

Physics 438. Vibrations and Wave Motion
3-0-3. Prerequisite: Physics 303.

Oscillations and wave motion of discrete and continuous mechanical systems. The course will emphasize those aspects of wave motion common to quantum mechanics, classical mechanics, and electromagnetism.

Physics 440. Special Relativity
3-0-3. Prerequisite: Physics 303.


Physics 441. Molecular and Solid State Physics
5-0-5. Prerequisites: Physics 321 and Physics 309.


At level of Kittel, Introduction to Solid State Physics.
Physics 442. X-Ray Diffraction and Crystallography Laboratory
0-6-2. Co- or prerequisite: Physics 432.

Practical application is made of the principles and techniques covered in Physics 432. Reciprocal space and Fourier transform concepts are emphasized. Crystal orientation, chemical and physical characterization of crystal-line and amorphous materials, radial distribution functions, diffraction line profile analysis, space group determination, and determination of differences in atomic positions and structural defects are among the topics from which the student may make some selection.

Physics 456. Elementary Biophysics I
3-0-3. Prerequisite: Physics 209 or 229.

Applications of the principles and techniques of the physical sciences to areas of the life sciences.

Physics 457. Elementary Biophysics II
3-0-3. Prerequisite: Physics 456.

A continuation of topics from Physics 456. Physics of viruses, the central nervous system, and biophysical instrumentation.

Physics 458. Introductory Biophysics Laboratory
0-3-1. Co- or prerequisite: Physics 457.

This laboratory is taken at the student's option with Physics 457. It consists of selected laboratory exercises exemplifying and reinforcing material presented in the lecture course.

Physics 460. Introductory Statistical Physics
3-0-3. Prerequisites: Physics 209 and Math. 209.

Introduction to the concepts and principles of statistical physics necessary for a microscopic understanding of thermodynamics and related macroscopic phenomena. This course is intended primarily for non-physics majors.

Physics 463. Biophysics II
3-3-4. Prerequisite: Physics 363.

Selected topics that stress the application of the measurement and analytical techniques of the physical sciences to studies of living systems.

Graduate Courses Offered

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>Physics 601</td>
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<td>1-0-1</td>
</tr>
<tr>
<td>Physics 602</td>
<td>Graduate Student Seminar</td>
<td>1-0-1</td>
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<td>Physics 603</td>
<td>Graduate Student Seminar</td>
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<tr>
<td>Physics 611</td>
<td>Mechanics of Continuous Media</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Physics 613</td>
<td>Physical Crystallography</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Physics 614</td>
<td>Introductory Solid State Physics</td>
<td>3-0-3</td>
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<td>Physics 616</td>
<td>Statistical Mechanics</td>
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<td>Physics 621</td>
<td>Theoretical Mechanics</td>
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<td>Physics 622</td>
<td>Advanced Electricity and Magnetism</td>
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<td>Physics 624</td>
<td>Nuclear Physics</td>
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<td>Physics 627</td>
<td>Quantum Mechanics I</td>
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<td>Physics 628</td>
<td>Electromagnetic Theory</td>
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<td>Physics 631</td>
<td>Principles of Modern Physics</td>
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<tr>
<td>Physics 633</td>
<td>An Introduction to Collision Theory</td>
<td>3-0-3</td>
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<td>Physics 637</td>
<td>Quantum Mechanics II</td>
<td>5-0-5</td>
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<td>Physics 639</td>
<td>Quantum Mechanics III</td>
<td>5-0-5</td>
</tr>
<tr>
<td>Physics 642</td>
<td>Diatomic Molecules</td>
<td>3-0-3</td>
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</table>
Pass-Fail Option

A maximum of 12 hours credit toward a degree in physics may be earned in courses taken under the pass-fail option, with the following courses excepted:

(a) Courses stipulated by course number as requirements for the degree,

(b) The additional 20 hours of physics courses, including 3 courses with laboratories, required for the degree, and

(c) Courses taken during the freshman year, except that permission to elect the pass-fail option may be secured from the schedule advisor in special situations in a course which is not normally a part of the freshman program.

Some caution should be exercised in electing courses under the pass-fail option. A course taken on the pass-fail basis is acceptable as a prerequisite only by special consent of the department offering the advanced course; hence, courses that may be needed as prerequisites for other courses should not be taken pass-fail. The general intent of the pass-fail system is to permit students to explore subjects outside of their major field of interest and one must expect that some stigma will be attached to a physics major who takes important physics or mathematics courses under the pass-fail option. This could become a matter of concern in seeking fellowships, admission to graduate schools, or employment.
SCHOOL OF PSYCHOLOGY
(Established in 1959)

Director—Edward H. Loveland; Regents' Professor Emeritus—Joseph E. Moore; Professors—Richard K. Davenport, M. Carr Payne, Jr., Sam C. Webb; Associate Professors—E. Jo Baker, M. Jackson Marr, Stanley A. Mulaik, Charles V. Riche, William W. Ronan, C. Michael York; Assistant Professors—C. Dale Baskett, Anderson D. Smith; Principal Secretary—Julia M. McHugh.

General Information
The School of Psychology serves a dual function in the Institute. First, it offers the student majoring in architecture, engineering, industrial management, and natural sciences a training in the basic and applied aspects of the science of behavior. Second, it offers programs of study leading to the Bachelor of Science in Applied Psychology, and Master of Science and Doctor of Philosophy in Psychology.

The undergraduate curriculum in psychology stresses fundamentals, providing opportunity for broad training in mathematics, the natural sciences, humanities, and social sciences, as well as for exploration of a broad spectrum of engineering and management subjects. The large number of elective courses which the student takes enables the curriculum to fulfill a wide variety of educational and vocational needs. Evidence of the flexibility of psychology programs of study is that graduates have been able to engage successfully in post-graduate study in many fields, including business administration, history, industrial management, labor relations, law, medicine, music, psychology, and theology.

The program provides excellent preparation for graduate work in psychology and is especially adaptable to the needs of students desiring pre-medical education. Graduates of the program also have been employed successfully in a variety of positions relating to personnel subsystems (including human engineering), personnel research, personnel services, systems development, management, and administration of business, engineering, and health programs.

Two undergraduate curricular options are available.

The General Option permits students to prepare for post-graduate study in psychology as well as in a number of other fields, or for employment immediately subsequent to graduation. This option is extremely flexible, and permits the student to adjust his curriculum to meet his own educational and vocational needs.

Students in the general option are able, through appropriate choices of elective courses, to create a minor area of study. For this purpose the psychology faculty has worked with faculties in other departments to develop coherent sequences of courses in those subject matter areas in which psychology majors frequently wish to choose minors. For example, students interested in augmenting their psychology major through minor study in biology (for
pre-medical or other purposes) have available a sequence of courses in genetics, comparative anatomy, cytology, and physiology. Those interested in political, psychological, and social problems occurring in ecological, governmental, or organizational contexts will find attractive a minor sequence which combines political science, sociology, and systems engineering. Similar sequences are available in other disciplines.

**GENERAL OPTION**

### Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<th>2nd Q.</th>
<th>3rd Q.</th>
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<td>I.S. 151</td>
<td>Digital Computer Organization</td>
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<td>.......</td>
<td>2-3-3</td>
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<td>Eng. 107-8-9</td>
<td>Introduction to Literature</td>
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<td>Math. 107-8-9</td>
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<td>P.T. 101</td>
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**NOTE:** Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.  
*Choice of: (1) two quarters of one of the following: American History, Political Science, Philosophy and History of Science, or Sociology, with the third quarter selected from one of the three remaining areas; or (2) three quarters of Modern Language in either German, French, or Spanish. Three quarters of either M.L. or S.S. are required.

**Students who are exempted from all or any one of P.T. 101, 102, or 105 will take P.T. 104.**

**These free elective courses may be taken at any time during a student’s course of study. However, if six credit hours of basic ROTC are elected, ROTC must be scheduled the first quarter the student is enrolled. For further details, see page 29 of the catalog.**

### Sophomore Year

<table>
<thead>
<tr>
<th>Course No.</th>
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### Junior Year

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<th>Subject</th>
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<tr>
<td>Math. 205-6</td>
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<td>Psy. 405</td>
<td>Seminar in Organizational Psychology</td>
<td>3-0-3</td>
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<td>Experimental Psychology I</td>
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<tr>
<td>Physics 227</td>
<td>Particle Dynamics</td>
<td>4-3-5</td>
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<td>Physics 229</td>
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*A total of not more than 9 hours of electives may be in advanced ROTC.

### Senior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
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<td>3-3-4</td>
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<td>Psy. 413*</td>
<td>Applied Experimental Psychology</td>
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<td>Psy. 414</td>
<td>Special Problems</td>
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<td>Psy. 415</td>
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</table>

*Psychology 602 may be substituted for Psychology 413 with the approval of the School of Psychology and Dean of the Graduate School.

**A total of not more than 9 hours of electives may be in advanced ROTC.
The Linguistic Option is intended for those students who wish to combine a major in psychology with a coherent minor in linguistics, and thus prepare for graduate study in linguistics or in those areas of psychology relating to the study of language. This option will be particularly useful to those who aspire to advanced study in psycholinguistics, which deals with psychological problems in the development and use of language. It may also provide a basis for post-graduation employment in positions involving work with cultural groups in which linguistic problems exist as significant variables in education, or vocational preparation and placement.

**LINGUISTIC OPTION**

**Freshman Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<td>General Chemistry</td>
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<td>I.S. 151</td>
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<tr>
<td>Eng. 107-8-9</td>
<td>Introduction to Literature</td>
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</table>

*The Modern Language requirement can vary from 15-21 hours. It consists of completing 21 hours in a single language or one upper level course in one language and one year of either Russian or Chinese as a second language.

**Students who are exempted from all or any one of P.T. 101, 102, or 105 will take P.T. 104.

***The free elective courses may be taken at any time during a student's course of study. However, if basic ROTC is elected, it must be scheduled the first quarter the student is enrolled.

**Sophomore Year**

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<td>PHS</td>
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### Senior Year

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<td>Current Developments in Linguistics</td>
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<td>Semantics and Linguistic Structures</td>
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<td>18-3-19</td>
<td>15-6-17</td>
<td>18-3-19</td>
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</table>

### Courses of Instruction

**Courses of Instruction**

**NOTE:** 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

**Psy. 300. Psychology and Contemporary Issues in Society**

3-0-3. Prerequisites: None.

This course is designed to acquaint the student with current contributions of the science of behavior toward understanding selected contemporary issues. Course content will focus on human behavior. Topics such as aggressiveness, behavior control, drug addiction, creativity, and sexual behavior will be discussed.

**Psy. 303. General Psychology A**

3-0-3. Prerequisite: None.

This course is an intensive coverage of the methods and findings of contemporary psychology. Emphasis will be placed upon the scientific approach to the study of behavior and upon topics of maturation and development, learning, and motivation.
Psy. 304. General Psychology B
3-0-3. Prerequisite: Psy. 303

This is a continuation of Psychology 303. Such topics as individual differences, emotion, perception, and personality will be discussed.

Psy. 380. (M.t. 380) Leadership
1-3-2. Prerequisite: None.

The purpose of this course is to foster the development of leadership and communication skills which can facilitate effective functioning of small groups. Topical coverage represents a survey of material which is of immediate usefulness to the student, rather than intensive treatment of subject matter. Class discussion will be supplemented by opportunities to practice leadership and communication skills in the laboratory.

Psy. 400. Developmental Psychology
3-0-3. Prerequisite: Psy. 303.

A comprehensive study of the behavior and development of the child from infancy through adolescence. Emphasis will be given to the results of empirical research on experiences and processes which affect child behavior.

Psy. 401. Industrial Psychology
3-0-3. Prerequisite: None.

This course introduces the student to scientific methods of inquiry as they are utilized in the study of human behavior in industry. Emphasis is on scientific and experimental study of individual differences, human relations, psychological aspects of equipment design, learning, and motivation.

Psy. 402. Psychology of Adjustment
3-0-3. Prerequisite: Psy. 303.

This course will deal with the typical individual and the social adjustment problems of normal people. Its chief aim will be to assist the student better to understand himself and his fellow man. The primary approach will be from the viewpoint of objective psychology.

Psy. 403. Introduction to Psychological Testing
3-0-3. Prerequisite: Psy. 401 or 304.

This course deals with theoretical and practical issues in psychological measurement, with particular reference to psychological testing. Theoretical concepts of measurement and their implications in testing are stressed. Students have opportunities to administer, take, and evaluate selected tests. Principles of test construction are surveyed.

Psy. 404. Psychology of Advertising
3-0-3. Prerequisites: Psy. 303 and 401.

An analysis of the psychological factors which govern buying activities of consumers. These and other facts are combined to establish the psychological foundations of effective advertising and selling. The psychological aspects of such topics as product testing, advertising media research, copy testing, and consumer and audience research will be discussed.

Psy. 405. Seminar in Organizational Psychology
3-0-3. Prerequisites: Psy. 401 or 410.

The principal focus of this course is on the development and utilization of human resources in an organizational setting. While many of the concepts and methods to be discussed may be utilized in industry, this is not simply a course in "industrial psychology," rather, it is intended to provide the student with knowledge of psychological aspects of organizational functioning, and to encourage the student to equip himself with knowledge, skills, and attitudes conducive to further study in this and other areas of psychology.

Psy. 406. Psychological Statistics
2-3-3. Prerequisite: Permission of the instructor.

A study of the application of statistical techniques of the description, prediction, and control of human behavior. Emphasis will be placed upon the logical aspects of the statistics studied.

Psy. 407. Experimental Psychology I
2-3-3. Prerequisite: Psy. 303.

An introduction to psychological measurement and laboratory techniques. Students will plan, conduct, evaluate, and
report experiments dealing with such topics as visual, auditory, tactual, and kinesthetic perception; sensorimotor coordination; and human feedback systems. Emphasis will be placed on the applications of the methods of science to the experimental study of human behavior.

Psy. 409. Introduction to Engineering Psychology
3-0-3. Prerequisite: None.

This course introduces the non-psychology major to the speciality, Engineering Psychology, which is presented as an integral component in the design, implementation, and evaluation of man/machine systems. The course surveys the application to applied problems and general methodological questions of engineering psychology, and considers in greater detail one or more specific applications of the discipline.

Psy. 410. Social Psychology
3-0-3. Prerequisite: Psy. 303.

The behavior of the individual in society is the main concern of this course. Emphasis will be placed on the scientific study of the individual in relation to other individuals and groups.

Psy. 411. Experimental Psychology II
3-3-4. Prerequisites: Psy. 304 and 407, and permission of the instructor.

This course is concerned with the experimental findings in the areas of learning, motivation, and emotion. Students will be required to design and execute several experimental investigations of pertinent problems.

Psy. 412. Psychology of Learning
3-3-4. Prerequisite: Psy. 411, and permission of the instructor.

This course is concerned with an empirical and theoretical analysis of learning. Applications of learning principles to the understanding of human behavior will be considered.

Psy. 413. Applied Experimental Psychology
3-3-4. Prerequisites: Psy. 406 and 412, and permission of the instructor.

Consideration of the application of the methods and data of experimental psychology.

Psy. 414. Special Problems
0-3-1. Prerequisites: Psy. 406 and 411, and permission of the instructor.

The student will, under the direction of a staff member, do semi-independent work in literature review and/or experimental design.

Psy. 415. Special Problems
3-3-4. Prerequisite: Permission of instructor.

Students will work, under the direction of the instructor, on projects adding to their development beyond the scope of existing courses.

Psy. 420. Special Topics
1-3-2. Prerequisites: Psy. 304 and 407, and permission of the instructor.

The student will, under the guidance of a faculty member, read and study in an area of psychology not represented in the course offerings of the School of Psychology.

Psy. 421. Physiological Psychology
3-0-3. Prerequisites: Psy. 304 and Bio. 211.

This course is designed to acquaint the student with the physiological bases of human and animal behavior. Among the topics to be covered are neurophysiological, endocrinological, and biochemical factors as they relate to sensory and motor functioning, learning, memory, motivation, and behavior disorders.

Psy. 422. Comparative Psychology
2-2-3. Prerequisites: Bio. 211, Psy. 304, and permission of the instructor.

A detailed consideration of the methods and data of comparative psychology, including ethological issues. Students will be expected to read and discuss relevant published literature and to design, conduct, and report experiments. An effort is made to stress, whenever possible, cross-species behavioral continua.
Psy. 423. Introduction to Psycholinguistics
3-0-3. Prerequisite: Permission of instructor.

A critical examination of current problems in psycholinguistics. Topics such as approaches to the study of language, psycholinguistic experimentation, theories of language development, bilingualism, meaning, and the biological bases of language will be discussed.

Psy. 480. (Soc. 480). Socio-Psychology—Sociology Measurement Seminar
3-0-3. Prerequisites: Psy. 410 or equivalent and permission of instructor.

Intensive examination of selected measurement problems in social psychology and sociology. Among topics which may be considered are survey research issues and methodologies, attitude and opinion measurement, sociometric measures, self-report and observational techniques. Specific attention will be given to problems of data processing and analysis. Students will participate in one or more supervised individual or group projects as a means of acquiring skill.

Psy. 484. (Arch. 484). Psychology and Environmental Design I
3-3-4. Prerequisite: Permission of instructor.

This course will include an introduction to, and a review of literature relating to ecological and psychological concepts and issues which are relevant to environmental design, a survey of selected methods for the behavioral assessment of environments, and planning of and participation in a pilot study of a selected setting. The course will be planned and taught jointly by members of the architecture and psychology faculties.

Psy. 485. (Arch. 485). Psychology and Environmental Design II
3-3-4. Prerequisites: Psy. 484 and permission of instructor.

In this course the student will apply the principles and processes considered in the previous course to the design of a number of small environments. He will be expected to explicitly recognize applicable ecological-psychological issues and his design solutions must be based, insofar as possible, on empirical studies and general behavioral principles. The rationale for selection of specific design options must be presented and defended. The course will be planned and taught jointly by members of the architecture and psychology faculties.

Psy. 486. (Arch. 486). Special Problems in Psychological Aspects of Environmental Design
Credit to be arranged. Prerequisites: Psy. 484, 485, and permission of instructor.

The student will work on a problem relating to the interaction of environmental design and behavior.

Graduate Courses Offered

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

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<tr>
<th>Course</th>
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<td>Advanced Industrial Psychology</td>
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<td>Psy. 602</td>
<td>Applied Experimental Psychology</td>
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<td>Psy. 603</td>
<td>Social Psychology</td>
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<td>Psy. 604</td>
<td>Human Information Processing</td>
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<td>Proseminar in General Psychology</td>
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<td>Psy. 608</td>
<td>Human Motivation</td>
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<td>Psy. 609</td>
<td>Social Psychology of Organizations</td>
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<td>Foundations of Psychology</td>
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<td>Design of Psychological Experiments</td>
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<td>Special Problems in Engineering Psychology</td>
<td>Credit to be arranged</td>
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<tr>
<td>Psy. 710</td>
<td>Seminar in Industrial Psychology</td>
<td>3-0-3</td>
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<tr>
<td>Psy. 711</td>
<td>Seminar in Experimental Psychology</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Psy. 712</td>
<td>Seminar in Engineering Psychology</td>
<td>3-0-3</td>
</tr>
<tr>
<td>Psy. 713</td>
<td>Seminar on Psychology and Management</td>
<td>3-0-3</td>
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<tr>
<td>Psy. 721</td>
<td>Sensation and Perception</td>
<td>4-0-4</td>
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<tr>
<td>Psy. 750</td>
<td>Professional Problems</td>
<td>2-0-2</td>
</tr>
<tr>
<td>Psy. 800</td>
<td>Doctoral Thesis</td>
<td></td>
</tr>
</tbody>
</table>

For requirements for the graduate degree in Psychology, consult the *Graduate Bulletin*. 
DEPARTMENT OF SOCIAL SCIENCES

Department Head—Patrick Kelly; Professors Emeritus—George Hendricks, Robert Scharf; Professors—Edward A. Gaston, John C. Gould, Morris Mitzner, Glenn N. Sisk, Willard E. Wight; Associate Professor—Sandra W. Thornton; Assistant Professor—James E. Brittain, Richard W. Griffin, Jon J. Johnston, James D. McBrayer, Jr., Thomas D. Philips, Germaine M. Reed, Lawrence G. Schutte, Robert K. Whelan; Instructor—John N. Hines, Willoughby G. Jarrell; Lecturer—Sevgi O. Aral; Secretary—Mrs. Barbara A. Wardlaw.

General Information

The Department of Social Sciences offers course work in four disciplines: History, Philosophy and History of Science, Political Science, and Sociology. Each of the four disciplines has a dual function in the academic community of Georgia Tech. On the one hand, they perform their vital traditional roles of helping the student to cultivate a critical awareness and perspective on the perennial evaluative issues that confront man, as an individual and as a member of a complex social order. On the other, they reflect upon and contribute to the resolution of the scientific and technological issues that are Tech's special province.

To assist the student in identifying flexible, yet coherent programs of study in areas other than his major, the Department of Social Sciences has developed eight minors options as follows:

- American Political Systems
- History of Science and Technology
- International Affairs
- Philosophy of Science
- American Studies
- Science, Technology, and Society
- Urban Affairs
- Sociopolitical Systems (open to Psychology majors only)

Though not as extensive as his major, a minor will enable the student to acquire additional conceptual skills and perspectives. Development of minors is elective with no formal requirement as to number of hours. A minimum of 15 to 18 hours is recommended, however.

The Department of Social Sciences annually publishes a booklet which describes the minors program in more detail. This booklet is available on request.

United States and Georgia History and Constitution Requirements

The State of Georgia requires all students to display a knowledge of U.S. and Georgia Constitutions and U.S. and Georgia History.

To complete the requirement in U.S. and Georgia Constitutions, a student must pass Pol. 151 or Pol. 351, or an examination on the U.S. and Georgia
constitutions.

To complete the requirements in U.S. and Georgia History, a student must satisfy one of the following conditions:

a. Pass History 101 or 102, or 301 or 302;

b. or pass an examination on U.S. and Georgia history.

Examinations for both requirements are administered each quarter by the Department of Social Sciences to students who are first quarter seniors. Students who elect to take either examination in the first quarter of the senior year have three (3) opportunities that quarter to pass one or both exams. If unsuccessful, the student must then take the appropriate course(s) prior to graduation.

Courses Open Primarily to Freshmen

NOTE: Freshmen choosing courses in this department are required to take a two-quarter sequence in one of the following fields: History, Philosophy and History of Science, Political Science, or Sociology. Then they must take one quarter in one of the other fields of study.

Hist. 101. History of the United States to 1865
3-0-3. Prerequisite: None. Normally open to freshmen only.

A survey of the social, political, and economic history of the United States through the Civil War period with emphasis on selected topics. Gives exemption from U.S. and Georgia History examination.

Hist. 102. History of the United States 1865 to Present
3-0-3. Prerequisite: None. Normally open to freshmen only.

A survey of the social, political and economic history of the United States from the period of the Civil War to the present with emphasis on selected topics. Gives exemption from U.S. and Georgia History examination.

PHS 126. Introduction to Philosophical Analysis
3-0-3. Prerequisite: None.

An understanding of the nature and contribution of philosophy and philosophical analysis is sought through a critical study of selected works. The relation of philosophy to the sciences, religion, and society will be emphasized.

PHS 127. Science, Technology, and Human Values
3-0-3. Prerequisite: None:

An introductory study of the revolutionary impact of modern science and technology on the characteristic religious, ethical, and social values in the Western tradition. An analysis of the presuppositions and consequences of alternative responses to this revolution will be stressed.

PHS 128. Introduction to the History of Science and Technology
3-0-3. Prerequisite: None.

Interpretive study of origins and development of science and technology to the present time. Includes examination of historical details and consequences of scientific, industrial, technological revolutions. Emphasis placed on interaction of science and technology with cultural, social, political, and economic environments.

Pol. 151. Government of the United States
3-0-3. Prerequisite: None.

A study of the structures and functions of the governments of the United States and Georgia. Gives exemption from the United States and Georgia Constitution examination.
Pol. 152. Political Issues
3-0-3. Prerequisite: Pol. 151.
A consideration of selected aspects of governmental policy and current political problems.

Soc. 176. Introduction to the Principles of Sociology
3-0-3. Prerequisite: None.
A study of basic social relations, including social structure and functions, analysis of social processes, and the foundations of personality; and an analysis of social organization, including differentiation, stratification and mobility, population, and social change.

Soc. 177. Social Institutions
3-0-3. Prerequisite: Soc. 176.
An analysis of the structure and functions of social institutions, including familial, educational, religious, economic and political; a study of institutional change and social disorganization within the institutions, including crime and deviant behavior, population problems, family instability, juvenile delinquency.

Upper Division Courses:

History

Hist. 301. History of the United States to 1865
3-0-3. Prerequisite: Junior standing. Not open to students who have had History 101.
A survey of the social, political and economic history of the United States through the Civil War period with emphasis on selected topics. Gives exemption from the U.S. and Georgia History Examination.

Hist. 302. History of the United States 1865 to Present
3-0-3. Prerequisite: Junior standing. Not open to students who have had History 102.
A survey of the social, political, and economic history of the United States from the period of the Civil War to the present with emphasis on selected topics. Gives exemption from U.S. and Georgia History Examination.

Hist. 303. Nineteenth Century Europe
3-0-3.
Modern European history and its impact on world civilization.

Hist. 304. World Problems Since 1914
3-0-3.
A continuation of Hist. 303.

Hist. 306. Recent Latin American History
3-0-3.
Historical evolution of Latin America in recent times, with particular attention to social change.

Hist. 310. American Diplomatic History
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.
An historical analysis of United States diplomacy from the Revolutionary War to present. Emphasis is placed upon the political, economic, and social factors of American history influencing foreign policy and upon the role of the South in world affairs.

Hist. 312. American Economic History
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.
Special attention is given to the rise of technology, our industrial system, the westward movement, the development of our banking system, and government regulation of history.

Hist. 314. History of Georgia
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.
Through the social, economic, and political life of Georgia, the problems which have confronted the state are examined in their historical setting. The relating of Georgia's history to the national scene gives the student a broader perspective of the state's place in the nation.
Hist. 316. United States Colonial History
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.

Settlement and growth of the English colonies in North America with emphasis on the foundations of American political and economic institutions.

Hist. 317. History of the Old South to 1865
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.

A study of social, political, and economic developments in the South from the colonial period through the Civil War.

Hist. 318. History of the New South Since 1865
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.

Continues Hist. 317. An examination of social, political, and economic developments from the Reconstruction period to the present.

Hist. 320. The American Civil War
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.

A survey of the major political, economic and military events occurring in both the Union and the Confederacy during the American Civil War.

Hist. 321. Afro-American History
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.

A historical analysis of the American Negro from the colonial period to the present. Emphasis is placed on the Afro-American’s cultural heritage, the institution of slavery, reconstruction, the era of “Jim Crow,” and the struggle for civil rights in the twentieth century. Special attention is given to the Negro’s contribution to American letters, music, and other performing arts.

Hist. 323. United States Social and Intellectual History
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.

Studies in the social and intellectual traditions of the United States, with emphasis on the more recent period. Assigned readings.

Hist. 336. Technology and Economic Change
3-0-3. Prerequisite: None.

Growth of technology in modern world in its relationship to economic and social change. Craft technology; industrialization invention, origins of mass production and interchangeable parts, power sources, transportation, mechanization of agriculture, technology and large-scale enterprises, new industries.

Hist. 420. Special Topics in History
To be arranged.

Hist. 421. The United States Since 1917
3-0-3. Prerequisite: Hist. 101 or 102, or History Examination.

Social, political, economic, and diplomatic history of the United States in the middle of the twentieth century is examined as to causes, results, and movements.

Philosophy and History of Science

PHS 326. Introduction to Philosophical Analysis
3-0-3. Prerequisite: Not open to students who have had PHS 126.

An understanding of the nature and contribution of philosophical analysis is sought through a critical study of selected works. The relation of philosophy of the sciences, religion, and society will be emphasized.

PHS 328. History of Ancient Philosophy
3-0-3.

A study of the development of philosophy from the early scientific writings of pre-Socratics to Christian thought. The works of Plato and Aristotle stressed.

PHS 329. History of Modern Philosophy
3-0-3.

The development of Western thought from Bacon to Kant, with emphasis on the
philosophic dimensions of the rise of modern science.

**PHS 330. Contemporary Philosophy**  
3-0-3.  
A study of the diverse movements in philosophy from Hegel to Russell, with emphasis on the philosophic response to the development of modern scientific inquiry.

**PHS 331. Types of Ethical Theory**  
3-0-3.  
Critical examination of traditional and modern ethical theories; consideration of the theoretical problems of ethics; definitions of "good"; the nature and presuppositions of ethical judgments; the justification of ethical standards.

**PHS 334. Contemporary Religious Thought**  
3-0-3.  
An introduction to the development of the most important concepts in modern religious systems. Particular emphasis will be placed on the contributions of both recent philosophical analysis and contemporary theological debate.

**PHS 339. Symbolic Logic**  
3-0-3.  
An approach to basic logical notions through use of special symbols.

**PHS 341. Survey of Science in the 16th and 17th Centuries**  
3-0-3.  
A study of the scientific discovery and scientific methods from the age of Galileo to the Enlightenment.

**PHS 342. A Survey of Science in the 18th and 19th Centuries**  
3-0-3.  
The growth and expansion of modern science from Lavoisier to the close of the 19th century.

**PHS 343, 344, 345. History of Engineering**  
3-0-3.  
A study of the development of engineering from ancient times to about 1930. Beginning with a description and analysis of the goals, methods, and status of the engineer in the ancient world set against the social background of the times, the course provides a perspective in terms of which the position and contributions of the engineer in modern times can be evaluated and studied. The development of modern engineering will be treated by concentrating on those key aspects of greatest importance for future engineering development and for economic and social change—coal, steel, textiles, machinery, transportation, electric power, and others.

**PHS 346, 347, 348. Philosophy of Science**  
3-0-3.  
An historical and analytical study of the main problems of the philosophy of science, such as the nature of scientific explanation and knowledge, theory and observation, prediction and casualty, and criteria of confirmation and the concept of empirical significance.

**PHS 428. History of Technology in the United States**  
3-0-3.  
An introduction to the development of technology in the United States as interwoven with its economic and social background and influence. Representative topics: cotton, slavery, and Eli Whitney; interchangeable manufacture and the "American System"; McCormick and prairie agriculture; Samuel Colt and firearms; American machine tools; American shipbuilding—the clipper ship and the iron clad; petroleum—Drake and Rockefeller; the Wright Brothers and aviation; Ford and the automobile.

**PHS 430. Theories of Knowledge**  
3-0-3.  
Critical examination of problems related to perception, verification, logic, *a priori* and *a posteriori* knowledge; the meaning and criteria of truth; the presuppositions and cognitive significance of common sense, scientific, and philosophical propositions.
PHS 435. Philosophy of Science
3-0-3.

Examination of selected theoretical problems such as: causality, induction, the nature of scientific explanation and the status of inferred entities; consideration of the cultural and philosophical import of certain scientific theories.

PHS 436. History of Electrical Science and Technology
3-0-3. Prerequisite: Senior or graduate standing.

An interpretive study of the origins and evolution of electrical science and technology since the seventeenth century. Among the topics to be considered are: Franklin’s predecessors; electrical fluids and the mathematization of electricity; origins of electromagnetic field theory; origins of electrical technology; telegraphy, telephony, and electrical lighting; the professionalization of electrical engineering, developments in electrical power technology: direct current, alternating current, high-speed, turbo-generator; new technologies of the twentieth century.

PHS 440. Semantics
3-0-3. Prerequisite: Senior standing.

The relations of formal logic and natural languages, sense and reference, semantical paradoxes, semantic criteria of truth.

PHS 448. Selected Topics in the History of Science
To be arranged.

PHS 449. Selected Topics in the Philosophy of Science
To be arranged.

Political Science

Pol. 270. Introduction to Analysis of Political Behavior
3-0-3. Prerequisite: Pol. 151 or consent of instructor.

Introduction to political analysis behavioral and post-behavioral perspective. Explores basic concepts employed in selected theoretical approaches. Basic statistics used in political science may also be included.

Pol. 271. American Political Thought
3-0-3. Prerequisite: Pol. 151 or consent of instructor.

Examination and analysis of the fundamental political thoughts which have shaped the American political system.

Pol. 351. American Constitutional Problems
3-0-3.

A study of the structures and functions in the United States and Georgia, taught largely through the medium of constitutional law. Such significant problems as federalism, separation of powers, and civil liberties are studied. Gives exemption from the United States and Georgia Constitution examination.

Pol. 353. National Defense Policy
3-0-3. Prerequisite: Pol. 151 or consent of instructor.

An analysis of the security policies of the United States. Emphasis is placed on the methods and instruments in the selection, establishment, and execution of the policies within the existent or projected historical domestic and international situation. The elements of national power and state of technology are foci among many relevant variables.

Pol. 354. United States Military Policies
3-0-3. Prerequisite: Pol. 151 or consent of instructor.

A critical examination of American military policies and operations from the Revolution to the present. Emphasis is placed on the changing modes of military affairs from the limited wars of the 18th century to the guerrilla wars after WWII.

Pol. 355. State and Local Government
3-0-3. Prerequisite: Pol. 151 or consent of instructor.

Analysis of structure and functions of state, county, and municipal governments.

Pol. 356. American Foreign Policy
3-0-3. Prerequisite: Hist. 310, or consent of instructor.
A study of the formulation of foreign policy; the structure and function of the State Department and of other government agencies concerned with the conduct of foreign policy. In-depth consideration of selected aspects of current foreign policy.

**Pol. 357. National Legislative Processes**  
3-0-3. Pol. 151 or Pol. 270 or consent of instructor.  
Empirical and systematic analysis of national legislative branch, with attention to relationships among Executive Branch, interest groups, and Congress.

**Pol. 358. The American Presidency**  
3-0-3. Prerequisite: Pol. 151 or Pol. 270 or consent of instructor.  
Sources, nature, and use of presidential power, the roles of the President. Recent historical examples emphasized.

**Pol. 361. Foundations of National Power and International Relations**  
3-0-3. Pol. 151 or consent of instructor.  
A study of the United States' power position in world affairs, relative to that of other powers, and the events in the world today which have an impact on the position. International relations are emphasized.

**Pol. 362. International Organization**  
3-0-3. Prerequisite: Pol. 361 or consent of instructor.  
An examination of the evolution of international organizations; analysis of their structures and functions; consideration of their impact on international politics; the future of international organizations.

**Pol. 365. Latin American Governments and Politics**  
3-0-3. Prerequisite: Pol. 151 or consent of instructor.  
A survey of governmental and political processes in the Latin American countries.

**Pol. 366. The Developing Nations**  
3-0-3. Prerequisite: Pol. 151 or consent of instructor.  
In-depth study of selected under-developed nations; the structures and functions of their governments; the problems of economic and political development; the impact of these nations on world affairs.

**Pol. 367. Western European Governments and Politics**  
3-0-3. Prerequisite: Pol. 151 or consent of instructor.  
Comparative analysis of governmental and political processes in the nations of Western Europe.

**Pol. 368. Communist Political Systems**  
3-0-3. Prerequisite: Pol. 151 or consent of instructor.  
An analysis of governmental and political processes in the communist governments.

**Pol. 369. Soviet Foreign Policy**  
3-0-3. Prerequisite: Pol. 368 or consent of instructor.  
Study of the formation and conduct of Soviet Foreign Policy. Consideration of ideological, geopolitical influences; development of relations with the western world.

**Pol. 371. American Political Parties**  
3-0-3. Prerequisite: Junior standing.  
Consideration of the parties' development through history, their functional significance for the institutions of government, and their ability to arouse and sustain mass support at election time. Discussion of recent trends in party behavior.

**Pol. 372. Urban Government and Politics**  
3-0-3. Prerequisite: Pol. 151.  
Examine municipal government in U.S. Focuses on: legal position of local forms of government vis a vis the state and federal governments, effects of urbanization and urbanism, historical function of municipal government, and prospects for the future.

**Pol. 373. Urban Political Problems**  
3-0-3. Prerequisite: Pol. 151.
Examines political behavior of groups and individuals in city politics. Includes politics of ethnic groups, roles of leaders of these groups, and how they interact with the planners and traditional power structure.

**Pol. 374. Urban Public Policy**

3-0-3. Prerequisites: Pol. 372 or 373.

Examines policy-making of urban planning; planning principles, welfare and family planning, citizens' control over policies, means for assessing effects of policy on the city.

**Pol. 450. Special Topics in Political Science**

To be arranged.

**Pol. 455. Legislative Intern Program**

To be arranged.

Work-study program combining an academic study of the legislative process with internship at Georgia Legislature in winter quarter. Interns selected competitively each year.

**Pol. 470. Political Theory**

3-0-3. Prerequisite: Pol. 151 or consent of instructor.

A study of the development of classical political thought from Plato to the twentieth century.

**Pol. 471. Contemporary Political Thought**

3-0-3. Prerequisite: Pol. 151 or consent of instructor.

An analysis of recent political theory, with emphasis on radical ideologies. The development of Marxism, Fascism, and American ideologies will be considered.

**Pol. 474. Science, Technology, and Public Policy**

3-0-3. Prerequisite: Pol. 151 or consent of instructor.

An examination of the relationship between science and government, including the role of science-technology in policy making and the political factors influencing scientific activity. Consideration of selected issues of public policy reflecting the interaction of government and science, such as federally supported research, atomic energy, and health.

**Pol. 475. Science, Technology, and World Politics**

3-0-3. Prerequisite: Pol. 151 or consent of instructor.

An analysis of the impact of science-technology on the international system; the role of science and technology in the foreign policy process; the patterns of international scientific collaboration and competition. A consideration of selected issues involving science and international politics: the moon race, the use of outer space, arms control, and disarmament.

**Sociology**

**Soc. 376. Urbanization**

3-0-3. Prerequisite: Soc. 176.

Growth of metropolitan communities, differentiation of functions; urban complexity; ecological areas; the city as a way of life, measures, and trends in the process or urbanization.

**Soc. 378. Statistics for Planning**

3-0-3.

Statistical principles for analysis of economic, social, and population data; sampling; measures of central tendencies; normal curve; testing of findings; correlation and arriving at conclusions.

**Soc. 379. Demographic Analysis**

3-0-3. Prerequisite: Soc. 176, Soc. 378.

Factors affecting population problems: population growth, fertility, mortality, migration, distribution, and composition.

**Soc. 380, 381, 382. Special Topics in Urban Problems**

1-6-3. Prerequisite: Soc. 380 must taken first.

Direct involvement in socially useful projects dealing with urban problems. Projects to be selected, but would include such things as teaching classes in basic adult education or remedial education,
registering voters in slum areas, organizing meaningful recreation programs in low-income areas, and working with co-operatives serving low-income areas. Field work supplemented by readings, research, and weekly classroom discussions.

Soc. 383. Ethnic Minorities in American Society
3-0-3.

An analysis of the social, economic and technological roles and contributions of various racial and cultural minorities in forming the American culture of today. Special emphasis will be placed on intergroup relations in the urban setting, including minority-majority relationships, and relationships among the ethnic minorities themselves.

Soc. 384. Social Stratification and Mobility
3-0-3. Prerequisite: Soc. 176 or consent of instructor.

Process of stratification, including the criteria for and characteristics of stratification; relationships between social position; vertical and horizontal mobility and implications of stratifications for the functioning of society.

Soc. 385. Social Problems of Industry
3-0-3. Prerequisite: Soc. 176 or consent of instructor.

Analysis of the factory and the business enterprise as social institutions, with particular attention to the contrasting functions of formal and informal organization, and to the significance of cooperation, authority, communication, status, and group norms in the work situation.

Soc. 386. Individual and Society
3-0-3. Prerequisite: Soc. 176 or consent of instructor.

A study of interpersonal relations in the small or informal group, seen in a variety of contexts, such as the family, and in educational, military, or industrial organization.

Soc. 388. Urban Sociology
3-0-3. Prerequisite: Soc. 176.

Introduces student to basic concepts of sociology as applied to urban phenomena. Concepts covered: characteristics of the city, urban and rural cultures, urbanized social relations, nature of urbanism and consequences for human personality.

Soc. 390. Urban Ecology and Demography
3-0-3. Prerequisite: Soc. 176.

Involves application of ecological perspective to the study of urban phenomena; human spatial distribution in and around cities, relation of population to its physical environment, theories of city location and patterns of city growth.

Soc. 476. Technology and Society
3-0-3. Prerequisite: Senior or graduate standing.

Analysis of the social conditions which promote or retard technological activity. Particular emphasis on the historical development of technology in Western society and on the social role of the scientific and engineering professions in that development.

Soc. 480. Social Psychology-Sociology Measurement Seminar
3-0-3. Prerequisite: Psy. 410 or equivalent and permission of instructor.

Intensive examination of selected measurement problems in social psychology and sociology. Among topics which may be considered are survey research issues and methodologies, attitude and opinion measurement, sociometric measures, self-report and observational techniques. Specific attention will be given to problems of data processing analysis. Students will participate in one or more supervised individual or group projects to acquire skill in measurement techniques.
**Soc. 488. Seminar in Contemporary Urban Sociology**

3-0-3. Prerequisites: Soc. 176 and consent of instructor.

Extensive and critical review of literature in field in order to keep students abreast of latest thinking concerning urban phenomena and problems.

**Soc. 490. Special Topics in Sociology**

To be arranged.

**Soc. 492. Seminar in Comparative Urban Development**

3-0-3. Prerequisite: Soc. 176 and consent of instructor.

Entails cross-national comparison of cities and urban regions, most appropriate model for understanding cities and urban regions, differential offices of urbanization on different societies, and strategies for handling problems.

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**Graduate Courses Offered**

<table>
<thead>
<tr>
<th>Pol.</th>
<th>650</th>
<th>Special Topics in Political Science ............... To be arranged</th>
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<tr>
<td>Pol.</td>
<td>651</td>
<td>Governmental Aspects of Planning .................................. 3-0-3</td>
</tr>
<tr>
<td>Pol.</td>
<td>655</td>
<td>Legislative Intern Program ........................................ 3-0-3</td>
</tr>
<tr>
<td>Soc.</td>
<td>677</td>
<td>Planning for People.................................................. 3-0-3</td>
</tr>
</tbody>
</table>
A. FRENCH TEXTILE SCHOOL

Director—James L. Taylor; Callaway Professor—John L. Lundberg; Professors—Walter C. Carter, W. Denney Freeston; Assistant Director and Associate Professor—James W. McCarty; Associate Professors—Winston C. Boteler, Gerald B. Fletcher, Ralph C. Lathem, Wayne C. Tincher; Assistant Professors—L. Howard Olson, Rick A. Porter; Research Technician—Jack R. Kilgore; Mechanical Technician—William L. Tucker; Mechanical Technician—Howard R. Dotson; Principal Secretary—Loretta Pharris; Secretaries—Linda Brittain, Geneva Harris.

General Information

This school, housed in the modern Harrison Hightower Building, offers courses leading to the degrees of Bachelor of Textile Engineering, Bachelor of Science in Textile Chemistry, and Bachelor of Science in Textiles. Each degree may be taken as a regular four-year course, or in accordance with the five-year cooperative plan.

Graduate courses are also provided leading to the degrees of Master of Science in Textile Engineering, and Master of Science in Textiles.

The school is vitally interested in serving the expanding textile industry, and the objective of the courses provided is the training of students for employment in this industry and its related branches.

During the first two years the work is largely fundamental, including the basic courses of Mathematics, Physics, and Chemistry, followed by more specialized training in the field of Textiles during the junior and senior years.

Instruction through classroom, library, and experimental laboratory practice is arranged to give both a theoretical and practical understanding of textile procedure. Original work on the part of the student is encouraged in both regular and graduate courses.

Supervised visits to textile plants in this area are made periodically by junior and senior classes, thus giving the student contact with industry and textile operations on a production scale.

Program for B. of Textile Engineering Degree

Freshman Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>1st Q.</th>
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<tr>
<td>Chem. 104-5</td>
<td>General Chemistry</td>
<td>4-3-5</td>
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<tr>
<td>E.Gr. 170</td>
<td>Visual Communication and Engr. Design I</td>
<td>2-3-3 or</td>
<td>2-3-3</td>
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<td></td>
<td>Engineering Elective*</td>
<td>- - 3 or</td>
<td>- - 3</td>
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<tr>
<td>Math. 107,8,9</td>
<td>Calculus I, II, III</td>
<td>5-0-5</td>
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### Freshman Year (Cont.)

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<td>Gen. 101</td>
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NOTE: Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.

*See page 38 of the catalog for engineering electives.

**These free elective courses may be taken at any time during a student's course of study. However, if six credit hours of basic ROTC are elected, then it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of this catalog.

***Any three of the listed courses of Physical Training may be used to satisfy this requirement.

****See page 37 of this catalog for a listing of courses which may be used to satisfy this requirement.

### Sophomore Year

<table>
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Totals 15-3-16 15-3-16 14-0-14

*See page 37 of this catalog for a listing of courses which may be used to satisfy this requirement.
### Junior Year

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*These must be selected from the approved list on page 37 of this catalog.

**Not more than 9 hours of electives may be replaced by advanced ROTC.

### Senior Year

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## Program for B.S. in Textile Chemistry

### Freshman Year

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**NOTE:** Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.

*Text. 110 Introduction to Textile Engineering (3-0-3) may be substituted for E.Gr. 170.

**Any three courses listed under Physical Training may be used to satisfy this requirement.

***These free elective courses may be taken at any time during the student's course of study. However, if six credit hours of basic ROTC are elected, then it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of this catalog.

### Sophomore Year

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### Senior Year

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*Of the 30 elective hours shown for the junior and senior years, nine hours must be taken from the courses listed on page 39.
## Program for B.S. in Textiles

### Freshman Year

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**Totals** 18-7-19 17-7-19 15-7-17

**NOTE:** Under Quarters, 3-3-4 means 3 hours class, 3 hours lab, 4 hours credit.

*Text. 110 Introduction to Textile Engineering (3-0-3) may be substituted for E.Gr. 170.*

**Any three courses listed under Physical Training may be used to satisfy this requirement.

***These free elective courses may be taken at any time during a student’s course of study. However, if six credit hours of basic ROTC are elected, then it must be scheduled beginning the first quarter the student is enrolled. For further details, see page 29 of this catalog.

### Sophomore Year

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**Totals** 16-3-17 13-3-14 14-3-15
### Junior Year

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<td>Text. 470</td>
<td>Fiber Science</td>
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<td>Engl. 315</td>
<td>Public Speaking</td>
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<td>Electives*</td>
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**Totals** 15-9-18 15-6-17 15-6-17

### Senior Year

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<th>Course No.</th>
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<td>Chem. &amp; Chemical Processing of Fibers &amp; Text. II</td>
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<td>Physical Text. Analytical Methods</td>
<td>2-3-3</td>
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<td>Chem. Textile Analytical Methods</td>
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<td>Text. Plant Design and Layout</td>
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<td>Text. 454</td>
<td>Textile Seminar</td>
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<td>Text. 456</td>
<td>Special Problems</td>
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<td>Text. 438</td>
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**Totals** 14-6-16 12-9-15 16-3-17

* *Not more than 9 hours of electives may be in advanced ROTC.*
Course of Instruction

NOTE: 4-3-5 means 4 hours class, 3 hours laboratory, 5 hours credit.

Text. 110. Introduction to Textile Engineering
3-0-3.

An introduction to the field of textiles and textile engineering. Incorporates the art, science, and technology of consolidating fibers and fibrous materials into useful products. The organization and structure of the textile industry and career opportunities are stressed.

Text. 200. Survey of Polymer and Fiber Technology
3-0-3. Prerequisite: Chem. 105.

An introduction to the history, structure, properties, fabrication and use of polymers in textiles and other applications. This course will provide a basic foundation for further study of fibrous materials.

Text. 201. Survey of Fibrous Materials
3-0-3.

A thorough survey of natural and synthetic fibers used in the textile industry.

Text. 202. Survey of Fiber Processing
3-0-3.

A survey course in yarn manufacturing covering the theory and principles of processing natural and synthetic fibers.

Text. 216. Yarn Processing I
3-3-4. Prerequisite: Sophomore standing.

The first of two courses designed to cover the fundamental theory and practice of processing fibers into yarns. This course covers the processing systems from opening through carding for all types of fibers.

Text. 217. Yarn Processing II
3-3-4. Prerequisite: Text. 216.

The second course of the two quarter sequence covering the fundamental theory and practice of fiber processing. This course covers processing systems from roving through twisting. Included are the various systems and calculations for long draft equipment and the newer procedures for texturizing and bulking of man-made yarns in several different applications.

Text. 251. Survey of Fabric Production
3-0-3.

A survey course in the design, construction and utilization of fabrics made from both natural and synthetic fibers. (Not open to textile students.)

Text. 252. Survey of Dyeing and Finishing of Textile Materials
3-0-3.

A survey course covering dyeing and finishing of textile materials made from both natural and synthetic fibers. (Not open to textile students.)

Text. 271. Computer Applications in Textiles
2-3-3. Prerequisite: Sophomore standing.

Emphasis is placed on application of computer orientated techniques to textile problems. Computer languages are not stressed and no previous computer language experience is required. Digital analog computers are employed in solving various problems. Simulation and linear programming techniques are used in most cases.

Text. 334. Woven Structures I
3-3-4. Prerequisite: Sophomore standing.

This course covers a study of standard fabrics, fabric construction, fabric geometry, the dynamics of weaving machinery, and basic structural design.

Text. 335. Woven Structures II
3-3-4. Prerequisite: Text. 334.

A study of the more complex mechanisms of weaving machinery including the newer developments in higher speed equipment. The designing of some of the more intricate fabrics and the preparation of warps for weaving is also discussed.
Text. 336. Fabric Structures Other Than Woven I
3-3-4. Prerequisite: Text. 335 or consent of instructor.

The design and production of fabrics other than woven materials. Includes knitted fabrics, tufted fabrics, and other classes of fabrics in the general group known as non-woven fabrics.

Text. 337. Fabric Structures Other Than Woven II
3-3-4. Prerequisite: Text. 336.

A study of warp and weft knitting including properties of knit fabrics, design of fabrics such as jersey, rib, double knit, and tricot. A study of the different machinery and the relation of design to available equipment including production problems.

Text. 391. Introduction to Textile Chemistry
3-3-4. Prerequisite: Chem. 105.

An introduction to the study of chemistry as it applies to fibers, dyes, finishes, and polymers.

Text. 392. Structures of Organic Polymers
3-0-3. Prerequisites: Text. 391 and Physics 213.

A study of the chemical and physical structure of organic polymers and the relationship of their structure to properties. Emphasis is placed on naturally occurring fibrous polymers and those synthetic polymers which can be formed into fibers and/or films.

Text. 410. Structure and Mechanics of Knit Fabrics
3-0-3. Prerequisite: Text. 337 or consent of instructor.

A basic review of fabric geometry produced by both warp and weft knitting including overall physical properties of knit fabrics and the stress distribution along individual loops. Fabric mechanics is used to solve problems encountered in knitting.

Text. 414. Physical Textile Analytical Methods
2-3-3. Prerequisites: ISyE 349 and senior textile standing.

The physical analysis of both natural and man-made fibers and the yarn of other structures made from the different fibers. The use of statistical quality control techniques to make effective use of the developed data is stressed.

Text. 415. Chemical Textile Analytical Methods
2-3-3. Prerequisites: Text. 391 and 392 (or concurrent).

This course acquaints the student with the chemical analytical procedures employed by the textile industry and shows how these procedures are used in solving industrial technical problems.

Text. 422. Jacquard Design and Weaving
2-3-3. Prerequisite: Text. 334.

The designing of Jacquard patterns and the techniques involved in the transfer of design to the fabric.

Text. 438. Textile Cost Analysis
3-3-4. Prerequisite: Senior textile standing.

A course covering the basic principles of distributing the costs of materials, labor, and overhead to the various operations within a textile enterprise. Study of depreciation and machinery replacement, marketing costs, financial statements, the use of computers to store data and generate needed reports, and the interpretation of these reports.

Text. 439. Textile Instrumental Analysis
1-6-3. Prerequisite: Senior standing.

Separation and instrumental analysis of dyes, surfactants, resin finishes, and other textile chemicals are covered. Characterization of fibers and elucidation of chemical fiber damage are studied. Computers are used for data reduction. Emphasis is placed on spectrophotometric, colorimetric, chromatographic and differential thermal analysis, although other methods are used. The course culminates in the analysis of a commercially compounded textile product.
Text. 451. Textile Plant Design and Layout
3-0-3. Prerequisites: Text. 217 and 335.

Includes problems of mill organization, equipment and layout of machinery, equipment cost, and problems of conversion when changing machinery to manufacture a different product.

Text. 453. Textile Plant Engineering
2-3-3. Prerequisite: Text. 472.

This course acquaints the students with the selection and cost of process equipment, organization programs, plant layouts and the proper equipment for air-conditioning, lighting, power, and material handling.

Text. 454. Seminar
1-0-1. Prerequisite: Senior standing.

Specific topics concerned with scientific literature; what industry expects of graduates in textiles and similar subjects are covered by experienced speakers.

Text. 455. Textile Engineering Problems
1-6-3. Prerequisite: Senior standing.

Special problems involving analytical or experimental investigations in the field of textile engineering.

Text. 456. Special Problems in Textiles
1-6-3. Prerequisite: Senior standing.

Special problems involving analytical and/or experimental investigations in the field of textiles and/or textile chemistry.

Text. 457, 458. The Chemistry and Chemical Processing of Fibers and Textiles I and II
3-3-4. Prerequisites: Text. 392 for 457 and 457 for 458.

A two quarter sequence including a detailed study of the chemical processing of fibers and textiles, their purification, their dyeing, and their finishing. Emphasis is placed on the relationship of fiber structure and behavior during chemical processing.

Text. 461. Textile Chemistry
3-0-3. Prerequisites: Text. 457 and Chem. 342.

Chemical principles used in the development of process formulae are discussed. Chemical aspects of finishing processes are considered.

Text. 462. Engineering Analysis of Dyeing and Finishing Systems
3-3-4. Prerequisites: Ch.E. 350 and C.E. 313.

Design and operating principles of systems employed.

Text. 470. Fiber Science
3-0-3. Prerequisite: Physics 227 or Physics 211.

Topics studied: physical structure and mechanical properties of fibers; methods for evaluating fiber properties of fibers; methods for evaluating fiber properties and relating them to performance characteristics of yarn and fabric structures.

Text. 471. Fiber Processing Principles
4-3-5. Prerequisites: Physics 227 and senior standing.

Operational methods and physical principles employed for conversion of fibers into yarns and related structures are analyzed and evaluated. Analytical methods for characterizing the yarn and intermediate products are studied.

Text. 472. Fabric Construction-Analysis and Design
4-3-5. Prerequisite: Text. 471.

Principles embodied in the design and operation of machines for weaving and knitting, and the properties and performance characteristics of fabric are studied.

Text. 473. Chemical Processing of Textile Materials
3-0-3. Prerequisites: Chem. 105 and senior standing.

Acquaints students with those basic chemical principles that are used in fiber manufacturing and textile processing.
Text. 490. Science of Color

3-0-3. Prerequisites: Chem. 105 and Physics 213 or consent of instructor.

The physical, chemical, and biological principles involved in perception of color including theory of color vision; systems for measurements; and specifications of color. The applications of color science in the textile and related industries will be emphasized.

Graduate Courses Offered

Text. 601, 2, 3 Dynamics of Fiber Processing System .................. 3-0-3
Text. 607, 608 Problems in Fiber Processing Systems .................. 0-6-2
Text. 611 Physical Methods of Investigating Textiles .................. 3-6-5
Text. 612 Process Control in the Textile Industry ..................... 3-0-3
Text. 616 Engineering Properties of Fibrous Materials ................. 3-0-3
Text. 636 Origin, Preparation, and Structure of Fibrous Substrates .......................................................... 5-0-5
Text. 637 Fundamental Aspects of Dyeing Processes .................. 3-0-3
Text. 638 Chemical Technology of Stabilization Processes ............... 3-0-3
Text. 681, 2, 3 Special Topics ...................................................... 3-0-3
Text. 700 Master's Thesis ............................................................
Text. 701, 2, 3 Seminar .............................................................. 1-0-0
Text. 704, 5, 6 Special Problems in Textiles and Textile Engineering .............. Credit to be arranged

(Complete details about these courses are contained in the Graduate Bulletin, which is available upon request.)
BIOENGINEERING CENTER

Interim Director—Edwin J. Scheibner; Associate Director—Frederick Dixon; Secretary—Mary F. Lupton.

The Bioengineering Center was established in 1970 to serve as a focal point for the University System of Georgia and other interested institutions and organizations in the Southeast in "the application of the knowledge, techniques, and approaches of the physical and engineering sciences to the problems and research areas of the life sciences."

Major functions of the Center include the coordination of technical and personnel resources to provide for effective interaction among the various disciplines and projects involved, the development of an information and communications exchange for pertinent research proposals to provide assistance in obtaining funding, and the encouragement and promotion of research studies within the broad area of bioengineering. It is furthermore intended to maintain an awareness of potential applications of research results and develop methods for transferring such knowledge to the benefit of society. The educational role of the Center is limited to assisting individual schools and departments in developing relevant interdisciplinary study and research opportunities for qualified students.

A designated Bioengineering degree program is not offered at Georgia Tech. However, a student with interests in this direction may prepare for later participation in bioengineering research activities and graduate study by taking appropriate electives while following the basic curriculum of the School in which he chooses to enroll. For additional information please write to the School Director involved, or to the Dean of the Engineering College if more general guidance is needed.
ENVIRONMENTAL RESOURCES CENTER

Director and Regents' Professor—Carl E. Kindsvater; Assistant Director and Lecturer—Clarence M. Conway; Professor (Part-time)—Willard M. Snyder; Associate Professors—L. Douglas James, Gene E. Willeke; Assistant Professors—Arthur C. Benke, Eugene A. Laurent; Instructor—F. William Kroeck; Assistant Research Scientist—Henrie E. Baltimore; Principal Secretary—Mrs. Willie G. Gibson; Secretary—Miss Pamela A. Miles; Advisory Council—Harry L. Baker, Jr., Walter L. Bloom, Robert E. Green, Maurice W. Long, Thomas E. Stelson, Sam C. Webb, Henry S. Valk, Carl E. Kindsvater (Chairman).

The purpose of the Environmental Resources Center is to initiate, facilitate, and coordinate efforts designed to bring the full competence of the Institute to bear on all facets of environmental resources education and research. Through its activities, the Center fosters coordinated programs of education and research related to environmental management. It places special emphasis on multidisciplinary, problem-focused programs which involve interaction between science and technology, socio-economic systems, and the natural environment.

The Center does not offer a designated degree. Instead, it encourages the development of multidepartmental curricula augmented by special courses and directed studies in the interdisciplinary aspects of environmental problems. It stimulates and coordinates Georgia Tech's involvement in off-campus and service activities related to environmental resources. It seeks funds to support education and research in relevant subject areas, and it provides leadership and coordination for interdisciplinary teams, committees, short courses and conferences, and publications. As one of its most important functions, the Environmental Resources Center serves as a center for the storage and exchange of information regarding ongoing research and educational programs and public service activities.

The activities and policies of the Center are developed and carried out under the guidance of the Advisory Council, which is composed of appropriate administrative officers. Contacts with related research and training programs are maintained through School Directors and Department Heads, with assistance from ad hoc committees composed of faculty and staff representatives.

In 1965 the Center (then the Water Resources Center) was authorized by the General Assembly of Georgia to administer Title I of the Federal Water Resources Research Act in the State. To advise the Center in carrying out this responsibility, the Board of Regents appointed a Joint Tech-Georgia Advisory Committee on Water Resources Research comprised of representatives of both Georgia Tech and the University of Georgia.

The Environmental Resources Center was established at Georgia Tech in March 1970 by action of the Board of Regents of the University System of Georgia. It is the successor to the Water Resources Center, which was established in 1963.
HEALTH SYSTEMS RESEARCH CENTER

Director and Regents’ Professor—Harold E. Smalley.

Visiting Professor—A. D. Joseph Emerzian.

Adjunct Professors—Philip Adler, Jr. (Industrial Management), Walter L. Bloom (Biology), Mark Brown (Radiology, MCG), J. Rhodes Haverty (Allied Health Sciences, GSU), Vladimir Slamecka (Information and Computer Science), Robert E. Stiemke (Civil Engineering), W. Loren Williams (Psychology, MCG), Richard Wilson (Architecture), George R. Wren (Health Administration, GSU), Thomas J. Zwemer (Dentistry, MCG).

Visiting Associate Professor—John R. Watt.

Adjunct Associate Professors—J. Norman Berry (Medicine, Emory), Raphael B. Levine (Biophysics, Atlanta Regional Commission), F. Levering Neely (Medicine, Emory).

Assistant Professors—Richard M. Bramblett, John W. Coyle, James B. Mathews, James F. Smith.

Instructor—Edwin M. Sheats.

Staff Consultant—Joseph H. McNinch.


Secretary to the Director—Dorothy C. Brutko; Education Secretary—Lynn G. Floyd; Research Secretary—M. Linda Weatherly; Project Assistant—C. Phillip Meyer.

Representatives of Cooperating Organizations—J. Gordon Barrow (Georgia Regional Medical Program), A. Evan Boddy (Cherokee Atomedic Hospital), Richard E. Gillock (MCG Hospital and Clinics), J. Fred Gunter (South Fulton Hospital), Glenn M. Hogan (Georgia Hospital Association), Douglas B. Kendrick (Grady Memorial Hospital), Robert N. Lehrer (School of Industrial and Systems Engineering, GIT), Hulett D. Sumlin (Piedmont Hospital).

General Information

Health Systems is that field of study and practice aimed toward improving the delivery of health care services principally through the application of systems science, including industrial and systems engineering, operations research, and management science. Emphasis is upon systematic planning, engineering design, and scientific management in respect to health care facilities, manpower, and methods. Because of the complexity of health systems, the approach is typically interdisciplinary, often involving other branches of engineering, the physical and behavioral sciences, industrial management, information science, computer technology, architecture, and the various health sciences and professions.

The Health Systems Research Center (HSRC) was established in 1969 by the
Regents of the University System of Georgia as an interdisciplinary and interinstitutional program of health systems research, education, and service, building upon a health related academic program activated at the Georgia Institute of Technology in 1958. Organizationally, HSRC is an independent division of Georgia Tech, reporting to the Office of the Vice President for Academic Affairs. The Center also serves as a coordinating agency for health systems programs throughout the University System and for cooperative relationships with other academic and health institutions and agencies throughout Georgia. HSRC is based at the Ferst Research Laboratories in the Piedmont Education Building on Peachtree Road in Atlanta. Offices are also maintained on the Georgia Tech campus in Atlanta and on the Medical College campus in Augusta.

General Aim

The basic philosophy of HSRC is to view health care delivery as a total system, rather than as isolated components or subsystems. Even though HSRC is not engaged in the direct conduct of biological or medical research, in directly providing health care, or in administering or operating health care institutions, it closely interacts and collaborates with those individuals, agencies, and groups doing so. The general aim of HSRC is to develop, apply, and disseminate new knowledge with respect to the design, experimentation, evaluation, implementation, and demonstration of new and improved systems for the delivery of health services to the public.

In recognition of the complexity of the health care system and the growing national concern for better means of providing health care for all people at a reasonable cost, HSRC is particularly interested in the analysis and design of systems which promote health maintenance and minimize hospitalization; which provide feasible alternatives to acute hospital confinement for those persons not requiring such expensive facilities and services; which promote the improved utilization of physicians, dentists, nurses, and other scarce manpower; and which utilize the advantages of advanced technology and modern management methods.

HSRC Programs

Research programs are concerned mainly with developing systems for planning, designing, and managing health care facilities, manpower, and methods, and with techniques for evaluating current and proposed health care delivery systems. Recent projects have been devoted to the analysis of medical information systems, to the development of methods for planning and evaluating radiographic facilities, and to the design of health maintenance facilities.

Educational opportunities through HSRC include seminars, short courses, and conferences on a non-credit basis, student involvement in community outreach
projects, health systems courses, career oriented professional curricula, research training, and health systems options for undergraduate and graduate degrees. Students must be admitted to an appropriate school at Georgia Tech and be approved by HSRC for participation in the program.

Service programs of HSRC provide valuable data sources and real-world laboratories for health systems research, and they offer enriched opportunities in health systems education. In cooperation with the Georgia Hospital Association, HSRC has established a community outreach program which promotes practical improvements in management systems for health care delivery in Georgia hospitals. Under this service program, shared services are provided to participating institutions by the professional application of systems science, with emphasis upon practical, relevant, and useful results for the hospitals. Ample opportunity is provided for HSRC-affiliated students to be involved in this program, thus providing educational benefits and assistance with educational expenses.

Degree Programs

While HSRC is not a degree granting school of instruction, it does offer educational opportunities to both undergraduate and graduate students enrolled in various schools, such as the School of Industrial and Systems Engineering, programs of the College of Industrial Management, the School of Information and Computer Science, and the School of Architecture. A student wishing to emphasize health systems in his program of study may do so by obtaining approval of his own school and making application to the Health Systems Research Center. Such “HSRC trainees” typically follow regular curricula or core programs of their own schools, include a sequence of health related courses as electives, and engage in project work or student research on health systems problems.

Program in Hospital and Medical Systems

Through a cooperative arrangement with the School of Industrial and Systems Engineering, students in that School may affiliate with HSRC as a part of the special “Program in Hospital and Medical Systems” which is administered jointly with the Medical College of Georgia. This arrangement enables students to gain a health systems orientation while pursuing programs of study leading to the BIE, the MSIE, or the Ph.D. degree. Students are trained at Georgia Tech in the scientific treatment of hospital and medical systems and undertake project work and thesis research either in one of several cooperating institutions in Metropolitan Atlanta or at the Medical College of Georgia Hospital and Clinics in Augusta.

The following health related courses are taught by ISyE faculty members on the HSRC staff and are available to HSRC trainees:
ISyE  418  Industrial Engineering in Hospitals ................................. 3 hours
ISyE  491,2,3  Special Problems (health systems topics).............. 1 hour each
ISyE  665  Case Studies in Hospital Management Systems .......... 3 hours
ISyE  700  Master’s Thesis (health systems topic) ......................... Credit to be arranged
ISyE  704,5,6  Special Problems (health systems topics).............. 1 hour each
ISyE  765  Projects in Hospital Management Systems ................. 3 hours
ISyE  800  Doctor’s Thesis (health systems topic) ....................... Credit to be arranged

Other Schools
Since HSRC places considerable emphasis upon its educational component and attempts to integrate education, research, and service, arrangements can be made for involvement in HSRC programs by students from various schools on the Georgia Tech campus and from affiliated institutions such as the Medical College of Georgia and Georgia State University. Such cooperative programs are intended to provide a health systems orientation to graduate work within a given academic discipline, as well as opportunities to employ interdisciplinary approaches to health systems problems.

Financial Assistance
Financial support is often available through teaching and research assistantships, traineeships, fellowships, externships, or part-time employment on the Center staff or with cooperating health related institutions or agencies. For further information write to the Director, Health Systems Research Center.
RICH ELECTRONIC COMPUTER CENTER

Director—Irwin E. Perlin; Associate Director—John P. McGovern; Principal Secretary—Ann H. Lewis. SYSTEMS EFFECTIVENESS OFFICE: Head—S. P. Lenoir, Jr. OPERATIONS BRANCH: Head—W. A. Bezaire. RESEARCH BRANCH: Head—John P. McGovern.

Mission

The Rich Electronic Computer Center provides a wide range of computing services in the three general fields of instruction, research, and administration. The primary mission of the Computer Center is to provide computing facilities and services for Georgia Tech. However, the Center also provides computing support to other schools in the University System of Georgia, as directed by the Board of Regents.

Computer Center Objectives

The Center’s primary objectives are:

1. To provide computer support for the advancement of Georgia Tech’s objectives in education (instruction), research, and administration.
2. To make available to every student at Georgia Tech instruction in computing and necessary computing support in order to advance and insure his full professional development.
3. To study and evaluate advances in computer applications and technology in order to insure that the most modern productive tools are used by Georgia Tech.
4. To develop a primary role in the State’s program for advancing higher education through the concepts of information processing and computer applications.
5. To provide the best possible computing facilities for the solution of research and development problems of government and industry for which Georgia Tech has been given responsibility.

Facilities

The Rich Electronic Computer Center operates two large-scale computers. The Univac 1108 is a Shared Processor configuration operating in batch, demand, and remote modes. The Burroughs B 5500 operates under the batch and time sharing master control programs in both the batch and remote modes. A Calcomp Digital Plotter system and an Analog-to-Digital conversion system are also available.
Staff

The Computer Center has a staff of approximately 65 persons. This includes about 20 professional analysts and programming analysts.

Present Computing Workload in Support of Georgia Tech Activities

Computing for instruction and general (nonsponsored) research represents about 80% of the computing workload. Extensive use is made of the Center’s facilities in undergraduate courses, as well as in Master’s thesis and Ph.D. dissertation work. Approximately 40% of the students at Tech are now using computers regularly in their academic work. Sponsored research constitutes about 15% of the computing workload. Administration and service activities represent about 5% of the computing workload. In the administrative and service area, computer facilities are used by the Georgia Tech Library and Georgia Tech Alumni Association, and for the Football Stadium Seating Assignment system.

Support for the University System of Georgia Computer Network

Georgia Tech is participating in a National Science Foundation sponsored experiment involving the implementation of a regional computer network. Tech, along with the University of Georgia, is a lead institution in this experiment.
THE CO-OPERATIVE DIVISION
(Established in 1912)

Co-operative Courses in Aerospace, Chemical, Civil, Electrical, Industrial & Systems, Mechanical, and Textile Engineering; Chemistry, Engineering Science and Mechanics, Industrial Management, Physics, Textile Chemistry, and Textiles

(A Co-operative Plan Bulletin will be mailed on request)

Director—James Gordon Wohlford; Associate Director—William Henry Hitch; Assistant Director—William Thomas Lee; Principal Secretary—Darlene San Filippo; Secretary—Penni Edmondson.

The engineering and science graduate must have an educational background of sound scientific and economic principles, and he must be acquainted with industrial practices in his field of employment before he can assume responsibility for industrial projects. The interlocking of theory and practice is provided in the co-operative plan of education by the integration of technical theory and practical industrial experience.

The Georgia Institute of Technology has offered a Co-operative Course since 1912. The correlation of the scientific and engineering practices of classroom and laboratory work and practical industrial experience is accomplished in a five-year course. Co-operative students complete twelve academic quarters plus their scheduled industrial quarters. The alternation between campus and industry continues until the student has completed the second or third quarter (depending on the student’s section) of the junior year curriculum, at which time the students are scheduled to attend classes continuously until graduation.

Thirteen curricula are available to students under this plan. Originally only Mechanical and Electrical Engineering were offered, but Civil, Textile (including Textile Chemistry and Textiles), and Chemical Engineering were added between 1920 and 1928, and in 1946 Aeronautical (now Aerospace) and Industrial Engineering were included. Chemistry, Physics, and Engineering Mechanics were added in 1963, and Industrial Management in 1967.

Students in the Co-operative Division are selected from those who are in the upper third of their high school or preparatory class, or who have made better-than-average records in the Georgia Tech regular course or at some other accredited institution of higher learning. The entrance requirements for the Co-operative Courses include all “Specified or Required Units” on page 16. Only those students who expect to graduate under the Co-operative Division are accepted for these courses. A co-operative student must make a creditable scholastic record before being recommended for work in industry, and is allowed to continue under the co-operative plan only if he maintains a good record.
Upon graduation a Bachelor's Degree, Co-operative Plan, is awarded to a co-operative student in his particular field.

Students in the Co-operative Division are divided into two sections, the first beginning classes in June and the second in September. While Section One is at college three months, Section Two is at work in industry. The two sections alternate or exchange places with each other every three months until the fifth school year, when they merge and remain at college continuously until graduation. A co-operative student is given three weeks' vacation during each calendar year—one week at Christmas and two weeks during the summer.

The Institution is co-operating with more than two hundred and forty firms, including power companies, electric and electronic equipment manufacturers, oil companies, airlines, railroads, manufacturers of machinery and mechanical equipment, pulp and paper mills, chemical industries, textile mills, foundries, steel mills, construction and engineering firms, and state and federal agencies. The area covered by those industries includes the Southeastern states and many sections of the Middle Atlantic and Western Central states.

After satisfactory completion of at least three months' classroom work in the Co-operative Division, a student is recommended for work with an industrial company. Since the firms employing co-operative students offer a wide variety of practical training and many lines of specialization, students are afforded the opportunity to secure work in the field in which they are most interested. Although the Co-operative Division does not guarantee work nor stipulate any certain amount of compensation, every effort is made to place students to their best educational and financial advantage.

Co-operative students receive wages for their work at the prevailing rate in the shops in which they are employed; the wages are paid directly to the students. At the present time the average beginning wage for a freshman is around $450.00 per month. The wages increase as the student remains on the job assigned until he is advanced to a higher grade of work by his employer or by the Co-operative Division. By the time he graduates, a co-operative student will have received training in practically all departments of an industry. A high percentage of students trained in this way follow and succeed in their chosen profession. At the conclusion of the course the co-operative graduate is nor obligated to accept employment with the co-operating company; nor is the company obligated to offer employment. In many instances, however, such employment is offered and accepted.

The Director of the Co-operative Division makes frequent visits to employing companies. Through interviews with company officials and shop foremen he brings about co-ordination of industrial work with school curricula and takes care of any adjustments in types of work, wages, and other relevant matters. Before freshmen are sent to work, they attend orientation classes in which they are acquainted with the various aspects of their industrial work and receive pointers on how to succeed on the job, how to make friends with regular shop employees, how to save wisely, and other important factors.
A Georgia freshman should have about $1,100.00 and an out-of-state student about $1,600.00 for the total expenses of his first two academic quarters. Anyone interested in making application for admission into the Co-operative Division should write to J. G. Wohlford, Director, Co-operative Division, for a bulletin which gives full particulars about fees, courses, living expenses, wages paid the students while at work, discipline, school activities, and other pertinent information.
DIVISION OF GRADUATE STUDIES AND RESEARCH

(The Bulletin of the Graduate Division will be sent upon request.)

Dean—Sam C. Webb; Associate Deans—Maurice W. Long, Dale C. Ray; Assistant to the Dean—Karl M. Murphy; Secretaries—Hazel Beach, Doris Dean, Yvette Lea, Joy Moody, Carol Ralston.

GRADUATE COUNCIL

SAM C. WEBB, PH.D. ..........................................................Chairman

Ex-Officio
FRANK E. ROPER, M.S. ..................................................Registrar
VERNON CRAWFORD, PH.D. ....................Vice President for Academic Affairs
THOMAS E. STELSON, PH.D. ........................................Dean, Engineering College
HENRY S. VALK, PH.D. ............................................Dean, General College
ROBERT E. GREEN, PH.D. ...........Acting Dean, College of Industrial Management
MAURICE W. LONG, PH.D. ..................Director, Engineering Experiment Station
E. GRAHAM ROBERTS, PH.D. ..................Director, Libraries

Appointments Expiring June 30, 1972:
*M. G. LITTLE, M.S., Director, City Planning
*G. G. EICHHOLZ, PH.D., Acting Director, School of Nuclear Engineering
*L. DAVID WYLY, JR., PH.D., Regents' Professor, School of Physics
*SANDRA THORNTON, PH.D., Associate Professor of Social Science

Appointments Expiring June 30, 1973:
*LUCIO CHIARAVIGLIO, PH.D., Professor of Information and Computer Science
*M. CARR PAYNE, JR., PH.D., Professor of Psychology
KENDALL L. SU, PH.D., Regents' Professor, School of Electrical Engineering
W. T. ZIEGLER, PH.D., Regents' Professor, School of Chemical Engineering

Appointments Expiring June 30, 1974:
C. VIRGIL SMITH, Sc.D., Associate Professor of Aerospace Engineering
P. H. SANDERS, PH.D., Assistant Director, School of Civil Engineering
FRED A. TARPLEY, PH.D., Associate Professor, College of Industrial Management
W. C. CARTER, PH.D., Professor of Textile Engineering

Appointments Expiring June 30, 1975:
EUGENE C. ASHBY, PH.D., Professor of Chemistry
NORMAN R. BAKER, PH.D., Associate Professor of Industrial and Systems Engineering
FRANK W. STALLARD, PH.D., Associate Professor of Mathematics
CARL E. KINDSVATER, M.S., Director and Regents' Professor, Environmental Resources Center
NOVAK ZUBER, PH.D., Callaway Professor, School of Mechanical Engineering

*Executive Committee of the Graduate Council
Degrees and Fields of Study

The degree of Master of Science is offered with or without designation in the following fields: Aerospace Engineering, Applied Mathematics, Applied Biology, Ceramic Engineering, Chemical Engineering, Chemistry, Civil Engineering, Electrical Engineering, Engineering Science and Mechanics, Geophysical Sciences, Industrial & Systems Engineering, Information and Computer Science, Industrial Management, Mechanical Engineering, Metallurgy, Nuclear Engineering, Nuclear Science, Operations Research, Physics, Psychology, Sanitary Engineering, and Textile Engineering. It may be awarded without designation when the student does not major in the field in which he has earned his bachelor’s degree. The degrees of Master of Architecture and Master of City Planning are also offered.


In addition to the fields of study listed above for the Master of Science degree, collateral study of an advanced nature is available in Modern Languages and Sociology.

Fellowships

Atlantic Steel Company
A fellowship in Chemical, Civil, or Mechanical Engineering in the amount of $1500.

Automotive Safety Foundation
A fellowship in Highway Engineering; $1,800 stipend plus tuition and matriculation fees. Awarded on basis of national competition.

Burlington Industries Fellowship
A fellowship in the amount of $5,000 awarded to the A. French Textile School to be used to provide the fellow’s stipend, tuition, and research equipment and supplies.

Celanese Corporation
A fellowship in Textiles or Textile Engineering in the amount of $2,500, including tuition and matriculation fees and other expenses incidental to research.

E. I. DuPont de Nemours & Company, Inc.
A grant of $10,000 allocated to each of four schools: Chemical Engineering, Chemistry, Electrical Engineering, and Mechanical Engineering. It is to be used to enhance or maintain the strength of their instruction in science and engineering.

Eastman Kodak Fellowship
A $6,000 grant to the Textile School. Stipend not less than $2,500 per calendar year or $3,000 if there are dependents, plus tuition and fees. Balance to be used as an unrestricted grant in the school.

G. B. Espy Faculty Bioengineering Fellowship
A fellowship to aid Georgia Tech professors in moving into the medical profession as bioengineers. Eligibility requirements are: (1) Must be a current member of Georgia Tech (as of fall 1970); (2) Must possess either a Ph.D. or Sc.D. in Chemical, Electrical, Mechanical, or Nuclear Engineering; and (3) Must be
accepted by a medical school as a full-time student in a program of study leading to the M.D. at time of application.

**General Electric Foundation**
A $5,000 grant to the School of Mechanical Engineering.

**Gulf Oil Corporation Graduate Fellowship**
A fellowship in Chemical Engineering; $2,500 stipend plus tuition and matriculation fees.

**Housing and Urban Development Fellowship (HUD)**
A fellowship in City Planning; $3,000 stipend plus $500 for each dependent up to two; plus $1,500 cost of education allowance to the school for tuition and fees.

**Kaiser Financial Aid Grant**
A grant of $4,600 to the School of Chemical Engineering; $3,600 to the recipient and $1,000 to the school.

**Lola D. Lasker Fellowship Trust**
Graduate fellowship in City Planning. Awarded on a basis of national competition.

**Richard King Mellon Charitable Trusts**
Fellowships for graduate work in City Planning. Preference is given to men and women who are working in the field of City Planning and who recognize a need for further graduate training.

**Edward Orton, Jr., Ceramic Foundation**
A fellowship in Ceramic Engineering; $1,800 stipend for 12 months.

**Robert J. Painter Memorial Fellowship**
A fellowship to be awarded to an outstanding applicant entering his final year of full-time graduate work leading to a doctor's degree in a field contributing to the science and knowledge of materials. $5,000 to the fellow and $1,500 to the institution. This grant must be awarded by June 1.

**The Robert and Company Associates Fellowships for Advanced Study in Architecture**
A fellowship in Architecture; $1,200 stipend. Recipient must be a native of Georgia.

**The Robert and Company Fellowship**
A fellowship to be used in Civil, Electrical, or Mechanical Engineering; $1,200 stipend. Recipient must be a native of Georgia.

**Sandoz Foundation, Inc.**
A grant of $5,000 awarded to the A. French Textile School to be used as a fellowship and supporting funds for tuition, equipment, and faculty supervision.

**Schlumberger Foundation**
Two fellowships in Electrical Engineering and Physics; $2,100 stipend with support for tuition, matriculation fees, and research needs.

**Shell Companies Foundation**
A fellowship for graduate study in Civil Engineering; $2,000 stipend for the academic year, $2,500 calendar year (married students $2,600 and $3,200 respectively) plus tuition and matriculation fees; $1,000 to the School of Civil Engineering.

**Standard Oil Company of California**
A fellowship in Chemical Engineering; tuition and matriculation fees, plus $2,000 to the student if single or $2,600 if student has one or more dependents; $1,000 unrestricted grant to the school.

**Mary White Staton Fellowship**
A fellowship in all schools of instruction – recipient must be from Colombia, South America; stipend of $2,000.

**T. Earle Stribling Textile Memorial Fellowship Fund**
A fellowship for advanced study and research in problems pertaining to the textile industry has been established in memory of the late T. E. Stribling, an alumnus of Georgia Tech. This fellowship carries a stipend of $2,000 for the calendar year, plus tuition and matriculation.
fees. Applications are encouraged from men whose preparation has been in the fields of Textile Engineering, Textile Chemistry, Chemical Engineering, Mechanical Engineering, Chemistry, or Physics.

**Texaco Fellowship**
A fellowship in Metallurgical Engineering; $3,000 plus tuition and fees for a calendar year.

**Union Camp Fellowship**
A $5,000 fellowship in Chemistry and Chemical Engineering; tuition and matriculation fees, plus a minimum of $250 a month to the student for a period of at least nine months, the remaining money to be used for department needs.

**United Steel Foundation**
A fellowship in Physics; up to $3,900 per year stipend. The award is made for two years.

**Whirlpool Corporation**
Two graduate fellowships in engineering; $2,400 stipend, plus tuition and fees.

**National Fellowship Programs**
National programs are available through the Institution, including Fellowships – National Science Foundation, NDEA Title IV, Atomic Energy Commission Special Fellowships in Nuclear Science and Engineering, Oak Ridge Graduate Fellowship. Traineeships – Atomic Energy Commission, National Science Foundation, Public Health Service.

FOR FURTHER INFORMATION CONCERNING ANY OF THE FELLOWSHIPS, WRITE THE DEAN OF THE DIVISION OF GRADUATE STUDIES AND RESEARCH.

**Graduate Fellowships**
Fellowships may be made available through grants to the Institute from the National Science Foundation, National Institutes of Health, Atomic Energy Commission, and National Defense Education Act Title IV Program. These are in addition to the fellowships listed on the preceding pages.

**Instructors and Assistants**
A number of part-time instructorships and teaching or research assistantships are available for qualified graduate students through the Schools, Departments, and the Engineering Experiment Station. These appointments are normally for one-third full time and carry stipends ranging from $2,000 for the academic year.

**Admission**
In general, applicants for admission to graduate study should hold a bachelor’s degree from a recognized university, school, or college and should have graduated with academic standing in the upper half of their class. Those applicants who plan to become candidates for the doctorate should have had academic standing in the upper quarter of their baccalaureate class or must have demonstrated, or be prepared to demonstrate, outstanding ability in their work toward a master’s degree.
Length of Study and Graduate Requirements

Thirty-three quarter hours of advanced study past the bachelor’s degree plus a thesis, or fifty quarter hours of advanced study past the bachelor’s degree without a thesis are necessary in fulfillment of the requirements for the master’s degree. At least one full academic year in residence past the bachelor’s degree must be completed on campus before the master’s degree can be awarded.

At least three full academic years of advanced study past the bachelor’s degree are necessary for the award of the doctorate. Ordinarily between 67 and 90 quarter hours of advanced course work will be undertaken, the balance of the required time being devoted to research and the preparation of the dissertation. At least three full quarters of the doctorate program must be spent in residence at the Georgia Institute of Technology and unless special permission is obtained, these must be the three immediately preceding the award of the degree.

Graduate Bulletin

A copy of the Graduate Bulletin, discussing requirements for advanced degrees in detail and listing advanced work in courses available in the various departments, may be obtained on request from the Dean of the Division of Graduate Studies and Research.
ENGINEERING EXPERIMENT STATION

Director—Maurice W. Long; Director Emeritus—Wyatt C. Whitley; Assistant Director—Rudolph L. Yobs; Assistant to Director—Thomas F. Jones; Administrative Secretary—Claudine Taylor. ELECTRONICS DIVISION: Chief—Richard C. Johnson; Principal Secretary—Voncile H. Patrick. HIGH TEMPERATURE MATERIALS DIVISION: Chief—J. D. Walton, Jr.; Principal Secretary—Jean Williams. INDUSTRIAL DEVELOPMENT DIVISION: Chief—Ross W. Hammond; Principal Secretary—Margaret Textor. NUCLEAR AND BIOLOGICAL SCIENCES DIVISION: Acting Chief—George D. Leddicotte; Senior Secretary—Barbara N. Cartledge. PHYSICAL SCIENCES DIVISION: Chief—Edwin J. Scheibner; Principal Secretary—Betty R. Jaffe.

PURPOSES

Recognizing that teaching and research are complementary, Georgia Tech believes that a progressive technological institution should carry on, conjointly, a strong educational program and a coordinated fundamental and applied research program. This philosophy is put into practice by a full-time Engineering Experiment Station staff composed of engineers, scientists, and technicians, a large number of associated faculty members, and a strong supporting Graduate Division.

Activities of the Engineering Experiment Station are centered in several major areas: chemical sciences, electronics, high temperature materials, industrial and economic development, nuclear and biological sciences, and physical sciences. Within these areas specific research strengths have been developed in such diverse fields as micromeritics, cryogenics, fertilizer technology, mineral engineering, metallurgy, water chemistry, electronic communications, radar, applied electromagnetics, materials engineering, ceramic processing, economic resource analysis, biology and bioengineering, radiation chemistry, neutron and reactor physics, solid state physics, crystal physics, biomedical instrumentation, and computer techniques.

The Engineering Experiment Station also provides a wide variety of services to the Institute, the business and industrial community, and the city, state and nation. These include industrial product development, management and technical assistance in economic development, management and technical assistance to business and industry, technology transfer, professional guidance and assistance in economic development principles and techniques, nuclear and reactor services, radiation safety control, and electron microscopy.

Results of many of the research and service projects conducted by the Engineering Experiment Station are made available to the public by publication in technical journals, in special reports, and through Georgia Tech's bimonthly newsletter, Tech Topics. Matters of interest to the state-wide industrial development community are reported monthly in the Georgia Development
News.

In facilities, research volume, and staff, the Engineering Experiment Station is one of the largest state engineering experiment stations in the nation. The principal sources of financial support are the United States Government, by means of research contracts administered through the Georgia Tech Research Institute; private industry, through contracts for specific research projects; the State of Georgia, by means of appropriations through the Board of Regents; and gifts, grants-in-aid, and endowments.

At the end of the 1970-71 fiscal year, the Station employed the full-time services of 325 professional, technical, and support personnel and the part-time services of an additional 225 persons. Over 200 graduate and undergraduate students were employed during the year, and 60 shared faculty members participated in Station projects. Total Station income was $7 million, and nearly 700 research and service projects were active during the year.

Whenever feasible, advanced undergraduate and graduate students are employed on projects in the Engineering Experiment Station to afford them direct experience and training in research and development activities and, when possible, provide support for graduate thesis work.

RESEARCH STAFF

Engineering Experiment Station faculty members and professional staff are listed among the General Faculty beginning on page 393.
THE DEPARTMENT OF CONTINUING EDUCATION

Director—Richard Wiegand; Associate Director—Robert S. Herndon; Assistant Director—George H. Adams; Coordinator—J. K. Collins; Principal Clerk—Edward J. Sprole; Audio Visual Technician—Mitchel Morgan; Principal Secretary—Rena Bond; Senior Secretary—Sandra Houston; Secretaries—Barbara Caminiti, Marylen Phillips, Debbie Stegemoller, Sherry Tracy; Duplicating Equipment Operator—Albert Brown.

The industrialist and the educator share the responsibility of keeping the professional college graduate abreast of the forward strides being made by the dynamic and burgeoning technology of this century. The Department of Continuing Education conducts up to 200 programs annually in various subjects to help college graduates and others keep pace. All offerings of the Department are non-credit.

These courses are conducted in specially equipped classrooms on the campus. In addition to these special facilities, the Department has access to regular Georgia Tech classrooms and laboratories which have been made available through the cooperation of the various schools and departments.

Skilled and experienced teaching personnel—and specialists from business and industry—are secured to provide the best in instruction.

Courses, though scheduled for a short duration of time, are very intensive in subject coverage. Special technical and management short courses, as well as conferences and institutes, train key industry personnel by providing information and instruction on new developments and best methods. In addition to these courses, other short courses prepare the engineering and/or professional graduate for state professional examinations.

Short course work emphasizes close cooperation with industry, trade associations, technical, scientific, and business organizations in planning and presenting these special educational programs.
SOUTHERN TECHNICAL INSTITUTE
Marietta, Georgia

General Objectives

The Southern Technical Institute is the unit of the Engineering College of the Georgia Institute of Technology designed for the student who desires to become an Engineering Technician or an Engineering Technologist.

Ten two- and four-year engineering technology programs leading to the Associate or Baccalaureate degree are offered: Architectural Engineering Technology, Civil Engineering Technology (Surveying and Construction Option), Civil Engineering Technology (Structural Materials and Design Option), Electrical Engineering Technology (Electronics Option), Electrical Engineering Technology (Electronic Computer and Control Option), Industrial Engineering Technology, Industrial Engineering Technology (Management Option), Mechanical Engineering Technology, Textile Engineering Technology, and Textile Engineering Technology (Apparel Manufacturing Option).

These curricula are designed to provide the basic scientific training, the specialized technical "know-how," and the supervisory and management training needed by the engineering technician. The courses are briefer, more intensive, and more specific in purpose than those of the professional engineering curricula, although they lie in the same fields of industry and engineering. Their aim is to prepare the individual for specific technical positions or lines of activities rather than for broad sectors of engineering practice.

Engineering Technician and Engineering Technology

An engineering technician is one whose education and experience qualify him to work in those areas of engineering which require the application of established scientific and engineering knowledge and methods, combined with technical skills, in the support of engineering or scientific activities toward the accomplishment of engineering objectives.

The engineering technician is the newest member of the Engineering Team. This team is composed of the scientist, the engineer, the engineering technician, and the craftsman. His addition to the team resulted from what may be called the impatience of the 20th century. Prior to World War II the lapse-time between a scientific discovery and its application was 6 to 10 years. Today our technology is moving so fast that this time is now 3 to 6 months or less.

This increasing pressure to move more quickly from experiment to product requires engineers to witness, interpret, and make use of scientific discoveries almost as they occur. This change in engineer's work requires engineering education to be more and more in the area of advanced mathematics and the physical sciences, and less and less in applied or operational engineering fields. Today an engineer's work is generally concerned with development and design rather than with applied or operational engineering work.

Because the engineering arts and skills are essential to industry, the American Society for Engineering Education has sponsored the Engineering Technology Program with curricula designed to fill the educational gap caused by the change
in the engineer's work and to train men qualified to take over much of the operational engineering work formerly done by large segments of the engineering profession, thus freeing engineers for engineering work requiring a much more scientific and mathematical background.

The engineering technician is concerned with the production and operational aspects of engineering and industry, and he performs specific tasks which usually embrace a specialized field of research, design, development, or construction; or of control and operation of production facilities and manpower.

Graduates from engineering technology courses are in great demand. Engineering technicians with several years' experience have advanced to top positions in engineering, management, and architectural areas.

A full-time day program is available at the Southern Technical Institute campus at Marietta, Georgia. Two academic years or six quarters are required to complete the Associate in Engineering degree programs, and four academic years or twelve quarters are required to complete the Bachelor of Engineering Technology degree programs. For complete information regarding this school write for its special catalog.

Southern Tech also makes six of its eleven curricula available on a part-time schedule in evening classes on the Southern Tech campus. These are Architectural Engineering Technology, Civil Engineering Technology, Electrical Engineering Technology, Industrial Engineering Technology, Industrial Engineering Technology (Management Option), and Mechanical Engineering Technology. Those who work in Atlanta's metropolitan area may thus avail themselves of the opportunity of obtaining this type of training through evening study.

The job opportunities for engineering technicians are numerous. Studies made by the American Society for Engineering Education reveal that two engineering technicians are needed for every engineer. The Associated Industries of Georgia estimates that there are, in Georgia alone, 5000 well-paying positions for trained engineering technicians, at salaries ranging upward from $7500 per year.

The work offered qualifies the engineering technician graduate for a rapidly expanding number of technical jobs in engineering. His work is closely related to that of the graduate engineer and, in fact, the two usually work as a team.

A special bulletin containing complete information will be sent upon request. Direct such requests to the Registrar, Southern Tech, Marietta, Georgia.

**Entrance Requirements**

Applicants must be high school graduates or equivalent and must have two credits in algebra, one credit in geometry, two credits in science, and four credits in English. Applicants must have also taken the College Entrance Examination Board Scholastic Aptitude Test (Verbal and Mathematical), and the College Entrance Examination Board Achievement Tests in English and Mathematics (Level I—Standard).
Veteran’s Program
Veterans are eligible to enter the Institute under the G. I. Bill of Rights, as established under Public Laws 89-358, 634, 815, and 90-77.

Tuition and Fees
The rates for fees, board, and room are subject to change at the end of any quarter.

DAY CLASSES AND EVENING CLASSES

Full-Time Schedule (12 or More Hours)

<table>
<thead>
<tr>
<th>Matriculation Fee per Quarter</th>
<th>Tuition Fee per Quarter</th>
<th>Medical Activity Fee per Quarter</th>
<th>TOTAL FEES Per Quarter</th>
<th>TOTAL FEES Per Academic Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident of Georgia .......... $110.00</td>
<td>$3.50</td>
<td>$9.00</td>
<td>$122.50</td>
<td>$367.50</td>
</tr>
<tr>
<td>Non-Resident of Georgia .......... $110.00</td>
<td>$110.00</td>
<td>$3.50</td>
<td>$9.00</td>
<td>$232.50</td>
</tr>
</tbody>
</table>

Part-time Schedule (Fewer Than 12 Hours)

<table>
<thead>
<tr>
<th>Resident of Georgia $10.00 per hour</th>
<th>Non-Resident of Georgia $20.00 per hour</th>
</tr>
</thead>
</table>

Day and Evening School students carrying fewer than 6 hours are not required to pay the $3.50 medical fee nor the $9.00 activity fee. Part-time students, however, do not benefit from the medical services that the full-time students do.

THE ABOVE RATES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

The Southern Technical Institute in cooperation with the State Department of Education offers Industrial Education and Firemanship Training Courses over the State as described below. No fees are charged for these courses.

Industrial Education
In conformity with the provisions of the various vocational education acts, this department, in cooperation with the State Department of Education, has a responsibility for training industrial, fire service, and related technical teachers for the following.

1. Evening and part-time classes in public schools and industrial and fire service organizations.
2. All day public trade schools.
3. Supervision courses.

The activities of the department include research to determine specific industrial and fire service education needs of a community, industry or plant; developing courses of study to meet these needs; selecting teachers of the required occupational experience; training these teachers for specialized service,
developing specialized instructional materials for use by such teachers; training local teacher trainers in the larger centers; and improving teachers in service after placement.

Because of the specialized local character of this extension work all activities are conducted under special arrangements between the Georgia Institute of Technology, the Georgia State Department of Education, local boards of education, and industrial and fire service organization. The following courses and other activities are conducted at many localities in the state: principles and organization of industrial education, conference leading, methods of teaching, industrial education psychology, course planning, practice teaching, industrial plant surveys, teaching related subjects, and occupational analysis.

The Georgia Fire Institute

The Georgia Fire Institute was established in the Industrial Education Department in 1958 by the Board of Regents through a special appropriation by the State. It is a coordination of both the Georgia Institute of Technology and the State Department of Education, co-operating with local boards of education and fire departments, for amplifying the program of fire service training that has been in development for many years by these agencies. Its aim is the optimum training of Georgia firemen, paid and volunteer, public and private, to reduce and hold to the minimum Georgia's loss of life and property by fire.

Throughout the State the Fire Institute conducts short and long-time classes in local fire departments, short intensive zone fire schools in the special fire service problems of various sections of the State, and short intensive statewide fire schools. In the latter it is successor to the former Georgia State Fire College. The training includes the techniques and technologies of fire prevention, inspection, extinguishment, rescue, and investigation, and fire department officership and administration.
Library

Director of Libraries—E. Graham Roberts; Associate Director—Arthur T. Kittle; Head, Research Services Division—Mrs. Anne P. Bugg; Head, Reference Department—Miss Jean Kirkland; Reference Librarians—Miss Christine Elkington, Miss Vivian Hayes, Miss Louise W. Lewis, Mrs. Mary Jane Montesinos, Miss Pamela E. Pickens; Head, Department of Library Instruction—Miss Frances E. Kaiser; Head, Information Exchange Center—Miss Ruth C. Hale; Coordinator of Services to Business and Industry—James B. Dodd; Head, Circulation Department—Mrs. Patricia V. Martin; Circulation Librarians—John E. Poe, Rolly L. Simpson; Head, Book Acquisitions Department—Mrs. Beatrice R. Caine; Head, Periodical Acquisitions Department—Mrs. Carolyn B. DallaValle; Head, Serials Acquisitions Department—Mrs. Linda Kay Beinke; Head, Gifts and Exchange Department—Mrs. Helen R. Citron; Acquisitions Librarians—Miss Janet L. Bogle, Mrs. Marilyn L. Williamson; Head, Processing Department—Mrs. Elita L. Moyers; Head, Catalog Department—Miss Mildred G. Emmons; Catalog Librarians—James R. DeJarnatt, Miss Frances K. Drew, Miss Maryellen LoPresti, Mrs. Jeanne C. Magill, Mrs. Mary M. Thigpen, Mrs. Helen S. Walzer; Head, Data Processing Department—John P. Kennedy; Data Processing Assistants—Mrs. Teresa Chan, Miss Sharon L. Gaskill, Mrs. Julia C. Gwynn; Architecture Librarian—Mrs. Ann M. Bottomy; Government Documents Librarian—C. R. Leacy; Map Librarian—Miss Barbara J. Walker; Patents Librarian—Miss H. Safford Harris; Other Non-Academic and Clerical Assistants—Miss Jane F. Albrecht, Miss Lucy A. Bigham, Mrs. Rosemary B. Boone, Mrs. Carolyn R. Branton, Mrs. Bonnie Brown, Mrs. Rebecca S. Champaign, Miss Deborah Corbett, Mrs. Cynthia J. Goetze, Mrs. Angela L. Helm, Mrs. Catherine M. Hernandez, Mrs. Betty A. Hilburn, Mrs. Joan R. Hoffman, Mrs. Dianne B. Hopkins, Mrs. Frances S. Jacobs, Mrs. Brandel L. Jones, Mrs. Evelyne M. Kamat, Miss Mary H. Lumpkin, Mrs. Rebecca C. Marks, William H. Marks, Mrs. Catherine M. McBrayer, Mrs. Kathleen B. McCrory, Miss Melodey J. Mozeley, Miss Mary V. Nease, Mrs. Marcia R. Otwell, Mrs. Lola S. Paille, Miss Julia L. Rotenberry, Mrs. Evelyn B. Sellers, Miss Marsha Springs, Miss Kathy S. Stumphf, William A. Thompson, Miss Terry T. Uyeno, Howard W. Voigt, Miss Florence Washington, Mrs. Barbara S. Waters.

The Price Gilbert Memorial Library is a centralized scientific, technical, and management collection of 729,000 volumes plus 688,000 microtext and other bibliographic units. These materials are housed in adjoining structures designed to accommodate one million volumes and seat 2,000 users.

The Library's collection of over one million patents is the largest in the Southeast. In 1962 the Library was designated one of twelve federal scientific report centers. Its collection of documents from the Atomic Energy Commission, Department of Defense, National Aeronautics and Space Administration, and the National Technical Information Service now totals 500,000 titles. Extensive files of British standards and specifications and those issued by
American associations and societies are maintained. The Library is also a depository for government publications issued by the U.S. Government Printing Office for maps issued by the U.S. Army Topographic Command (TOPCOM). The government documents collection includes 175,000 publications and maps number 68,000.

The Library currently receives over 9,300 serials, including 5,000 periodicals. Approximately 75 percent are in scientific and technical fields. Especially strong is the collection of abstracts, indices, and bibliographies for science and engineering.

The impact of the Library's collection extends far beyond the campus. Last year the most frequent off-campus users were academic institutions and industrial firms in 45 states and 10 foreign countries.

In 1966 the Library was selected by the Library of Congress as one of 16 libraries in the U.S. to participate in the Marc I pilot project to experiment with converting library catalog records to machine readable form. The cataloging for all material processed by the Library since January 1, 1966, is now in machine-readable form. Serial records have also been computerized and, because of the largely serial nature of scientific and technical publications, approximately 85 percent of the Library's holdings are recorded on magnetic tape.

The Georgia Institute of Technology is associated with Agnes Scott College, Columbia Theological Seminary, Emory University, Atlanta Art Institute, Atlanta University, Georgia State University, Oglethorpe College, and the University of Georgia in developing a University Center in the Atlanta area. A union catalog of the library materials of these cooperating institutions is maintained. All these resources are available to Georgia Tech students and faculty.

The Library is also affiliated with the University of Georgia's Information Dissemination Center which provides computer-based searches of published literature. Magnetic tape files are available covering the fields of chemistry, biology, nuclear science, physics, geology, and engineering. Requests for literature searches are handled through the Georgia Tech Library's Research Services Division.

All books, not reference or held on reserve, may be withdrawn for home use. The Library is open from 8:00 a.m. to 12 midnight Monday through Friday; from 8 a.m. to 6 p.m. Saturday; and from 2 p.m. to 12 midnight Sunday.
OFFICE OF THE DEAN OF STUDENTS

Dean of Students—James E. Dull; Dean of Students Emeritus—George C. Griffin; Associate Dean of Students—W. Eugene Nichols; Administrative Assistant—Mary Lou Smith; Secretary—Linda Purdy.

The Dean of Students Office supervises extracurricular activities and student services. It is the focal point in the administration of affairs concerning the life of students in all but the academic field. The importance of the student as an individual is emphasized through activities such as new student orientation, dormitory programs, international student affairs, student publications, radio communications, fraternity and sorority activities, Student Government student clubs, and Student Center programs. The Dean of Students Office also offers individual counseling, guidance and testing services, makes available medical and psychiatric facilities, aids in the programming of religious activities, and provides opportunities for community service involvement and leadership development. In addition, the office has the responsibility and concern for student discipline.

The principle goal of the Dean of Students Office is to assist the student in making the best possible adjustment to college life and to gain the best possible benefit from being a member of the college community through participatory involvement.

Health Services

Director of Health—John A. Wilhelm, M.D.; Administrator—Philip J. W. Junot; Physicians—Ralph A. Elliott, M.D., McClaren Johnson, Jr., M.D., Hugh Walker, M.D.; Medical Consultant and Physician to Athletic Association—Lamont Henry, M.D.; Radiologists—Albert A. Rayle, Jr., M.S., J. Frank Walker, M.D.; Nurse Supervisor—Mrs. Winifred Cooper, R.N.; Night Supervisor—Mrs. Leslie Beavers, R.N.; Nurses—Mrs. Ella Anderson, R.N., Mrs. Anne Hogan, R.N., Mrs. Marie Steiner, R.N., Miss Patricia Hunter, R.N., Mrs. Kathryn Holcomb, R.N., Mrs. Mildred Moore, R.N., Mrs. Martha Trnavsky, R.N.; Technicians—Miss Lynda Black, Miss R. Jane Allen, Virgil E. Lloyd; Receptionists—Mrs. Deborah Montforo, Miss Bernice Muffley, Miss Gail Steiner; Consultant Psychiatrist—Sidney P. Isenberg, M.D.

The Health Service aims to keep each Georgia Tech student in the best possible mental and physical health by utilizing the most modern preventive and therapeutic techniques available and keeping in mind the problems peculiar to college students and their welfare.

Counseling Center

Director—Dr. James A. Strickland; Assistant Director—Dr. T. Thomas McMurrain; Counselors—Nathan T. Pierce, Mrs. Mary H. Rossman; Psychometric Assistants—Mrs. Beverly F. Haynes, Mrs. Emily S. Quinn; Secretary—Mrs. Judy L. Bruce.
The Counseling Center, located on the second floor of the Dean of Students Building, is a popular place for students to come for help with almost any difficulty. Professional counselors, over the years, have helped students with such difficulties as choosing another college better suited for them, choosing a career, improving study habits, and solving test anxiety, marital difficulties, social difficulties, and emotional difficulties. The counselor keeps all information confidential and no information is released to anyone unless the student requests such release in writing.

Additional services available include a library of career information, catalogs from other colleges and universities, and applications for national testing programs required for admission to law, business, and graduate schools. A wide variety of interest, personality, and ability tests are available to help the student.

An appointment for counseling can be made either by coming to the Counseling Center or by telephoning 894-2575.

Housing

Director—Gary J. Schwarzmueller; Business Manager—Raymond S. Gent; Housing Staff Coordinator—Rudy F. Xavier II; Operations and Activities Coordinator—Lon Weston; Womens Dormitory Director—Doris A. Bowers; Senior Clerk, Married Student Housing—Mrs. Irma J. Morris; Senior Secretary—Mrs. Deborah T. Jones; Secretaries—Gwendelyn M. Davis, Margie S. Strickland.

The housing administration, organization, and operation is intended to express the individual student’s personal responsibility for the development of social competence, the values of group living and practice in democratic processes, the elevation of scholastic standards, and the fostering of a high academic atmosphere.

Student Center

Director—Tim F. Mitchell; Assistant Director—Edwin P. Kohler, II; Assistant to the Director, Business—Walter H. Tripod; Program Director—Donald R. Nelson; Activities Coordinator—Pete S. Matrangos; Crafts Coordinator—Jane L. Willey; Recreation Coordinator—William C. Nixon; Arts-Music Coordinator—Becky R. Kirkland; House Coordinator—Rex W. Allen; Night Manager—Thomas P. Fletcher; Food Service Director—James R. Greene; Dining Hall Manager—Mary Alice Burke; Office Manager—James R. Holder; Principal Secretary—Vickie L. Frush; Senior Secretary—Mary Kay Daly; Secretary, Activities—Marilyn Umen; Secretary, Student Government—Diane S. Thompson; Secretary, Bookkeeping/
Records—Jan N. Oglesby; Scheduling Secretary—Reda M. Lucas; Secretary, Organizations—Linda A. Calhoun; Receptionist—R. Sue Cooper.

The Georgia Tech Student Center organization, operation, and administration exists and functions as a focal point of the total campus community. It serves an important role in providing a well-rounded education for the Georgia Tech student. Through its facilities and activities, students have a greater opportunity to learn from each other and from the faculty in an extra-educational association. Students gain increased opportunities for self-expression by creating and directing various programs within the Center. These programs also foster increased communication and interaction with the outside community, thus broadening the scope of campus life. The Student Center has become a campus living room—a place where students, faculty, alumni, and guests can become better acquainted and can work together toward meeting the individual's needs for a complete education.

Community Service and New Student Orientation

Director—Donald R. Nelson; Secretary—Mrs. Lillian Welch.

Involvement, whether in campus activities or community services, is an important aspect of the total educational experience. At Georgia Tech there are a number of programs that direct the unique skills, ingenuity, vocational interest and concerns of the students and faculty to the growing needs of the community, while expanding the student's educational experience. Community service at Tech is designed to apply the resources of the university with its academic direction to the needs of the community and to provide creative outlets for individual response to social problems.

New Student Orientation is designed to familiarize the new student with the activities and academic programs at Georgia Tech as well as the traditions, services, and opportunities on campus.

Women Students

Dean of Women—Judith E. Priddy; Secretary—Nora Bennett.

Women students are now enrolled in all degree-granting areas, having first been admitted to Georgia Tech in 1952. It is the intention of the Institute to accept as many qualified female students as do apply.

Tech women have the opportunity to be a part of a small exclusive group in the midst of an internationally known institution. They are actively involved in all phases of campus life. Tech women participate and hold leadership positions in many campus organizations, while primarily concentrating on: Women's Student Association; Women's Dormitory Council and Judiciary; and Alpha
Gamma Delta and Alpha Xi Delta sororities. Presently, there are two dormitories for women students at Tech.

**International Students**

*Assistant Dean of Students (International Student Advisor)—W. Miller Templeton; Secretary—Dianne Junkins.*

Traditionally, Georgia Tech has one of the highest percentages of students from other countries of any technical college in the Southeast. Usually, each year there are approximately 400 students from 60 foreign countries.

Realizing that attending an American university for the first time is a completely new experience for most international students, the Dean of Students Office has created the staff position of International Student Advisor (ISA). The ISA has the responsibility for helping students from other countries adjust to Georgia Tech and to the American culture and customs. He offers frequent help to the students in their dealings with the Immigration and Naturalization Service and maintains a supply of all necessary INS forms and papers. He is available to help with any problem or situation which rises out of their unfamiliarity with the American college environment. The office also offers continuing programs to promote intercultural understanding and adjustment.

**Fraternity Affairs**

*Assistant Dean of Students—Garry M. Bledsoe; Secretary—Mrs. Beth Hightower.*

The fraternity system exists to provide students with a self-governing organization in which each student, in association with his fraternity, may further his personal development and achieve his personal goals. Through friendly association and allegiance to common goals fraternities seek to develop in their members attitudes and skills which will enhance the educational experience offered by Georgia Tech. Fraternities provide social and recreational activities for their members as well as intramural athletic competition, social service projects, scholarship programs, and opportunities to live in a house which offers living, dining, and social facilities.
STUDENT ACTIVITIES

Student organizations and related activities at Georgia Tech are associated with a responsible Student Government which, in cooperation with the office of the Dean of Students, utilizes Student Center resources, facilities and staff and student life on the campus. The focal point is the Student Council and Graduate Senate which provide the means for self-governance in all areas of institutional student-related activity.

Student Government – 1971-72

Through the Student Council and the Graduate Student Senate, the student body maintains responsible self-governance. The various committees of the Student Government provide the student body with valuable services and constructive action within the Institute.

Student Council

The Student Council is the governing unit for the undergraduate student body. The Council, which was first established in 1922 by ANAK, is composed of representatives from each degree-granting department of the Institute and from each class. The Council is headed by the Student Body President and Vice President.

Officers

Chris Bagby, Student Body President
Ron Ovetsky, Student Body Vice President
Philip Motley, Judiciary Cabinet Chairman
Susie Owens, Secretary of the Student Council
Lou Isaf, Treasurer of the Student Council
James E. Dull, Faculty Advisor

Senior Class Representatives:

Stan Baumgartner, President
King Sidwell
Mike Skillman

Junior Class Representatives:

Chris Parker, President
Lou Isaf

Tom McCoun
Paul White
Freshman Class Representatives:

Gery Vornbrock, President
Dean Alford
Ed Boggs
Richard Carling

Departmental Representatives:

Charlie Mallis, A.E.
Randy Pope, A.E.
Rob Rivers, Arch.
Jack O’Neill, Biol.
Howard Whitehead, Cer.E.
Rocky Von Dullen, Chem.
Don Williams, C.E.
Steve Hendrix, Ch.E.
Brian Savory, E.E.
Meade Sutterfield, E.E.
Bill Williams, E.E.
Tom Britton, E.S.M.

Co-op Representatives:

Bill Brooksbank
Jim Cook
Ray Helton

Members at Large:

Don Dinur

Honorary Members:

Margaret Crawford, WSA Representative
Arnoldo Ramirez, ISO Representative
Rush Smith, Technique Editor

Graduate Student Senate

The Graduate Student Senate is the governing unit of the graduate student body. The Senate was first established in 1959 as an Ad Hoc Committee to represent the graduate students on the issue of football seating and since has grown to
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encompass all phases of graduate student problems. The representatives are
elected from the various departments of the graduate school. The Senate is led
by a group of officers known as the Executive Committee, who are elected by
the entire graduate student body.

Officers:

Jesus Léon, President of the Graduate Student Body
Tom Christian, Executive Vice President
Victor Walsh, Vice President for Student Affairs
Harold Hite, Co-ordinating Vice President
A. B. Cottingham, Treasurer
Henry Paris, Corresponding Secretary
John Jackson, Recording Secretary

Graduate Student Departmental Representatives:

John F. Madden, A.E. James Altman, I.E.
Michael F. Stewart, Biol. Robert Baxley, I.E.
James W. Stendera, Cer.E. Lee Ettinger, I.E.
Sherman Glass, Ch.E. T. M. Swicord, I.M.
John W. Goodrum, Ch.E. Mike Benoit, I.M.
M. P. Fortune, Jr., Chem. Dyches V. Boddiford, I.C.S.
Larry Whisenant, Chem. C. A. Parsons, I.C.S.
Jeffrey H. Blood, C.P. G. E. Giles, Jr., M.E.
Robert W. Howard, C.E. Calvin Jameson, M.E.
James R. Williams, C.E. Paul Stansbury, N.E.
John H. Lockhart, Jr., C.E. Sam Hobbs, N.E.
Pierce Cantrell, Jr., E.E. Joseph Catapano, Phys.
Victor Walsh, E.E. Harry Ellis, Phys.
Tom Hayes, E.E. Dianne Bradford, Psy.
Joseph D. Morgan, E.S.M. Renney H. Mackay, Tex.

Board of Student Publications:

This Board was organized in July, 1945, at the request of the Student Council
and is responsible for all student publications on the Georgia Tech campus. Officers of the Board for 1971-72 are:

Chairman and Treasurer—Dean W. Eugene Nichols; Secretary—Ronald Ovetsky.
The Interfraternity Council is composed of representatives from each fraternity and sorority at Georgia Tech and is the governing body of all fraternities at the Institute. The Council coordinates such activities as Greek Week, the Fraternity Buying Cooperative, membership requirements, and regulations pertaining to chapter activities.

**Officers 1971-72**

**I.F.C.**
- Richard F. Rodgers, Jr. .................................................................President
- Gerald W. Staton, Jr. .................................................................Executive Vice President
- Jim E. Brown .................................................................Administrative Vice President
- Andrew C. Oliver, III .........................................................Secretary
- Charles Cohn, II .................................................................Treasurer
- Garry M. Bledsoe .................................................................Faculty Advisor

<table>
<thead>
<tr>
<th>Fraternity</th>
<th>President</th>
<th>Advisor</th>
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<tbody>
<tr>
<td>Alpha Epsilon Pi</td>
<td>N. Lefkove</td>
<td>P. Aronin</td>
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<tr>
<td>Alpha Tau Omega</td>
<td>N. Anderson</td>
<td>P. T. O'Connor</td>
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<td>H. Morgan</td>
<td>H. L. Baker</td>
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<tr>
<td>Chi Phi</td>
<td>D. Hallman</td>
<td>P. Sherry</td>
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<tr>
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<td>D. Miller</td>
<td>A. F. Abril</td>
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<td>J. Mansfield</td>
<td>W. H. Tripod</td>
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<td>J. J. Bynum</td>
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<td>B. A. Gilbreath</td>
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<td>J. H. Murphy</td>
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<td>J. Stepp</td>
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<td>G. Davis</td>
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<td>R. Enzweiler</td>
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<td>Phi Kappa Tau</td>
<td>J. Rinkehart</td>
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<td>Phi Kappa Theta</td>
<td>R. A. Lamar</td>
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<td>Phi Sigma Kappa</td>
<td>S. Simony</td>
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<td>K. Ebert</td>
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<td>Pi Kappa Phi</td>
<td>J. E. Smith</td>
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<td>R. Jackson</td>
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<tr>
<td>Sigma Chi</td>
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<tr>
<td>Sigma Nu</td>
<td>T. Sanville</td>
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<td>Sigma Phi Epsilon</td>
<td>B. Turner</td>
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<td>Tau Kappa Epsilon</td>
<td>P. Martin</td>
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<tr>
<td>Theta Chi</td>
<td>T. Cyr</td>
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<td>Fraternity</td>
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<td>Theta Xi</td>
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<td>P. Mayer</td>
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<td>C. Cohn</td>
<td>R. W. Larson</td>
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<tr>
<td>Psi Upsilon (Colony)</td>
<td>A. W. Powell</td>
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<tr>
<td>Alpha Xi Delta</td>
<td>J. Halyburton</td>
<td>R. Stiemke</td>
</tr>
<tr>
<td>Alpha Gamma Delta (Colony)</td>
<td>S. Owens</td>
<td>J. E. Priddy</td>
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**PROFESSIONAL AND TECHNICAL SOCIETIES**

**Departmental Societies**

<table>
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<th>Departmental Societies</th>
<th>Faculty Advisor</th>
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<tbody>
<tr>
<td>Alpha Kappa Psi</td>
<td>A. F. Abril</td>
</tr>
<tr>
<td>American Association of Colorists and Chemists</td>
<td>L. F. Porter</td>
</tr>
<tr>
<td>American Ceramic Society</td>
<td>J. F. Bensel</td>
</tr>
<tr>
<td>American Institute of Aeronautics and Astronautics</td>
<td>D. P. Giddens</td>
</tr>
<tr>
<td>American Institute of Architects</td>
<td>W. W. Howell</td>
</tr>
<tr>
<td>American Institute of Chemical Engineers</td>
<td>J. W. Mason</td>
</tr>
<tr>
<td>American Institute of Industrial Engineers</td>
<td>T. L. Sadosky</td>
</tr>
<tr>
<td>American Marketing Association</td>
<td>L. A. Neidell</td>
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<tr>
<td>American Nuclear Society</td>
<td>J. M. Kallfelz</td>
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<tr>
<td>American Society of Civil Engineers</td>
<td>M. Hampton</td>
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<td>Beta Beta Beta (Sigma Chapter)</td>
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</tr>
<tr>
<td>Delta Sigma Pi (International Fraternity)</td>
<td>M. J. Garcia</td>
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<td>Industrial Design Students</td>
<td>W. J. Seay</td>
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<tr>
<td>Institute of Electrical and Electronics Engineers</td>
<td>T. M. White</td>
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<tr>
<td>Planner’s Society</td>
<td>M. G. Little</td>
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<tr>
<td>Psi Society (Psychology)</td>
<td>E. Jo Baker</td>
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<tr>
<td>Society of Automotive Engineers</td>
<td>W. Williams</td>
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<tr>
<td>Society of Physic Students</td>
<td>I. R. Gatland</td>
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<tr>
<td>Society for Advancement of Management</td>
<td>J. Armstrong</td>
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**Departmental Honorary Societies**

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<tr>
<td>Alpha Pi Mu</td>
<td>D. E. Fyffe</td>
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<td>Arnold Air Society</td>
<td>R. V. Dean</td>
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<td>J. W. Mason</td>
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<td>Delta Kappa Phi</td>
<td>H. Olson</td>
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<tr>
<td>Eta Kappa Nu</td>
<td>J. Connelly</td>
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<tr>
<td>Kappa Kappa Psi</td>
<td>B. L. Sisk</td>
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<td>Keramos - Professional Ceramic Engineering Fraternity</td>
<td>A. T. Chapman</td>
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<td>Pi Mu Epsilon</td>
<td>J. M. Osborn</td>
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<td>Pi Tau Sigma, M. E. Honorary Fraternity</td>
<td>H. L. Johnson</td>
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<tr>
<td>Scabbard and Blade</td>
<td>T. C. Kildebeck</td>
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<td>Sigma Gamma Tau Society</td>
<td>D. W. Dutton</td>
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<td>Tau Sigma Delta</td>
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Honorary Organizations

ANAK ................................................................................................ W. R. Beard
Beta Gamma Sigma ........................................................................ J. L. Fulmer
Briarean, Section I .................................................................
Briarean, Section II .................................................................
Keoseme Society ........................................................................ P. B. Sherry
Omicron Delta Kappa (ODK) ..................................................... W. Flinn
Order of Omega ........................................................................... G. M. Bledsoe
Phi Eta Sigma ........................................................................... A. H. Bailey
Phi Kappa Phi ........................................................................... D. W. Dutton

Religious

Baptist Student Union ........................................................... D. E. Briscoe
Campus Crusade for Christ .................................................. D. McGill
Catholic Student Center ......................................................... M. DiLella
Christian Science Organization .............................................
Episcopal Church on Campus .................................................. P. C. Cato
Inter-Varsity Christian Fellowship .......................................... B. Lowrey
King's Men ................................................................................ R. E. Green
Lutheran Student Association ................................................ D. A. Donges
Navigators ................................................................................ C. Bollar
Presbyterian Student Center ................................................... W. McKay, Jr.
Wesley Foundation ................................................................. J. L. Underwood
YMCA .......................................................................................... C. O. Parker
Hillel ......................................................................................... H. Epstein

Miscellaneous

Afro-American Association .....................................................
AIESEC ....................................................................................... J. A. Knutsen
Alpha Phi Omega ..................................................................... D. L. Morgan
Angel Flight ............................................................................... R. V. Dean
Aqua-Jackets ........................................................................... D. R. Blakely
Barbell Club ............................................................................... W. M. Templeton
Bulldog Club ............................................................................. T. Plaxico
Cheerleaders ............................................................................ W. Templeton, J. Priddy
Chess Club ................................................................................
Chinese Club ............................................................................ J. T. S. Wang
Circle-K Club ............................................................................ J. A. Strickland
Co-op Club, Section I ............................................................. F. E. Roper
Co-op Club, Section II ............................................................ G. P. Rodrigue
Counter-Insurgency Unit of Georgia Tech ......................... R. B. Williams
Dames Club ............................................................................

Organizations / 345
Drama Tech ................................................................. A. Frank
Executive Roundtable ...................................................... J. B. Peatmen
Flying Club ..............................................................................
Free University ................................................................. P. B. Sherry
Gamma Beta Phi ................................................................. C. C. Rogers
Glee Club ............................................................................... J. L. Black
Graduate Student Senate ................................................. S. C. Webb
IAESTE ...........................................................................
Interdormitory Council ................................................ G. Schwarzmueller
Interfraternity Council ................................................ G. M. Bledsoe
International Student Organization .................................. W. M. Templeton
Judo Club ............................................................................... H. S. Min
Pan American Union ......................................................... W. M. Templeton
Pershing Rifles .................................................................
Photography Club ........................................................... P. S. Matrangos
Pistol Team ........................................................................... W. R. Morningstar
Political Forum ..................................................................... R. D. Johnson
Radio Club .............................................................................
Ramblin’ Reck Club ........................................................... W. M. Templeton
Rifle Team ............................................................................. W. R. Morningstar
Sailing Club ....................................................................... R. J. Gerdes
Soccer Club ........................................................................... M. Crowl
Sport Parachute Club ........................................................ A. J. Seremeth
Sports Car Club ............................................................... P. B. Sherry
Student Center ................................................................. T. F. Mitchell
Student Council ................................................................. J. E. Dull
T Club ................................................................................... B. Williamson
Tech Band .............................................................................. B. L. Sisk
USA-USSR Cultural Exchange Program ............................ C. O. Parker
Veterans Club ........................................................................ R. Hutchinson
Women’s Student Association ......................................... J. Priddy
World Student Fund Committee ...........................................
WREK Radio Station ........................................................... J. A. Strickland
Young Republican Club ..................................................... R. W. Allen
UNDERGRADUATE FINANCIAL AID

Financial aid at the Georgia Institute of Technology is intended to assist students in meeting normal college expenses, and it is our intention to help as many students as possible. Our hope is that no student will fail to consider Georgia Tech as a college he might wish to attend because of financial reasons. It is our desire to help, either through our own funds, or by directing the student to other sources. The financial aid applicant should realize, however, that the amount of aid which can be granted seldom meets all the educational expenses, and financial assistance will have to be supplemented by the student, family, or other outside sources.

The Financial Aid Office has the responsibility of administering all funds provided to Georgia Tech for the assistance of undergraduate students. Not only does this office award all financial assistance the institution has for the use of undergraduate students, but it also receives and assigns awards forwarded to the institution from outside agencies for the use of individual students. All students wishing to receive scholarships, loans, or any other type of monetary aid should contact this office for information and service.

INTERNATIONAL STUDENTS may apply for scholarship aid, but due to limited funds and other restrictions, should not normally expect assistance.

TRANSFER STUDENTS will be considered for scholarships, loans, and work opportunities as other entering students and should adhere to the February 1 deadline if they wish assistance for any quarter of the year beginning with the subsequent fall quarter, since all scholarships for enrolled and transfer students are awarded during the summer.

Although the Co-operative program at Georgia Tech is not a financial aid program, many of those who attend are able to assist themselves with their college expenses through this program. One-fifth of the undergraduate enrollment attends under the Co-operative plan and earns from $2,000 to $2,800 per year. Co-op enrollment is restricted to students in the fields of engineering, science, and industrial management. Since financial aid is not a prerequisite for consideration, a student attending under the Co-operative plan will not be denied consideration for other aid because of his enrollment. Students desiring other information on the Co-operative program should write to the Director of the Co-operative Division, Georgia Institute of Technology, Atlanta, Georgia 30332.

Many students obtain part-time employment at Tech or in the Atlanta area. Our Placement Center attempts to keep an up-to-date listing of opportunities and most students will be able to help themselves through part-time employment, if they so desire.

Request for Specific Assistance

Submission of an application for financial aid to the Financial Aid Office will ensure consideration for all programs of aid. However, applicants desiring
specific types of aid should check the appropriate spaces on their applications. All students should indicate the quarters for which they are applying.

**Basic Principle of Financial Aid**

We subscribe to the principle that the primary purpose of financial aid is to provide assistance to students, who, without such aid, would be unable to attend college.

The primary responsibility for financing an education rests with the student and his family. Any financial aid is, therefore, awarded according to individual need and individual college costs. Financial aid includes scholarships, loans, and employment, which may be offered to students singly or in combination.

**Determination of Award**

The family of the applicant is expected to make a maximum effort to assist the student with college expenses. Financial assistance from colleges and other sources should be viewed only as supplementary to the efforts of the family.

The student also has a responsibility of contributing to his college expenses. His resources may include savings, summer earnings, contributions from friends and relatives, etc. Students receiving aid are expected to use part of their summer earnings toward defraying college costs. The following table shows the expected savings from summer employment for freshman and subsequent years.

**Schedule of expected savings from summer earnings**

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
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<tbody>
<tr>
<td>Prefreshman</td>
<td>$400</td>
<td>$300</td>
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<tr>
<td>Presophomore</td>
<td>500</td>
<td>400</td>
</tr>
<tr>
<td>Prejunior</td>
<td>600</td>
<td>500</td>
</tr>
<tr>
<td>Presenior</td>
<td>600</td>
<td>500</td>
</tr>
</tbody>
</table>

Applicants are expected to contribute at least one-fifth of their savings toward each year's college expenses.

**Obtaining and Submitting of Application**

Applications for financial aid may be obtained by calling or writing:

James L. Garner  
Director of Financial Aid  
Georgia Institute of Technology  
Atlanta, Georgia 30332  
(404) 894-4160

Requests for further information on any programs of aid should also be directed to the above address.
**Determination of Need**

The following table lists the amounts that typical families with no unusual problems should normally be able to provide toward each year of college, according to the College Scholarship Service. Families with unusual problems would normally be expected to provide less. (From *A Letter to Parents to Assist in Financial Planning for College* by Sidney Margolius — College Entrance Examination Board — 1972-73.)

<table>
<thead>
<tr>
<th>Net Income before Federal taxes</th>
<th>Number of dependent children</th>
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**Obtaining Proceeds of Awards**

The Georgia Institute of Technology does not have a system of student accounts whereby a student may have funds deposited and obtain them as needed. Any awards granted by the institution to students or forwarded to the institution to be provided to students will be deposited in institutional accounts from which checks will be prepared, made payable to the student, and advanced during registration for each quarter. Annual awards will normally be provided in equal quarterly installments.

If you are granted an award by someone other than Tech, and this money is to be sent to Tech for your use, you should ask that the funds be forwarded at least two weeks before the start of the specific quarter to the attention of the Financial Aid Office. Any instructions or restrictions should be forwarded with the award.

Scholarship checks, both those awarded by the institution and those awarded by other sources, will be available on registration days in the lobby of the Administration Building and thereafter in the Cashier’s Office on the campus. Proceeds from loans granted by the institution may be obtained in the Cashier’s Office.
The student should complete registration, except for payment of fees, before he attempts to receive his award. Proof of registration is required before release of funds.

If you have been notified of an award and are not sure it has been sent to Tech, please inquire about it at the Financial Aid Office. Advances cannot be made until funds are received and late receipt of funds may cause delays or late fee penalties.

**Aid to International Students**

As previously stated, international students will not normally be provided financial aid by Georgia Tech. Almost all funds of the institution are restricted to citizens or permanent residents of the United States.

International students needing monetary assistance should correspond with the American Consulate in their home country or their own Ministry of Education to inquire about other sources of funds.

**Army, Air Force, and Naval ROTC**

Students who have applied for enrollment in the Army, Air Force, or Naval ROTC Program as regular students should complete their applications in the same manner as other students since they may not be notified regarding the results of their competition until it becomes too late to apply for aid.

**Athletic Scholarships**

Under certain circumstances, awards of institutional financial aid may be granted to students with athletic ability being considered as a factor in making the award. The granting of these scholarships or grants-in-aid is administered by the Financial Aid Office. To be considered for an athletic scholarship, a student does not need to submit a regular aid application or the Parents' Confidential Statement. Representatives of Georgia Tech will normally contact those students that they feel are qualified to be considered for athletic scholarships and provide them a letter of intent which may serve as an application for institutional financial aid.

Other students who wish consideration for athletic scholarships should contact the Financial Aid Office stating the reasons they feel they may be qualified.

**CONCEPT INDUSTRIES PRESIDENTIAL AWARDS**

Twenty-five $500.00 awards will be granted to entering freshmen at the Georgia Institute of Technology. These awards are made possible through the generosity of a friend of Georgia Tech. Criteria for the selection of the students for this
Financial Aid

award are as follows:
1. High school average.
2. College Board Scholastic Aptitude Test scores.
3. Leadership as shown through participation and office in school, community, and religious organizations.
4. High school class standing.
5. Financial need for the funds.
Preference would be given to engineering students from Georgia with approximately 75% of the awards being granted to this group. Any other factors that may indicate the overall outstanding ability of the student will be given consideration in the selection process.

FINANCIAL AID—INSTITUTIONALLY ADMINISTERED SCHOLARSHIPS

Scholarships granted to applicants will be assigned from the following funds. Georgia Tech is indebted to many generous individuals, foundations, industries, and other friends for these awards. Information on scholarships in general and specific information about each fund is shown.

Rules and Regulations Governing Undergraduate Scholarships

1. The majority of the scholarships which are available through the Georgia Institute of Technology are restricted to those undergraduates who have high academic ability and good character, but lack sufficient funds to begin or continue their college education.
2. A Georgia Institute of Technology scholarship application is required of each applicant. These forms are available from the Financial Aid Office and must be completed by entering freshmen and transfer students and returned no later than February 15. All other students must submit their application between January 1 and April 1 of the year preceding the term for which the funds are desired. An interview is required when the application is submitted (except for entering freshmen and transfer students who would be required to make a special trip to the campus).
3. The Georgia Institute of Technology is a member of the College Scholarship Service (CSS). Participants in CSS subscribe to the principle that the amount of financial aid granted a student should be based on financial need. The CSS assists colleges and universities and other agencies in determining the student’s need for financial assistance. Therefore, all applicants for financial aid must also submit the Parents’ Confidential Statement (PCS), designating the Georgia Institute of Technology as one of the recipients in accordance with the following:
   a. The parents of all students under 25 years of age must complete the Parents’ Confidential Statement (PCS) each year or sign a statement
provided by the Financial Aid Office that they did not contribute to the student’s financial support for the previous year and did not claim him as a dependent for income tax purposes.

b. If a student is over 25 and has received any financial support from his parents during the preceding year and/or has been declared as a dependent for income tax purposes, the parents must likewise complete the PCS each year. If not, the financial resources of the individual student over 25 will be used in determining the amount of the award.

c. All married students, whatever age, must also complete the Married Students’ Supplement to the PCS.

d. Any exception to the PCS requirements will be considered as individual cases by the Financial Aid Officer.

Entering freshmen and transfer students may obtain PCS forms from their high schools or from the Financial Aid Office, Georgia Institute of Technology, Atlanta, Georgia 30332, and must submit them to CSS no later than February 1. All other students must obtain the Parents’ Confidential Statement forms from the Office of Financial Aid and submit them to CSS no later than April 1.

4. Certain scholarships are renewable provided the recipients continue to demonstrate high scholastic ability, outstanding character, and financial need. A renewal application is required of students for all renewal scholarships. It is the student’s responsibility to complete this and provide any other information that may be required by the institution or sponsor during the deadline periods as established by the Director of Financial Aid.

5. All entering freshmen are required to take the College Entrance Examination Board Scholastic Aptitude Test and “certain” Achievement Tests (dependent upon field of study) prior to acceptance at the Georgia Institute of Technology. Results of these tests will be considered by the Director of Financial Aid in granting awards to entering freshmen.

6. An application for a scholarship cannot be considered until the student has been accepted for admission or is enrolled as a student at the Georgia Institute of Technology. Entering freshmen will be notified of awards not later than June 1; all others will receive notification not later than August 15.

7. A student need not apply for a particular scholarship since his eligibility for any scholarship is established upon receipt of the scholarship application and the Parents’ Confidential Statement.

8. Scholarship payments are made in equal quarterly installments during the academic year. Payments are made to the individual recipient who in turn may apply the payment against his expenses.

9. The proceeds of financial aid awards shall be used for the payment of tuition and required fees, room and board, and similar living expenses and for instructional equipment, materials, and books.

10. The Financial Aid Office must be notified of any unusual changes in family or personal financial situation. This office must also be notified of any additional financial assistance which is received from other sources and it is
understood that such assistance may cause a change in awards that have been offered by Georgia Tech.

11. Financial aid awards may be received only by the student while in school and carrying a full load (12 or more hours) unless special permission is received. If a student accepts funds after being dropped or after withdrawing, the student shall be liable for repayment.

12. If a student or parents of a student intentionally falsify any information, the award may be immediately withdrawn and the student will be liable for repayment of funds already received.

13. When, in the opinion of the Director of Financial Aid, a student commits any act that may be reason for disciplinary action, the award may be discontinued. Unusually poor academic achievement, such as academic probation, may also be reason for reconsideration of an award during the academic year.

14. By accepting a scholarship, the student gives approval for the institution to provide transcripts of grades and other records that may be requested by the sponsor.

Alcoa Foundation Scholarships (FAO-150)
Six $750 engineering scholarships to any student. Need, ability, and scholastic standing are the prime factors in the selection of candidates. Scholarships are renewable.

Allied Chemical Foundation Scholarships (FAO-100)
A grant of $1,500 to be awarded to students in the A. French Textile School. The amount of each award will be left to the discretion of the Director of Financial Aid, subject to concurrence by the A. French Textile School.

American Association of Textile Chemists and Colorists (FAO-200)
Two scholarships in the amount of $600 each to juniors or seniors in the School of Textile Chemistry. Selection is by the Director of Financial Aid, subject to sponsor approval.

Anonymous Alumnus Scholarship (Class of 1926) (FAO-250)
An $800 annual scholarship to an entering freshman co-operative student. Recipient must acknowledge receipt of the award to the Financial Aid Office.

David J. Arnold Scholarships (FAO-400)
Scholarships to be awarded from the interest on a fund established by Robert O. Arnold in memory of his brother. Award is unrestricted as to field of study and is awarded on the basis of financial need. Preference to residents of Spalding County, Georgia.

Atlanta Chapter Reserve Officers Association - Military Scholarship (FAO-430)
A $300 scholarship, preferably to a senior at Georgia Tech from Fulton or DeKalb County. Recipient must be a participant in the Air Force, Army or Navy ROTC and show scholarship, need, and leadership ability. The scholarship will rotate to an annual basis beginning with the Air Force in 1969-70. Selection by the Director of Financial Aid with the advice and counsel of the Professor of Military Science of the particular branch.

Atlanta Federal Savings Scholarships (FAO-450)
Two annual $500 scholarships, one made to an entering freshman and one to a senior. The freshman selection is made on the basis of financial need and high school academic excellence. The senior selection is made from students who rank in the upper 25% of their class and on the basis
of financial need. Recipients must be male graduates of an accredited high school within Cobb, Clayton, DeKalb, Fulton, or Gwinnett County, and must be enrolled or accepted for admission in the College of Industrial Management.

Atlanta Textile Club Scholarship (FAO-500)
One $300 scholarship to be awarded to a junior or senior in the A. French Textile School. Preference will be given to students from the Atlanta area.

Avondale Educational & Charitable Foundation Scholarship (FAO-600)
An annual scholarship of $1,000, renewable for three additional years provided the student remains academically eligible. The recipient of this award should be from Butts County, Georgia or the child of an employee of the Avondale Mills in Jackson, Georgia. Preference will be given to students in Textiles, Textile Engineering, or Textile Chemistry.

Barrett Architectural Fund Scholarship (FAO-630)
A grant of $1,000 will be awarded to architecture students at the Georgia Institute of Technology. Selection will be made by the Director of Financial Aid, with recommendations from the School of Architecture. Unrestricted as to academic year.

Eugene O. Batson Scholarship Fund (FAO-4400)
This fund of $10,000 was created by Mr. E. O. Batson in memory of his son, the income to be given to deserving students. Unrestricted as to field of study.

Estelle A. Blalock Scholarship Fund (FAO-670)
An endowment fund established in memory of Estelle A. Blalock. Selection of the recipient is to be made by the Director of Financial Aid with major consideration being given to a Georgia resident. Unrestricted as to major and year.

Burlington Industries Foundation Scholarships (FAO-750)
Two annual $500 scholarships to a rising junior and a rising senior. Selection on basis of leadership, scholarship, and financial need. Prefer Textiles, Industrial Management, Industrial Engineering, and related fields. Scholarship awarded junior recipient is renewable.

Fuller E. Callaway, Jr. Fund (FAO-2460)
Income from this fund is used to provide National Merit Scholarships to students at the Georgia Institute of Technology.

Coats & Clark, Inc. Scholarships (FAO-950)
Two $500 scholarships to be awarded each year. These scholarships are renewable for three additional years, provided student maintains proper requirements. Awards will be made to a high school graduate entering Georgia Tech for his freshman year in Chemical, Mechanical, Textile, Industrial, or Electrical Engineering, as well as in Chemistry, Textiles, and Textile Chemistry. If possible, one award will be made to an applicant from North Georgia and one to an applicant from South Georgia with preference to children of employees of Coats & Clark, Inc. Awards will be made on a basis of academic ability and financial need.

Continental Oil Company Scholarships (FAO-1030)
Six scholarships in the amount of $500 each. Three restricted to the use of students from the School of Chemistry and three for the use of students from the School of Chemical Engineering. Recipients should be American citizens, have no permanent job commitment, and not be on leave from a competing company. Scholarship and financial need will be taken into consideration with normally a scholarship being provided to a sophomore, junior, and senior in each participating school.

Damar, Incorporated Scholarship (FAO-1100)
One $600 scholarship awarded to a Cobb County, Georgia, resident. Award is made on basis of need and ability.

John Benton Dickey Memorial Scholarship Fund (FAO-5500)
Annual income from an endowment fund of $10,000 to be used to provide one or
more scholarships or loans to students of Georgia Tech. Available to students in any field who are academically outstanding and need financial assistance in order to attend college. These funds were left to Georgia Tech by the late Mrs. Kate McCalley Dickey in her Last Will and Testament.

Robert B. Dodds Unit Fund Scholarships (FAO-1150)

Scholarships to be awarded from the income on a capital stock fund to any student selected by the Director of Financial Aid. Preference will be given to qualified applicants from the State of Arkansas.

Berl Elder Memorial Scholarship (FAO-1270)

A scholarship of $405 given by the Consulting Engineer Council of Georgia in memory of Berl Elder. To be granted to an engineering student whose goal is to be a consulting engineer and one who has or will take the Engineering-in-Training examination prior to graduation or soon thereafter. Award is nonrenewable.

Ferro Corporation Scholarship (FAO-1300)

One annual scholarship of $300 to be provided to the Ceramic Engineering student who has the highest academic average at the end of the second quarter of his sophomore year. Award to be granted during the spring quarter.

Fieldcrest Mills Scholarship (FAO-1330)

A $1,000 scholarship for a rising junior renewable for the senior year. The recipient is also given the opportunity of summer employment with the company. Academic excellence, willingness to consider textile career after college, and suitable curriculum considerable for future employment in the textile industry, will be the main criteria for selection of this student along with academic ability and financial need. The recipient must be a U.S. citizen.

Louise M. Fitten Memorial Fund (FAO-5550-5555)

The interest on approximately $1,000,000 annually awarded to deserving students as scholarships. This endowment was provided to the institution from the estate of Miss Louise M. Fitten. Income is available for unrestricted scholarship purposes.

James Swann Floyd Fund (FAO-2460)

Income from this fund is used to provide National Merit Scholarships to students at the Georgia Institute of Technology.

Franklin Foundation Scholarships (FAO-1350)

$3,000 annual scholarship fund established to aid worthy students from the State of Georgia. Awards are made on the basis of need, ability, evidence of good character, and scholastic standing.

Fulton Federal Savings Scholarship (FAO-1400)

Three scholarships of $250 each for students majoring in the School of Architecture who are residents of Georgia. Ordinarily one award will go to a sophomore, one to a junior, and one to a senior.

Geigy Dyestuffs Scholarships (FAO-1450)

A $500 scholarship for a student, preferably a junior, majoring in Textile Chemistry. This award will be granted on the basis of financial need, academic ability and evidence of good character.

General Motors Scholarships (FAO-1500)

One scholarship is awarded each year to an entering freshman of demonstrated academic excellence and leadership potential. Unrestricted as to field of study. Stipend ranges from $200 to $2,000 per year, depending on financial need. Renewable for three years subject to fulfillment of academic and leadership promise.

Georgia Institute of Technology Merit Scholarships (FAO-2460)

Thirty scholarships. For National Merit Scholars seeking to enroll at the Georgia Institute of Technology.

Gilman Foundation Scholarship (FAO-1600)

An award of $1,000 for an entering freshman, renewable for three additional years. Preference will be given in the order.
indicated:
1. Male resident of St. Marys, Georgia, who is employed by or who is a son of an employee of St. Marys Kraft Corp., St. Marys Railroad Co., or Kraft Bag Company.
2. Any male employee or son of an employee of above mentioned companies, Gilman Paper Co., The Cellucord Corp., or Gilman Electric Light and Power Co., regardless of residence.

E. Barron Glenn Memorial Scholarship Fund (FAO-1630)
An annual award of $1,000 to be provided to students enrolled at Georgia Tech who excel academically and need funds in order to remain in school. This money is given in memory of the founder of Glenn Associates, Inc., E. Barron Glenn and his wife Grace who met an untimely death on June 3, 1962, in the air crash at Orly, France.

Goodyear Foundation Scholarship (FAO-1650)
An award of $1,000 for a junior or senior majoring in Mechanical or Chemical Engineering. Selection on basis of need, leadership, scholarship, and ability.

Dean George C. Griffin Scholarships (FAO-1750)
A scholarship amounting to $1,000 a year has been made available for 99 years by Mr. L. Allen Morris of the Allen Morris Foundation and Class of 1936, a resident of Miami, Florida. It is in honor of George C. Griffin, Dean of Students Emeritus at Georgia Tech. First preference for award of the scholarships will be given to residents of Miami or Dade County, Florida. Second preference will be to those from other sections of Florida. The main qualifications for the scholarships will be academic ability and financial need.

George C. Griffin Scholarship (FAO-5615)
A scholarship fund created from the interest on approximately $35,000 contributed by Georgia Tech alumni and friends honoring Dean Griffin on his retirement as Dean of Students. The scholarships are unrestricted as to field of study and are awarded on the basis of financial need.

Col. Frank F. Groseclose Scholarship (FAO-1800)
One scholarship in the amount of $200 to a senior in the School of Industrial Engineering. The recipient must be a member of the Georgia Tech Chapter of the A.I.I.E. The scholarship will be awarded on the basis of financial need rather than scholastic ability alone.

The Robert E. Gross/Lockheed Aircraft Corp. Scholarship (FAO-1850)
Income from $30,000 to be awarded annually by the Director of Financial Aid to any regularly enrolled student in scientific, engineering, economic or other fields applicable to the aerospace, electronic, marine, manufacturing, or construction industries. Recipient must be a U.S. citizen. Award is not available to co-operative students.

Walter J. Hecht Scholarship (FAO-5620)
Endowment estimated at $15,000 in the will of Mr. Walter J. Hecht for the establishment of a scholarship fund at Georgia Tech. Students selected on the basis of academic achievement and financial need. Students from any major and academic year are eligible.

The John P. Holmes Scholarships Honoring Ben Z. and Sallie P. Holmes (FAO-5625)
This scholarship was set up by John P. Holmes in memory of his parents to provide one or more scholarships annually to undergraduates on the basis of academic ability and financial need.

C. A. Jones Memorial Scholarships (FAO-5627)
A request of $50,000 to be invested and net income used for a fellowship and/or scholarships for students from the A. French Textile School at the Georgia Institute of Technology. Selection of the recipient by the Director of Financial Aid and A. French Textile School.

Kaiser Aluminum and Chemical Corporation Scholarship (FAO-1993)
Two scholarships, one for a Chemical Engineering student and one for a Mechan-
ical Engineering student, are offered. Each scholarship is valued at $1,000. Preference will be given to a deserving American minority student. Award is not renewable.

C. D. LeBey Memorial Scholarship (Class of 1922) (FAO-5630)
One scholarship each year, unrestricted as to field of study, has been established in memory of Mr. C. D. LeBey, President, Class of 1922. First preference to residents of Florida, Alabama, and Tennessee. Value is approximately $250.

Julian L. Looney Scholarship Fund (FAO-5660)
A trust fund of approximately $30,000 given by Hazel Betts Looney in honor of her husband. Income from the fund is available for unrestricted scholarship purposes.

Lowry Memorial Scholarship Fund (FAO-5690-5695)
This scholarship was set up by Colonel Robert J. and Emma C. Lowry for the purpose of assisting legal residents of the State of Georgia to obtain a college education, who, because of lack of funds, might otherwise be deprived of this opportunity. The interest on approximately $500,000 is distributed as gift or loan scholarships, depending on the individual needs of the students.

R. L. "Bob" MacDougall Scholarship (FAO-2050)
One scholarship each year, unrestricted as to field of study, has been established in the name of R. L. MacDougall by the Class of 1925 and friends. Value is approximately $300.

Martin-Marietta Freshman Tuition Scholarships (FAO-2150)
One or more annual scholarship grants to cover full tuition for entering freshmen for the co-operative plan during the freshman year. Recipients must be from Maryland, District of Columbia, or Orlando, Florida areas. Preference will be given to those students in Aerospace Engineering.

Mclendon Scholarship Fund (FAO-2200)
Fund of $500 established to be awarded to qualified students of good character, in financial need, and who would be otherwise unable to pursue their education. Unrestricted as to field of study.

Patterson and Dewar Engineers, Inc. (FAO-2600)
A fund of $400 per year established by Patterson and Dewar Engineers, Inc., to be awarded to a deserving senior. The scholarship is made in behalf of the clients of the firm in lieu of the Christmas gifts of earlier years. The recipient is requested to assume the responsibility to repay voluntarily to the scholarship the funds received, if practical, in the future.

Pennsylvania Glass Sand Corporation Merit Award Scholarship (FAO-2650)
An award covering tuition and fees for the senior year to the student in Ceramic Engineering who completes the junior year with the highest average.

Annie Laura Galloway Phillips Scholarship (FAO-2700)
A $200 annual scholarship established to help deserving boys. Award will be made on the basis of scholastic record and financial need.

Jack Phinizy Educational and Charitable Foundation Fund (FAO-2750)
Awards of $200 each for a freshman and a sophomore student in engineering. Restricted to students from Florida, Georgia, or North Carolina. Boys from Richmond County, Georgia, all things being equal, will have preference. Granted on the basis of academic ability, engineering aptitude, and financial need.

The ITT Rayonier Scholarships (FAO-2900)
Two scholarships of $500 each established by the ITT Rayonier Foundation. One of the scholarships is available for a senior in the School of Chemical Engineering and the other for a senior in the College of Industrial Management.

Lucia Reeves Scholarship (FAO-2950)
One or more scholarships for worthy young men and women to be awarded from the income on a capital stock fund.
Selection is by the Director of Financial Aid.

Regents' State Scholarships (FAO-5750)

Georgia Tech's share of a fund appropriated by the General Assembly for the University System with the Board of Regents. Scholarships are for Georgia students with average grades and/or predicted grade point average in the upper 25% who possess superior ability and require financial need. The amount of each scholarship is determined by the Director of Financial Aid up to a maximum of $750 per year. Scholarships are renewable and with the provision that recipients must agree to stay and work in the State of Georgia one year for each $1,000 received under this program.

Edward Schmidt Scholarship Fund (FAO-3170)

A scholarship fund provided by Pucel Enterprises, Inc., Cleveland, Ohio, and administered by the Joseph A. Sedlak Management Consultant Inc. for an Industrial Engineering student who has exhibited interest in becoming involved in plant layout and/or design of material handling systems. Granted to an incoming student in the amount of $300 and renewable for the subsequent years. The student must remain in the upper 25% of his class. Selection is on the basis of the above criteria and financial need.

Schlumberger Foundation (FAO-3150)

One Schlumberger collegiate award in the amount of $1,000 to be made to students of high academic standing in their junior or senior year in the Schools of Electrical or Mechanical Engineering or Physics. Students must complete, prior to earning their undergraduate degree, at least twelve hours study in electricity.

Schroeter-Ergenzinger Foundation (FAO-3200)

Two scholarships in the amount of $1,000 each for entering freshmen in the scientific or engineering fields. Recipients must be of good moral character and scholastic ability with economic or financial need. Scholarship is renewable and selection is by the Director of Financial Aid.

Seydel-Woolley & Company Scholarship (FAO-3250)

One $500 scholarship to be given to an outstanding male sophomore, junior, or senior in the field of Textiles.

Shaheen Foundation Scholarship (FAO-3300)

The interest from $5,700 to be awarded to engineering students on the basis of need and ability. Selection by Director of Financial Aid with preference to students from Whitfield County, Georgia.

Scripps-Howard Foundation — William Philip Sims Scholarship (FAO-3300)

A $1,000 grant to be given to one or more students who demonstrate outstanding academic promise and concurrent financial need, and who are pursuing an academic curriculum which would qualify them for a journalism career in the editorial, business, broadcasting, or newspaper field and who intend to enter a career in the aforementioned areas.

Malcolm Bowman Smith Memorial Scholarship (FAO-3375)

Interest on a bequest of $35,000 will be used to assist needy students with their college expenses.

Smith-Turner Memorial Scholarship Fund (FAO-3400)

Scholarships to be awarded from the interest on a $25,000 trust fund established by Mr. Ivy Hendrix Smith in honor of Mr. N. S. Turner and Mr. George T. Smith. Selection is by the Director of Financial Aid to worthy students without restriction to class, curriculum, sex, or other limitations. Preference will be given to a Jacksonville, Florida student.

Southern Woolen and Worsted Association Scholarship (FAO-3410)

An annual award of $400 to worthy students enrolled in the A. French Textile School. Selection is by the Director of Financial Aid.

Standard Oil Company Scholarship (FAO-3430)

A Chemical Engineering scholarship in the amount of $500 to be provided to an
outstanding senior. Leadership, academic achievement, and need will be used as criteria for selection by the Director of Chemical Engineering and the Director of Financial Aid.

**Standard Oil Company of California Scholarship (FAO-3440)**

Two scholarships in the amount of $500 each to be awarded to an entering freshman and a sophomore in the School of Chemical Engineering.

Financial need and academic achievement or promise will be the prime criteria for awarding these scholarships.

**Starke Patterson Scholarship (FAO-5780)**

One or more annual scholarships to be awarded on the basis of academic ability and financial need. Recipients are to be selected from boys in the Co-operative plan from Memphis or Shelby County, Tennessee, high schools. Awards are made on the basis of academic record and financial need.

**T. E. Stribling Memorial Textile Fellowship/Scholarship Fund (FAO-3500)**

Entire and annual net income from Stribling Trust Fund for one fellowship to include tuition and fees, not less than $2,000 nor more than $2,500, plus $500 miscellaneous expenses. Any excess income may be used for undergraduate scholarships of not more than $600 to members of the junior and senior classes of the Textile School.

**The Taulman Company Scholarship (FAO-3530)**

A $1,000 scholarship provided by the Taulman Company to be awarded to a student or students in the School of Civil Engineering or Environmental Science. Preference is to be given to a student who wishes a career in Sanitary Engineering or in Environmental Science. Selection is by the Director of Financial Aid in conjunction with the Director of Civil Engineering.

**The Textile Engineering Scholarship Plan of the Textile Education Foundation, Inc. (FAO-3600)**

The Textile Education Foundation, Inc., of Atlanta, Georgia, established this scholarship plan in 1952 for the purpose of encouraging and assisting worthy young men who seek to obtain an education in Textile Engineering. A maximum of six scholarships will be awarded annually, each scholarship amounting to $750 per scholastic year for each of four scholastic years provided the recipient maintains the requirements. For further information write to: The Director, A. French Textile School, Georgia Institute of Technology, Atlanta, Georgia 30322.

**James F. Towers Scholarship (FAO-3650)**

Scholarships are to be awarded from the interest on a fund of $15,000 established by James F. Towers. Recipients should major in engineering or science. Preference will be given to male students from Floyd County, Georgia.

**Uniform Award-Army ROTC (FAO-3660)**

A fund of $200 established by the Georgia Society of Daughters of Founders and Patriots of America to provide assistance to deserving Army ROTC students in purchasing advanced ROTC uniforms. Students must reimburse fund at the completion of ROTC and upon receipt of uniform deposit refund.

**Union Oil Company of California Scholarship (FAO-3760)**

An annual award of $500 to be given to a Chemical Engineering student who is outstanding academically and needs funds in order to complete his education. Selection by Director of Financial Aid.

**William T. Walton Memorial Scholarship Fund (FAO-3850)**

An award to be provided to a student in Chemical Engineering. Mrs. Martine Walton, the widow of William T. Walton, requested on his death that, in lieu of flowers, donations be sent to the Georgia Institute of Technology to establish this fund. The interest from these donations will comprise the scholarship.

**Western Electric Fund Scholarships (FAO-4000)**

Three scholarships awarded to upper-classmen in the field of engineering.
Awards can be given to first or second year students. Scholarship maximum of $1,500 is based upon the cost of tuition, fees, and books. Scholarships are renewable. Preference will be given to those students majoring in Electrical, Industrial, or Mechanical Engineering, and Industrial Management.

Wilcox-Conally Scholarship (FAO-4150)
An award of $300 for any junior or senior in the School of Architecture.

Woman's Aero Club of Atlanta Scholarship (FAO-4200)
An award of $1,000 for any junior or senior majoring in Aerospace Engineering.

James Wright Memorial Scholarship (FAO-850)
One $500 scholarship to be awarded any student in the A. French Textile School. The funds for this award are provided by the A. B. Carter Company, Inc., in memory of Mr. James Wright, a former Tech student. Although this award is not renewable for subsequent years, the student receiving this award will be given prime consideration for other available awards for his future academic years.

Goodloe Yancey Scholarship Fund (FAO-1640)
An annual undergraduate fund of $1,000 to be used at the discretion of the Director of Financial Aid to provide financial assistance to a needy and promising Georgia young man (or men) who are enrolled at Georgia Tech in the School of Civil Engineering.

GEORGIA TECH ALUMNI
CLUB SCHOLARSHIPS

Various alumni clubs sponsor scholarship programs for students in their geographic areas. Interested applicants should contact their local high school counselor for further information or contact Mr. W. Roane Beard, Executive Secretary, Georgia Tech Alumni Association, 225 North Avenue, Atlanta, Georgia 30332.

Albany, Georgia Alumni Club (FAO-050)
Two or three scholarships (Co-op) for freshmen from the Albany, Georgia area. Only engineering courses available.

Augusta, Georgia Tech Club (FAO-550)
One, possibly two, $360 scholarships available to freshmen from the Augusta area.

Birmingham, Alabama Georgia Tech Club (FAO-650)
One $1,000 scholarship for freshmen from Birmingham and vicinity.

Cape Kennedy Georgia Tech Club (FAO-820)
One award of $500 for an entering freshman from the Cape Kennedy area.

W. L. Carmichael Academic Scholarship (FAO-1700)
One scholarship to be granted to a student from the Greater Atlanta Georgia Tech Club area by the Club. Selection on basis of academic potential with a stipend of $250 to $1,500 per year, based on information from the Parents' Confidential Statement. Renewal if student remains in upper 25% of class.

Chattanooga, Tennessee Georgia Tech Club (FAO-000)
One $400 scholarship available to freshmen from the Chattanooga area pursuing an engineering curriculum under the Co-operative program. Applicants must rank in the upper third of their high school class, be of good moral character, and have financial need.

Bobby Dodd Scholarships (FAO-1700)
 Fifteen or more freshmen scholarships of $300-$450 each for qualified needy students from the metropolitan area provided by the Greater Atlanta Georgia Tech Club. Students are urged to attend on the Co-operative plan. Scholarships are extended for the sophomore year to those students who make a point average of 3.0 or better in their first year.

Huntsville, Alabama Georgia Tech Alumni Club (FAO-1900)
One or more scholarships for students from the Huntsville area.
Jacksonville, Florida Georgia Tech Alumni Club (FAO-1970)
One or more scholarships from the Jacksonville, Florida area.

Macon, Georgia Tech Club (FAO-2100)
One, possibly two, $360 scholarships available to freshmen from the Macon area.

Middle Tennessee Georgia Tech Club (FAO-3540)
A scholarship fund in the amount of $500 to be awarded entering freshmen who require financial assistance. Recipients must be from the Middle Tennessee area.

Pittsburgh Georgia Tech Club (FAO-2800)
One $1,000 scholarship for high school students in Allegheny County to be awarded to an entering freshman who needs assistance.

Savannah, Georgia Tech Club (FAO-3100)
Two $375 scholarships for students from the Savannah area.

South Texas Alumni Association (Blake R. Van Leer Memorial Scholarship) (FAO-1720)
One $700 scholarship (Co-op) for freshmen from Houston, Texas and nearby cities. Only engineering courses available.

Washington, D.C. Georgia Tech Club (FAO-3900)
Three scholarships for students from the Washington, D.C. area. Scholarships are designated as: Three Musketeers Scholarship, C. Gale Kiplinger Scholarship and General Club Scholarship.
Students may find it difficult to have all necessary funds on registration day and desire to extend the cost over the quarter. To help meet this need, Georgia Tech has an established program of short-term loans. Purposes and rules are as follows:

Rules and Regulations Governing Short-Term Student Loans

1. A written application will be required of each applicant for a short-term loan, and an interview will be required when the application is submitted.

2. Each application must be approved by the Financial Aid Office before the loan will be granted.

3. Each student to whom a loan is granted will be required to sign a promissory note covering principal and interest.

4. There will be a set schedule of repayment which will be made a part of the application for the loan, and will also be made a part of the note to be signed by the student. (This schedule will normally consist of three equal installments with the entire balance to be repaid not later than ten days before the end of the quarter in which funds are obtained.)

5. All notes bear interest at the rate of 5% per annum from the date of the note.

6. A student making application for a loan must state the reason for the loan.

7. The parent or guardian of a student applying for a loan will be so notified.

8. In some cases, an endorser may be required and in such instances, the student shall be notified.

9. All sections of the application must be completed in full.

10. A student will not be allowed to have more than one outstanding short-term school loan at a time. (An exception to this rule is a loan made for plant trips.)

11. Students may submit applications for short-term loans at any time during a quarter and expect receipt of funds within a normal processing time of one or two days.

IF, HOWEVER, STUDENTS WISH TO RECEIVE FUNDS ON A DAY OF REGISTRATION for payment of fees and tuition, they must anticipate a processing period of two to three weeks before receipt of their checks. Consequently, applications for Short-Term School Loans must be submitted not later than two weeks in advance of any registration day.

12. THE ONLY EXCEPTION TO THE ABOVE TIME LIMITS ARE CASES OF EMERGENCY. When such emergencies occur, whether during the quarter,
between quarters, or on a day of registration, the student should request special consideration from the Director of Financial Aid to receive funds on an emergency basis.

Loan applications submitted on the first day of registration of any quarter before 3:00 p.m. and approved on an emergency basis by the Director of Financial Aid will be processed before late fees apply. Loan applications submitted on the second day of registration will not be processed before late fees apply, and applicants with emergency situations must request waiver of late fees through the Director of Financial Aid.

13. Student short-term loans will be considered for the following purposes:
   a. Tuition, fees, room rent, board, books, and supplies.
   b. Plant trips and after-graduation relocation.
   c. Emergency expenses not covered above.
   d. Fraternity expenses.

14. A student’s repayment record on previous loans of any type will be given prime consideration in the granting of a loan. Late repayment seriously endangers chances for new loans. Students with overdue loans will not be allowed to register for the next quarter until the obligation is cleared.

**Short-Term Loan Funds**

Approved short-term loan applications are assigned to funds which have been established through the generous contributions of friends and patrons of the Institute:

- George W. Adair Loan Fund .......................................................... $ 775.00
- Fred W. Ajax Memorial Loan Fund ............................................. 950.00
- John I. Alford Loan Fund ......................................................... 4,225.00
- William Ott Alston, Jr., Memorial Loan Fund ......................... 875.00
- American Institute of Architects, Georgia Chapter Loan Fund ........................................................................ 350.00
- American Society of Mechanical Engineers
  - Roger Martin Memorial Fund ..................................................... 1,575.00
  - J. Baldwin Loan Fund ............................................................. 67.00
  - M. R. Berry Loan Fund ............................................................ 5,000.00
  - James G. Boswell Foundation Loan Fund ................................ 800.00
  - S. F. Boykin Loan Fund ........................................................... 145.00
  - T. P. Branch Memorial Loan Fund ........................................... 247.00
  - Brittain-Busbin-Jarrell Emergency Loan Fund ....................... 8,685.00
  - J. B. Campbell Loan Fund ........................................................ 960.00
  - The DeWitt F. Capehart Loan Fund ......................................... 269.00
  - Class of 1919 Loan Fund .......................................................... 25.00
  - Class of 1934 Loan Fund ......................................................... 308.00
  - Josiah Dana Cloudman Loan Fund ........................................... 17,569.00
Holland Coleman, Jr., Architectural Memorial
  Scholarship Loan Fund .................................................. 1,722.00
William B. Coleman Post #51 of the
  American Legion Loan Fund ........................................ 580.00
Mrs. Alice Spencer Coon Loan Fund .................................. 4,394.00
Creole Foundation Loan Fund ........................................... 1,932.00
A. C. Dobbs Loan Fund ................................................... 140.00
Arthur J. Dyer Student Loan Fund .................................... 1,462.00
Ford Foundation Loan Fund ............................................. 101,583.00
A. French Loan Fund ...................................................... 3,211.00
Georgia Federation of Labor Loan Fund ......................... 1,570.00
Count Dillon Gibson Memorial Student Loan Fund ............ 3,134.00
Mary Brotherton Griffin Loan Fund .................................. 260.00
Mary D. Gude Loan Fund ................................................ 211.00
Lyman Hall Loan Fund ................................................... 9,535.00
Harrison-Trabant Loan Fund ............................................ 1,200.00
J. M. High Memorial Loan Scholarship Fund .................... 3,826.00
Dr. and Mrs. Thomas P. Hinman Loan Fund ....................... 341.00
Interfraternity Council Loan Fund .................................... 4,545.00
Irving Subway Grating Company, Inc., Loan Fund ............. 649.00
Louis Gholselin Johnson Loan Fund .................................. 835.00
Kappa Alpha Educational Foundation, Inc.,
  Loan Fund ............................................................... 137.00
The Clyde L. King, Jr., and John King
  Memorial Loan Fund ................................................... 12,317.00
John King Memorial Loan Fund ....................................... 39,058.00
Roy Stevenson King Loan Fund ....................................... 3,588.00
Last Sub Class Loan Fund of 1914 .................................. 195.00
Malta Lodge #641, F. & A. M. Loan Fund ......................... 1,910.00
Al Loeb Loan Fund ........................................................ 865.00
Lona Mansfield Loan Fund ................................................ 1,551.00
Mrs. T. O. Marshall Loan Fund ........................................ 11,912.00
E. P. McBurney Loan Fund ................................................ 18,302.00
J. A. McFarland Loan Fund .............................................. 190.00
Thomas E. Mitchell Education Fund of
  the University of Georgia ........................................... 24,601.00
Joseph N. Moody Loan Fund .......................................... 3,065.00
The Gayle Nimmocks Memorial Scholarship ...................... 230.00
Cy Perkins Memorial Loan Fund ...................................... 2,779.00
Quartermaster Loan Fund ............................................... 784.00
William B. Reese Emergency Loan Fund ......................... 500.00
M. Rich Loan Fund ........................................................ 16.00
The L. W. (Chip) Robert, Jr., Loan Fund ......................... 159.00
Scottish Rite Loan Fund ................................................ 1,845.00
Emergency Loan Fund

Generous friends of the institution have established funds of varying amounts which are used for emergency loans. Loans are made from these funds for emergencies only and are obtained in the same manner as regular short-term loans.

Georgia Tech Student Council Emergency Loan Fund (Vernon Shipley Memorial Loan)

A percentage of the donations to the annual Campus Charity Fund is used to finance this project of the Student Council. Loans may be granted for emergency situations to any enrolled student. Except in very unusual circumstances, loans will not exceed $100 and must be repaid within 60 days. Applications may be obtained from the Financial Aid Office. Loans bear no interest.

FEDERAL FINANCIAL AID PROGRAMS

We participate in the four federally sponsored financial aid programs. Following are descriptions and regulations on each: National Defense Student Loan, College Work-Study Program, Educational Opportunity Grants, and Cuban Loans. Also included is information on Veterans Administration programs.

Rules and Regulations Governing
National Defense Student Loans (FAO 5720-5725)

1. The student should apply for an annual amount. The maximum allowable per year (three quarters) is $1,000 for an undergraduate student, and the maximum total amount for one borrower during an undergraduate degree program is
limited to $5,000. A student's total maximum amount of loan may be increased to $10,000 for a graduate degree. The maximum loan a graduate student may be awarded is $600 per quarter. The student should indicate the quarters for which the loan is desired on the application form, as well as the amount desired.

Loans for four consecutive quarters (except for co-op students) will be considered only as special cases. It is expected that students will seek employment during the summer months to help provide funds for college expenses during the following year.

2. The amount awarded to the student will be determined from information on the Parents' Confidential Statement and will take into consideration other awards received from the Georgia Institute of Technology and/or from other organizations.

3. A student's academic record is considered in the granting of the loan. A student's credit history at the institution, including repayment record on Short-term School Loans, is taken into account in considering an application for a National Defense Student Loan. A student who is in the best judgment of the Financial Aid Officer a "poor risk" according to his financial record at the institution is ineligible for a National Defense Student Loan.

4. All applicants must complete the Georgia Institute of Technology application each year. The parents of all students under 25 years of age must also complete the Parents' Confidential Statement (PCS) each year or sign a statement provided by the Financial Aid Office that they did not contribute to the student's financial support for the previous year and did not claim him as a dependent for Federal income tax purposes.

If a student is over 25 and has received any financial support from his parents during the preceding year and/or has been declared as a dependent for income tax purposes, the parents must likewise complete the PCS each year. If not, the financial resources of the individual student over 25 will be used in determining the amount of the award.

All married students, whatever age, must also complete the Married Students' Supplement to the PCS.

Any exception to these PCS requirements will be considered as individual cases by the Director of Financial Aid.

5. To insure consideration, upperclass applications for loans must be submitted between November 1 and April 1 of the year preceding the academic year for which the loan is desired. Applications received after April 1 will be considered only if funds are available and at the discretion of the Director of Financial Aid. The deadline for prospective freshmen and transfers is February 1. An interview is required when the application is submitted (except for entering freshmen and transfer students who would be required to make a special trip to the campus).

6. The Parents' Confidential Statement should not be sent to the Georgia Institute for Technology, but to the address indicated in the information
included with the Parents' Confidential Statement.

7. All applicants will be notified by mail of approval or disapproval of their applications.

8. PLEASE NOTE that even though a student may receive notice of approval of an annual amount, he must comply EACH QUARTER with the following requirements or his loan will not be processed:
   a. A student should remain in good academic standing at the Georgia Institute of Technology. If he is placed on academic probation for any quarter covered by the loan, he may be ineligible to receive a loan for that particular quarter and his application for that quarter may be cancelled.
   b. A student must be enrolled as a full-time student at the Georgia Institute of Technology for each quarter covered by the loan unless he has received special approval to receive funds as a half-time student.

9. Prior to the receipt of the funds, the borrower must execute a promissory note. The oath and affidavit must be executed.

10. Funds received from these loans can be used only for legitimate educational purposes: payment of tuition and required fees, books and supplies, room, board, and similar living expenses.

11. The borrower must, prior to leaving school, make satisfactory arrangements with the Business Office for repayment of the loan; repayment to begin no later than the tenth month from the day of leaving the university or graduation with the following exceptions:
   a. As long as the borrower is pursuing at least a half-time course of study at any institution of higher learning, no interest shall accrue and no payments need be paid.
   b. Payment may also be delayed, not in excess of three years, during which the borrower is a member of the Armed Forces of the United States, is in service as a volunteer under the Peace Corps Act, or is a volunteer under VISTA.
   c. An amount, not to exceed 50% of any loan plus interest, shall be cancelled for services as a full-time teacher at the rate of 10% of the amount of the loan (plus interest), which is unpaid on the first day of teaching service, for each complete year of service.

12. Interest at 3% is charged on the unpaid balance beginning nine months after the borrower ceases to be at least a half-time student.

13. Repayments shall be made in equal monthly installments of at least $15 per month.
College Work-Study Program (FAO-4430)
The purpose of this program is to make part-time employment opportunities available to students, particularly those from low-income families, who are in need of the earnings from part-time employment in order to attend institutions of higher education.

Any student who is in need of the earnings from part-time employment in order to pursue a course of study at an institution of higher education is eligible. Preference for employment must be given to students from "low-income" families, as determined primarily by the level of income and size of family as shown below. Formerly, employment under this program was limited exclusively to students from "low-income" families.

Preference for this aid is determined by the parents' income as shown:

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<tr>
<th>Number of dependent children or other dependents</th>
<th>Family income less than</th>
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<tr>
<td>1</td>
<td>3,200</td>
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<td>2</td>
<td>4,000</td>
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<td>8</td>
<td>6,900</td>
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A limited number of jobs are available full-time during the summer. Those who qualify according to the above scale and desire employment should write the Financial Aid Office for more information.

Educational Opportunity Grants (FAO-5510, 5515, 5520, 5525, 5530)
The purpose of this program is to encourage and enable exceptionally needy high school graduates and college undergraduate students, who otherwise would be unable to continue their education, to pursue their studies at institutions of higher education by providing them with educational opportunity grants.

To qualify for an Educational Opportunity Grant a student must be accepted for full-time enrollment at an institution participating in the program or, in the case of a student already attending such an institution, be in good standing and in full-time attendance there as an undergraduate student. In addition, he must show evidence of academic or creative promise and capability of maintaining good standing in his course of study. Finally, he must be in exceptional financial need, and must show that he would not, except for an educational opportunity grant, be financially able to pursue a course of study at the institution.

No more than one-half of the total "package" of student financial aid given by an institution to a student, up to a maximum of $1,000, may be in the form of an Educational Opportunity Grant.
**Veterans Administration Programs**

Most veterans who served on active duty for more than 180 days, any part of which occurred after January 31, 1955, are generally eligible for financial support to attend college. For specific requirements, the local Veterans Administration Office should be contacted. Before communicating with Georgia Tech about benefits under this program, the prospective recipient must complete all requirements at the local Veterans Administration office.

Generally sons and daughters between 18 and 26 years old of deceased veterans, those of living veterans who have disabilities which are considered to be total and permanent, and those of veterans whose death or disability was a result of service in the Armed Forces are eligible for financial benefits to attend college. Contact your local Veterans Administration office for complete details.

The local Atlanta Veterans Administration address is: 730 Peachtree Street, N.E., Atlanta, Georgia 30308.

**Cuban Students Loan Program (FAO-4460)**

The purpose of this loan is to make available funds to Cuban nationals who are presently unable to receive support from sources within Cuba as a result of actions by the Cuban Government, and who are without sufficient resources in the United States to finance their attendance at institutions of higher education.

All new applicants for the Cuban Loan must apply for an annual amount and follow the applications procedures and regulations for applicants for the National Defense Student Loan.

An undergraduate student may borrow a maximum of $333 per quarter with a yearly maximum of $1,000, and a graduate student may borrow a maximum of $600 per quarter. The total of all loans for an undergraduate student may not exceed $5,000, and the total of all loans for a graduate student may not exceed $10,000.

In order to be eligible for a loan under this plan, a student must:

1. Be a Cuban national.
2. Be enrolled in the Institution as a full-time student on either the undergraduate or graduate level.
3. Be capable, in the opinion of the Institution, of maintaining satisfactory standing.
4. Be unable, as a result of action by the Cuban Government, to receive support for inside Cuba.
5. Be in need of the amount of the loan to pursue his course of study at the Institution.

Each student to whom a loan is granted will be required to sign a promissory note.

A borrower has a "year of grace" after he ceases to be enrolled as a full-time student in an institution of higher education during which he does not have to
make payments on the loan and during which the interest of 3% a year on the 
unpaid balance does not accrue. After that year elapses, the borrower will begin 
to repay the principal plus the interest in ten equal annual installments.

Cuban Loan borrowers must report to the Cashier’s Office for an exit interview before leaving full-time study at the Georgia Institute of Technology due to graduation, transfer to another school, or any other reason.

Applications may be secured from the Financial Aid Office at the Georgia Institute of Technology.

STATE FINANCIAL AID PROGRAMS

Many states have established scholarship programs for the use of students attending schools in or out-of-state. Interested students should contact the Department of Education of their state to see if it has a program. In addition, all states now have some type of loan program for college students.

The State of Georgia’s scholarship programs are described below. Information is also listed on the state guaranteed loan program in general and about Georgia specifically.

State of Georgia Scholarship Commission

This program provides scholarships for Georgia residents with financial need and scholastic ability for study in professional and educational fields. Amounts vary according to cost of attending institution offering course of study.

Recipients must repay by practicing professions in approved communities or sites of employment or in cash at 6% interest.

For additional information write to: State Scholarship Commission, 270 Washington St., S.W., Atlanta, Georgia 30334.

State of Georgia Teacher Scholarships

These scholarships provide financial assistance to complete programs of study in preparation for teaching. Available to Georgia residents of high scholastic ability and teaching aptitude.

Scholarships are to be repaid by teaching in the public schools of Georgia for a period of 3, 4, or 5 years, according to amount of scholarship aid received or in cash at 5% interest.

For more information write to: Scholarships, State Department of Education, Room 247, State Office Building, Atlanta, Georgia 30334.

Regents of the University System of Georgia Scholarships

Georgia residents attending institutions in the University System of Georgia who have financial need and rank, or are predicted to rank, in the top 25% of their class are eligible to apply for Regents’ Scholarships.

Recipients must repay in services in Georgia for one year for each $1,000 received or must repay in cash at 3% simple interest.

For additional information refer to section under Scholarships.

State Guaranteed Loans for College Students

The Guaranteed Loan Program has one simple purpose: to provide the means for students to borrow money for college at low interest cost, with the Federal Government paying part of the interest for qualified students.

a. A student applies for a loan at a bank or other eligible lending institution.

b. The lender makes the loan directly to the student.

c. A State agency or private non-profit agency “guarantees” the loans—that is, protects the lender against loss in
case the borrower defaults on his loan.

d. The Federal Government pays a portion of the interest on behalf of eligible students.

These programs, in most states, include any student who is enrolled or accepted for enrollment as eligible to apply for a loan for his educational expenses. The institution may be in any state, Puerto Rico, District of Columbia, Guam, American Samoa, or the Virgin Islands. Graduate and professional students as well as undergraduates are eligible to borrow.

Banks, savings and loan associations, insurance companies, credit unions, and similarly supervised institutions are lenders under this program.

If a student cannot obtain a loan from one source, he may apply to another. A list of eligible lenders will be supplied by the appropriate guarantee loan agency in your home state. Write for listing of state agencies to the Financial Aid Office.

Georgia's Guaranteed Loan is administered by the Georgia Higher Education Assistance Corporation. Its procedure is described below and should be similar to that in other states.

The Georgia Higher Education Assistance Corporation Loan (FAO-758)

The Georgia Higher Education Assistance Corporation was created as an independent, non-profit organization by the Georgia State Legislature in 1965 to operate the loan plan as provided by an amendment to the Constitution of Georgia in 1964.

Under this program guaranteed loans are provided for students who are residents of Georgia in attendance at any accredited post-secondary institution of higher education in the State of Georgia or elsewhere.

Loans are approved on a yearly basis except in the case of part-time students, who must apply for a loan to cover only one quarter at a time. The amount that a full-time student may borrow ranges from $1,000 a year for freshman students to $1,500 a year for graduate students. Applications for an academic year should be submitted three months in advance of the beginning of the school term. Applications may also be submitted during the school year, and students should check with their local banks or lending institutions for quarterly deadlines.

A prospective borrower under this loan program attending the Georgia Institute of Technology must first submit his application to the Director of Financial Aid for certification of enrollment. The student must then place the loan with a participating Georgia lending institution and borrow money from the lending institution on promissory notes.

The family financial statement is important. If the family's adjusted annual income is under $15,000 a year, the Federal Government will pay all interest charges on unpaid principal balances while the student is in school. If adjusted family income is over $15,000 a year, the loan may be insured, but the student must pay all interest from the start.

Repayment is deferred during the time a student continues his studies and might be deferred under various state agency programs while he serves in the Peace Corps or in the armed services. If loans total more than $2,000, they will be repaid in installments ranging from five to ten years, beginning nine to twelve months after the borrower leaves school. If the total is less than $2,000, the lender may require repayment in less than five years.

Additional information and applications for the Georgia Higher Education Assistance Corporation Loan can be obtained from the Georgia Higher Education Assistance Corporation, 703 Trinity-Washington Street Building, 270 Washington Street, S.W., Atlanta, Georgia 30334.

Vocational Rehabilitation—Georgia

College students may receive assistance from the Office of Vocational Rehabilitation in the form of payment of college tuition if they meet certain eligibility requirements. The applicant must possess a physical or mental impairment which would prove to be a vocational handicap.

In order to secure more information regarding this program, an individual should contact the local office of Vocational Rehabilitation in his community.
FINANCIAL AID—OUTSIDE SOURCES OF AID

Many foundations, companies, religious organizations, and other groups have established scholarship or loan programs for the use of Georgia Tech students. Some of these programs are exclusively for Tech and others are for use at many institutions. Following are listed some of those that might be of interest.

American Society of Mechanical Engineers
Student Loan Fund

The Woman’s Auxiliary of the American Society of Mechanical Engineers has established a loan fund for students of Mechanical Engineering in good standing who are either juniors, seniors, or graduate students. Correspondence should be addressed to Mrs. W. J. Schell, Jr., Chairman, Student Loan Fund, 151 Idlewood Drive, Stamford, Connecticut 06905.

Army Senior Year Scholarship for Women

Ninety scholarships are made available nationally each year by the United States Army for young women who have completed their junior year or are first semester seniors. Each scholarship pays the recipient approximately $350 per month during her senior year. Interested Georgia applicants should write Headquarters, United States Army Third Recruiting District, 1628 Virginia Avenue, College Park, Georgia 30337. Others should contact their local recruiting district headquarters.

The General Henry H. Arnold Education Fund

The Air Force Aid Society has created a loan fund to aid unmarried children of Air Force and Army Air Forces personnel in securing an undergraduate college education, with priority being given to students whose fathers are deceased. Additional information and application material should be requested from the Air Force Aid Society, National Headquarters, Washington, D.C. 20333.

The Lewis H. Beck Fund

The Lewis H. Beck Scholarship Fund is a student loan fund created by the late Mr. Lewis H. Beck of Atlanta, for the benefit of students attending Georgia Institute of Technology who are (1) residents of Georgia, (2) unmarried, (3) between the ages of 16 and 25, and (4) upperclassmen who, if sophomores, have completed their freshman year with a 2.5 or better average or, if juniors or seniors, have maintained a 2.0 or better average. The loan is administered by a special Board of Trustees. Applications may be obtained from the Financial Aid Office.

Callaway Educational Association Scholarships

Six general scholarships are awarded annually in the maximum amount of $300 per quarter to applicants who are employees or children of employees of Callaway Mills Company. A maximum of six Co-operative scholarships may also be awarded to any applicant in the following fields: Chemical, Electrical, Industrial, Mechanical, or Textile Engineering. Selection is by the Callaway Scholarship Plan Committee. For further information write: Callaway Mills Company, Scholarship Plan Committee, LaGrange, Georgia.

Ty Cobb Educational Scholarship

An upperclass scholarship for single residents of Georgia. Information should be obtained from the Cobb Foundation, 244 Washington Street, S.W., Room 448, Atlanta, Georgia 30334. Deadline to apply is May 1.

College Aid Plan

College Aid Plan, Inc., a national organization specializing in student financing, provides funds for any or all University expenses with monthly repayment programs which include broad insurance protection. Terms range from 9 to 72 months depending upon needs. Although the Georgia Institute of Technology is agreeable to CAP sending details of their program to parents, its use by them is entirely at their option. Further details may be obtained by writing to College Aid Plan, Inc., 1008 Elm Street, Manchester, New Hampshire 03101.
Columbus High School Class of 1912
Scholarships to be awarded by the Columbus High School in the maximum amount of $400 to their graduates. For further information write the Office of the Principal, Columbus High School, Columbus, Georgia.

Education Funds, Inc.
For students and parents desiring to pay education expenses in monthly installments, a deferred payment program is available through Education Funds, Inc., a nationwide organization specializing in education financing.

All EFI plans include insurance on the life of the parent and the student, total and permanent disability insurance on the parent, plus trust administration in event of the parent's death or disability. Agreements may be written to cover all costs payable to the school over a four-year period in amounts up to $14,000.

Parents desiring further information concerning this deferred payment plan should contact the financier of the school or Education Funds, Inc., 10 Dorrance Street, Providence, Rhode Island 02901.

Floyd County Scholarships
A scholarship fund to assist needy students without reference to politics, religion, or athletic ability. Recipients, as well as at least one of the parents, shall have been born in Floyd County or Rome City, Georgia. Selection is by the Floyd County School Board and the Rome City School Board. For further information write Trust Officer, The National City Bank of Rome, Rome, Georgia.

"Country" Gorman Scholarships
A scholarship for students who are scouts or former scouts. Academic ability and need are considered. Information may be obtained from Atlanta Area Council, Boy Scouts of America, 167 Walton St., N.W., Atlanta, Georgia 30303, and must be submitted by February 1, prior to entrance to college.

The Methodist Student Loan Fund
This loan is available to students of all classes, including graduates, who have been members of the Methodist church for one year or more immediately prior to application. In addition, applicants must be citizens of the United States, at least seventeen years of age, have earned at least a 2.0 average during the quarter immediately prior to application and be completely or partially self-supporting. Interested and qualified students should contact the Reverend William Landiss, Director, Wesley Foundation, 189 Fourth St., N.W., Atlanta, Georgia, for the necessary application forms and further information.

Muscogee Foundation Scholarship
One scholarship in the amount of $600 to an entering freshman in the field of textiles. Selection is by the Muscogee Scholarship Committee. For further information contact Secretary, Muscogee Scholarship Committee, Columbus, Georgia.

National Merit Scholarships
Students who enter the National Merit competition may generally use their award at any school they desire to attend. Many National Merit Scholars are enrolled at Georgia Tech. For further information on this program, see your high school principal or counselor.

Pickett and Hatcher Educational Fund
The late Mr. Claude A. Hatcher of Columbus, Georgia, created an educational loan fund for the purpose of aiding a large number of worthy students in securing courses in broad liberal college training. Loans are available for students of all classes, including graduates. Limitations prevent loans being granted to students of law, medicine, and the ministry.

Applications and requests for additional information should be addressed to Pickett and Hatcher Educational Fund, P.O. Box 2128, Columbus, Georgia.

Piping Promotion Trust Scholarship
A scholarship awarded annually to students entering Georgia Tech who are children of employees of Piping Promotion Trust contributors. Annual amount is $800. Applicants should apply to Trust directly.
Two-Year R.O.T.C. Scholarships

The Air Force R.O.T.C. offers 2-year scholarships to students who compete successfully for entry into their 2-year program as Category I (pilots or navigators) cadets. Information is available through the AFROTC unit at Georgia Tech.

R.O.T.C. Scholarships

The Army, Air Force, and Navy have scholarship plans which provide most of the cost of education for students enrolled under their program. Students desiring information should contact their local recruiting office, military installation, or write directly to the appropriate military unit at Georgia Tech.

Stevens Bros. Foundation, Inc.

The Foundation was incorporated as a nonprofit and charitable corporation which has been primarily engaged in making educational loans to senior and graduate men, provided they are citizens of the United States, in good standing and will begin work at the end of the academic year the loan is requested. Interested students should send a copy of their transcript with full details concerning their status and requirements to the Stevens Bros. Foundation, Inc., 610-612 Endicott Building, St. Paul 1, Minnesota.

Tuition Plan of New Hampshire, Inc.

For parents who prefer to pay their educational expenses in monthly installments, the services of the Tuition Plan of New Hampshire, Inc., are available.

Parents may choose a plan to cover the cost of four years' expenses (tuition, room, board, books, transportation, fraternity, and all related educational costs) in a single agreement.

In addition to the agreement covering the full four years' expenses, there are plans covering one, two, and three years' expenses.

Any insurable parent has the opportunity of electing life insurance protection on his Tuition Plan program.

Detailed information concerning the Tuition Plan of New Hampshire, Inc., is mailed to parents of new students each summer or you may write to Tuition Plan of New Hampshire, Inc., Concord, New Hampshire 03301.

United Student Aid Funds Loan Program

USA Funds is a private, nonprofit service corporation which endorses long-term loans made by local banks to needy college students. To be eligible for this loan, a student must be a full-time student in good standing. This loan is normally limited to nonresident students from states which do not offer a State Guaranteed Loan Program.

A student can borrow up to $1,000 a year. Repayment of this loan begins ten months after graduation and extends over a period of three years.

Application forms and additional information may be obtained from the Financial Aid Office.
MEDALS AND PRIZES

The American Institute of Architects Medal and Certificate

The School Medal of the American Institute of Architects is given annually in Schools of Architecture accredited by the National Architectural Accrediting Boards, to a graduating student in recognition of scholastic achievement, character, and promise of professional ability. The award is made possible through an endowment fund provided by the executors and heirs of the Henry Adams Estate.

Each student so honored receives, in addition to the engraved silver medal, a certificate citing his accomplishment in architectural studies; the runner-up also may be awarded the certificate if the head of the School so requests.

The Alpha Rho Chi Medal

The Medal of Alpha Rho Chi, national professional architectural fraternity, is given annually upon recommendation of the faculty of the School of Architecture, to that graduating student who has shown an ability for leadership, performed willing service for his School, and gives promise of real professional merit through his attitude and personality.

The Honor Society of Phi Kappa Phi

Among the prizes offered for scholarship by the Georgia Institute of Technology is membership in the honor society, Phi Kappa Phi, to which a limited number of seniors representing all departments are elected annually. Phi Kappa Phi is a national organization with chapters in many of the leading universities and colleges.

The local chapter of Phi Kappa Phi awards annually a scholarship cup to that member of the senior class who, on the basis of all work taken in this institution, ranks scholastically as one of the first two students in the class.

Tau Beta Pi

Tau Beta Pi is a national honorary engineering fraternity with chapters in most of the leading engineering schools of the country. The Alpha Chapter of Georgia offers membership to approximately twenty-five engineering students of each graduating class who can qualify according to the standards of scholarship, character, loyalty, personality, leadership, and school activities. The fact that Tau Beta Pi is the second oldest honorary fraternity in the country and numbers among its members many of our leading engineers makes membership in the society a coveted honor.

The local chapter of Tau Beta Pi awards annually a scholarship cup to an outstanding engineering senior who ranks among the first five of his class, on the basis of all scholastic work taken in this institution.

Phi Eta Sigma

Phi Eta Sigma is a freshman honor society in which any male student is eligible for membership who has made an average of at least 3.5 on the work of the first term of the freshman year. The society awards a scholarship cup to the freshman who makes the highest average for the first term.

Chi Epsilon Award

The Chi Epsilon Award is given annually by the Georgia Tech Chapter. The recipient is chosen from the five highest members, based on scholarship, of the senior class. The final choice of the recipient is made from the five candidates on the basis of leadership, sociability, practicality and scholarship. The winner receives a certificate and his name is placed on an honor roll in the Civil Engineering Building.

Textile Scholarship Medals

The Georgia Textile Manufacturers’ Association awards a watch annually to a member of the senior textile class, based on scholarship throughout his course and for original effort in the work of the Textile Department during his senior year. The American Association of Textile Technologists makes an award annually in the form of a suitable plaque to a member of the graduating class of the A. French Textile School. The award is based on scholarship and other personal qualities which indicate an outstanding student.
Briaerean Scholarship Cup
The Briaerean Society of the Georgia Institute of Technology presents annually a scholarship cup to a senior member of the society whose scholastic average for a period of four and one-half years entitles him to rank as one of the highest three members of the class.

Fraternity Scholarship Cup
The Interfraternity Council awards quarterly a scholastic cup to the chapter of that organization which makes the highest scholastic average.

Alpha Chi Sigma Prize
The professional chemical fraternity, Alpha Chi Sigma, annually presents a handbook to the junior who has made the best record in the Chemistry or Chemical Engineering course.

Eta Kappa Nu
The Eta Kappa Nu Association, national electrical fraternity, awards annually an electrical engineering handbook to the regular sophomore Electrical Engineering student (on the basis of four quarters) or to the co-op pre-junior electrical engineering student (on the basis of four quarters) having the highest scholastic average.

Delta Kappa Phi
The Delta Kappa Phi Plaque is awarded annually to the graduating senior selected as the outstanding graduate in the textile department. A certificate is presented at the annual Honors Day exercises. Delta Kappa Phi is the oldest national honorary textile fraternity in the country.

Pi Tau Sigma
Pi Tau Sigma, national mechanical engineering fraternity, elects to membership outstanding mechanical engineering students in the junior and senior years.
An annual award of an engineering handbook is made to the highest ranking sophomore student in Mechanical Engineering (based upon at least four quarters of work).

Aerospace Engineering Medal
The James Edward Oglethorpe Chapter of the Daughters of the American Colonists presents annually a medal to the member of the graduating class in Aerospace Engineering who has made the highest scholastic average, based on the work of at least four complete quarters.

Industrial Management Certificate
The Industrial Management Society, senior honorary organization for I.M. students, awards annually a certificate of scholarship to the senior in the College of Industrial Management who ranks first in his class on the basis of all scholastic work taken at Georgia Tech.

Gordon Gambill Memorial Endowment Award
An annual award of an appropriate book to the athlete with the highest academic grade each year at the sophomore, junior, or senior level from the following sports: baseball, basketball, football, and track. This award is made in honor of the late Gordon Gambill, Class of 1913.

The William Gilmer Perry Award
The Department of English awards annually a fifty-dollar bond to the student in his first year who has done the best work in freshman English. This award is made through the courtesy of the Georgia Tech Foundation, Inc., in honor of Dr. William Gilmer Perry, late Professor of English.

Alpha Pi Mu Award
The Alpha Pi Mu Award is presented yearly to extend recognition and honor to that senior student in Industrial Engineering who has exhibited outstanding scholastic achievement tempered with those individual characteristics which the members of Alpha Pi Mu consider necessary for success. The recipient of the award is chosen from the three top seniors scholastically, and the presentation is made at the annual Honors Day exercises.

The American Institute of Industrial Engineers, Atlanta Chapter Award
The American Institute of Industrial Engineers, Atlanta Chapter, award is presented to the Industrial Engineering junior who is most outstanding in scholastic attainment and who has demonstrated such personal qualities as leadership, character, and
breadth of interest. The presentation is made annually at the Honors Day exercises.

The American Institute of Industrial Engineers, Student Chapter Award

The American Institute of Industrial Engineers, Student Chapter, award is presented to the Industrial Engineering sophomore who is chosen from the top three in his individual engineering class as having the best combination of personal and academic qualities. This presentation is made annually at the Honors Day exercises.

Society for Advancement of Management Award

The S.A.M. Award is presented at the annual Honors Day exercises to the Industrial Management student who is the most outstanding in scholastic attainment and who has demonstrated such personal qualities as leadership, character, and breadth of interest.

Georgia Engineering Society Awards

Four awards consisting of a cash prize and certificate are awarded each year by the Georgia Engineering Society. Three awards are given to juniors in the College of Engineering who have earned the highest accumulative grade-point average at the end of the winter quarter. Not more than one award is given to students in any one of the schools of engineering. One award is given to the junior in the School of Architecture who is judged by a committee to be the most promising all-around student. The recipients must have completed at least six quarters of work at the Institute.

The American Society of Civil Engineers Award

The American Society of Civil Engineers Award is given annually by the Georgia Section of ASCE. The recipient is selected by a committee from a list of three candidates who have the highest point average among the graduating members of the Student Chapter of the ASCE and who have completed at least eight quarters of work at the Institute. The Award consists of the Junior Membership entrance fees and a cash prize of $90.

Army R.O.T.C. Awards

The Georgia Tech Honor Award is awarded annually to the outstanding senior cadet. The Superior Cadet Ribbon Award is awarded annually to the outstanding cadet in each year for scholastic and military achievements. The Beta Theta Pi Fraternity, Georgia Tech chapter, presents annually the McGuire Medal to the outstanding Distinguished Military Student of the Army ROTC.

The Georgia Society of Daughters of Colonial Wars presents annually a medal to the ROTC senior for excellence in Army ROTC leadership.

The Armed Forces Communication Association presents an award annually to the outstanding senior Army ROTC cadet in the field of communications and electronics.

Medals and Prizes / 377
The Association of the U.S. Army ROTC Medal is awarded annually to the outstanding ROTC junior. The Association of the U.S. Army presents annually a medal to the outstanding Infantry Branch junior. The American Legion Medal is presented annually by the Fulton County Voiture 217, 40 and 8, Honor Society of the American Legion to the second year basic cadet who is accorded the highest rating in military subjects, personal qualifications, leadership, and scholastic average. The ANAK Society annually presents medals to the three freshmen who attain the highest ratings for proficiency in Military Science. Awards are made annually to the three best drilled basic cadets.

**Air Force R.O.T.C. Medals and Trophies**

The Georgia Tech Honor Award is awarded annually to the outstanding senior cadet. The Beta Theta Pi Fraternity, Georgia Tech Chapter, presents annually the McGuire Medal to the outstanding Distinguished Military Student of the Air Force ROTC.

The ANAK Society of Georgia Tech annually awards a medal to an AFROTC cadet for Outstanding Contribution to Esprit de Corps.

The Scabbard and Blade Military Society gives annually an award for outstanding leadership in AFROTC Corps Training.

The Local Chapters of the Daughters of the American Revolution present annual awards to outstanding seniors in AFROTC.

American Legion Medals are annually awarded to both junior and senior AFROTC cadets for excellence in military achievement and scholastic achievement. The Fulton County Voiture 217 La Societe des 40 Hommes et 8 Chevaux Medal is awarded annually to an outstanding senior in the Flying category. The Sons of American Revolution Award is presented annually to the outstanding freshman.

The Daughters of Founders and Patriots of America Award is presented annually to the outstanding sophomore.

The Old Guard Battalion of the Gate City Guard presents annually an award for excellence in AFROTC.

The Reserve Officers Association presents annual awards to outstanding cadets in AS 400, AS 300, and AS 200.

The Armed Forces Communication and Electronics Association Award is presented annually to the outstanding AFROTC senior in the engineering field.

The Air Force Association annually gives a medal to the AFROTC senior who attains the highest rating for proficiency in leadership and scholarship.

The General Dynamics award is presented annually to the outstanding sophomore in the Flying category.

The Air Force Times Award recognizes annually the senior showing most initiative in community relations.

The Military Order of the World Wars presents annual awards to recognize the most improved cadet in each Aerospace Studies class.

**Naval R.O.T.C. Medals and Awards**

The Georgia State Society "United States Daughters of War of 1812" awards a gold medal each year to the NROTC senior who achieves the highest rating in Naval Science.

The ANAK Society annually awards two medals: one to the NROTC junior showing highest proficiency in leadership, and one to the NROTC freshman showing highest proficiency in Naval Science.

The Scabbard and Blade Society gives an award annually to an outstanding NROTC senior.

The McGuire Medal, awarded by the Beta Theta Pi Fraternity, is presented annually to a distinguished senior.

The Atlanta Chapter of the Reserve Officers Association annually presents an award to an outstanding NROTC student.

An appropriate award is presented each year to selected NROTC members of the Georgia Tech Rifle Team for proficiency in rifle marksmanship.

The Society of American Military Engineers annually awards 10 engineering medals for the outstanding engineering NROTC seniors and 10 medals for the outstanding engineering NROTC juniors selected from all NROTC schools in the United States.

The United States Naval Institute presents awards annually to the senior
Scholarship NROTC student and the senior College Program NROTC student having the highest cruise aptitude marks for summer training.

The Marine Corps Association annually presents an award to an outstanding senior NROTC student who is a candidate for commission in the U.S. Marine Corps.

The Georgia Tech Honor Award is awarded annually to the outstanding NROTC senior in scholarship, military achievement, and leadership.

The Armed Forces Communication and Electronics Association presents a gold medal and certificate to the outstanding NROTC senior majoring in electrical, electronic, or communications engineering.

The Fulton County Voiture 217 La Societe des 40 Hommes et 8 Chevaux presents a medal to the outstanding NROTC sophomore in scholarship.

The American Legion Post No. 1 Award is presented to an outstanding NROTC senior and junior for excellence in scholastic achievement.

The American Legion Fifth District Awards are presented to an outstanding NROTC senior and junior for excellence in military achievement.

The Fulton-DeKalb Council of the Navy League of the United States presents a Navy Officer's sword to the senior NROTC student contributing most to the prestige of the NROTC unit.

The Old Guard Battalion of the Gate City Guard presents a Navy Officer's sword to the Scholarship NROTC senior possessing most officer-like qualities.

The U.S. Marine Corps Reserve Officers Association presents a Marine Corps officer's sword to the outstanding Marine Corps option senior.

The Naval Reserve Association Award is an engraved watch presented each year to the NROTC senior showing outstanding proficiency in leadership.

The Professor of Naval Science Award is presented to the NROTC junior with the highest scholastic average in navigation.

The North American Rockwell Award is awarded to the outstanding NROTC senior in the Flight Indoctrination Program.

The General Dynamics Award is a plaque with scroll presented to an NROTC senior for outstanding achievement.

The Georgia Society of Professional Engineers Award

An award in recognition of demonstrated awareness of professional concepts in engineering is made annually by the Georgia Society of Professional Engineers.

The most outstanding engineering senior in the State of Georgia is chosen on the basis of interest in the professional aspects of engineering as evidenced by unquestioned personal integrity, participation in technical and professional activities, and scholastic standing.

Alpha Kappa Psi Scholarship Award

The Epsilon Sigma Chapter of Alpha Kappa Psi, a professional business fraternity, awards annually the Alpha Kappa Psi Scholarship Key to the male senior student pursuing a degree in the School of Industrial Management, who has attained the highest scholastic average for three years of collegiate work at Georgia Tech.
GEORGIA TECH ATHLETIC ASSOCIATION

Board of Directors

Chairman—Joseph M. Pettit; Vice-Chairman—W. T. Ziegler; Faculty Chairman—Jesse W. Mason; Secretary—W. Carl Biven; Athletic Director—Robert L. Dodd; Faculty Members—Vernon Crawford, William Sangster, Glenn Rainey; Alumni Members—Larry Morris, George Morris, Charles R. Yates; Student Members—Football Team Representative, Editor of the Technique, President of the Student Body; Honorary Alumni Members—L. W. Robert, Jr., Robert H. Tharpe, Sr.; Business Manager and Treasurer—John H. O’Neill, Jr.; Attorney—G. Arthur Howell; Advisory Members—Ewell I. Barnes, John McKenna, Paul Weber.

Intercollegiate Staff

Athletic Director—Robert L. Dodd; Assistant Athletic Director—John H. McKenna; Business Manager—John H. O’Neill, Jr.; Head Football Coach—William M. Fulcher, Ill; Assistants in Football—Maxie Baughan, Franklin Brooks, Bud Casey, Rex Dockery, Gerald Glenville, Bill Lewis, Steve Sloan, Bob Williams, Jack Williams; Freshman Football Coach—Dick Bestwick; Assistant Freshman Football Coach (retired)—Joe Pittard; Head Recruiter—Jack Thompson; Assistant Recruiter—Giles Smith; Head Basketball Coach—John “Whack” Hyder; Assistants in Basketball—Byron Gilbreath, Donald Clifton; Track Coach—Buddy Fowlkes; Assistant Track Coach—Russell Polhemus; Swimming Coach—Herb McAuley; Baseball Coach—James Luck; Tennis Coach—Jack Rodgers; Cross Country Coach—George C. Griffin; Gymnastics Coach—Bill Beavers; Golf Coach—Tommy Plaxico; Wrestling Coach—Lowell Lange; Academic Advisors—George Slayton, Richard Shepherd; Athletic Trainer—Pat Dyer; Assistant Trainer—Bill McDonald; Sports Information Director—Ned West; Assistant Sports Information Director—James Schultz; Ticket Manager—June Owens; Administrative Assistant to the Athletic Director—Mrs. Margie Bennett; Secretaries—Miss Sherron Carroll, Mrs. Martha Lewis, Mrs. Mary Fowler, Miss Suzanne Steed, Mrs. Joyce Stembridge; Receptionist—Mrs. Judith Mustin; Purchasing and Travel Agent—Mrs. Ann Harrell; Accountant—Mrs. Lillian Redmon; Bookkeeper—Mrs. Margaret Murrah; Clerk-Typists—Mrs. Eunice King, Mrs. Betty Kelley, Miss Mary Manning; PBX Operator—Mrs. Linda Watts; Dietitian—Miss Helen Twiggs; Assistant Dietitian—Mrs. Marianne Roper.

College Athletics

College athletics at the Georgia Institute of Technology are managed by a Board of Directors consisting of seven faculty members, three alumni members, and three student members. The President is chairman of the Board and appoints the faculty and alumni members. The student members are the captain of the football team, the editor of The Technique, and the president of the Student Council. The Business Manager of athletics is elected by the Board. The head coaches of the various sports are called into Board meetings from time to time. The Athletic Board holds regularly monthly meetings and called meetings at the
discretion of the President. The Board aims to secure cooperation of the faculty and students in athletic affairs to maintain a high standard of sportsmanship and to create adequate facilities to give every student an opportunity to take part in some athletic activity.

The liberal policy adopted by the faculty towards athletics has resulted in such interest in college sports that the number engaged in some form of exercise is quite large.

Intercollegiate schedules are played in football, cross country, basketball, swimming, track, golf, tennis, baseball, gymnastics, and wrestling.

**Athletic Plant**

Hugh Inman Grant Field, the football stadium, is located in the southeast quadrant of the campus and occupies two full city blocks. The closed U-shaped stadium seats 59,600 and surrounds one football field and a quarter-mile cinder track. At the north end of the U are located the Naval Armory building, the gymnasium and swimming pool building, and the athletic administration building. Under the east stand, dressing rooms and showers to accommodate 1,000 men have been constructed.

The completion of the Alexander Memorial Center in September of 1956 has given Tech's basketball, physical training and intramural programs a great impetus. The coliseum will seat approximately 7,000 spectators for basketball. It has two full-size basketball courts. This building is also used for numerous school functions and is owned by the Georgia Institute of Technology.

The physical training building adjoining the coliseum has dressing rooms and lockers for physical training, basketball, visiting teams, and officials. A full-size basketball court and offices for our Physical Training faculty (sophomore) are in this building.

The "old" gymnasium seats 2,000 for athletic indoor events and 3,000 when set up as an auditorium. The swimming pool seats 400 for aquatic events. This building has locker rooms and showers for both men and women. Offices for P.T. faculty (freshmen) are in this building.

The Naval Armory houses the Navy R.O.T.C. unit and in addition furnishes a supplementary gymnasium for intramural and physical training activity.

The athletic administration building houses the athletic and business offices and visitors' dressing rooms.

The liberality of Mr. John W. Grant and other money furnished by the Georgia Tech Athletic Association, and the government agencies—C.W.A., P.W.A., and W.P.A.—have resulted in a well-equipped sports and recreation center worth well over 6.5 million dollars. Acknowledgment is also made of the money loaned by Mr. Fred M. Kaufman which made possible the construction of the Naval Armory.

In addition to Grant Field, the Board of Directors in 1930 purchased a ten-acre tract located four hundred yards north of the main plant. This field is
known as Rose Bowl Field and contains three football fields, a baseball diamond, and baseball stands which seat 700.

Excellent tennis courts have been built on school property across from the gymnasium in Peters Park. The park also provides sixteen paddleball courts, two outdoor basketball courts and four volleyball courts.

The land bounded by 8th Street, 10th Street, Fowler and Cherry Streets, has been allocated to athletic purposes by Georgia Tech. This includes twelve additional all-weather tennis courts.
NATIONAL ALUMNI ASSOCIATION

Executive Secretary—W. Roane Beard; Assistant Secretary—R. Dan Davis; Assistant Secretary—Robert H. Rice; Editor, The Georgia Tech Alumnus—Ben L. Moon; Alumni Placement Director—Mrs. Mary Peeks; Accountant—Mrs. Jennie L. Bradley; Bookkeeper—Miss Sandra Arthur; Secretaries—Mrs. Sally Teske, Mrs. Joanne Smiley, Mrs. Nadia Tuley; Records Supervisor—James M. Lynch; Records and Clerical—Miss Mary Francis Harris, Mrs. Nell Ivey.

In 1920, under the leadership of William H. Glenn, B.S. in M.E., ’91, the various Georgia Tech Alumni Clubs which had been previously organized in Georgia and other states, were banded together into the present Georgia Tech National Alumni Association. Today Georgia Tech alumni, consisting of graduates and former students, are found all over the world.

Some of the worthwhile objectives of the association are to:
1. Maintain an up-to-date record of each alumnus of Georgia Tech.
2. Publish The Georgia Tech Alumnus and Tech Topics.
3. Organize and service local Georgia Tech Alumni Clubs.
4. Operate a placement service for Georgia Tech alumni—without cost to either employer or applicant for employment.
5. Organize special events for alumni such as class reunions, homecoming activities, club officer weekends, TECH TODAY programs, and alumni participation in commencements.
6. Furnish a medium through which alumni may aid and encourage the President of Georgia Tech and his faculty in maintaining and increasing the prestige of the institution, and assist in providing scholarships for worthy students.
7. Furnish visiting alumni with information and other such personal services.
8. Through the various media of publicity, acquaint the general public; the people of Georgia; civic, state and federal officials; industries of the United States, and institutions of secondary and higher education with the achievements of the Georgia Institute of Technology and its alumni.
9. Raise funds for Georgia Tech through the Annual Alumni Roll Call.

The Alumni Secretary acts as a central contact for Georgia Tech students after their graduation. All Georgia Tech graduates are urged to keep their files in his office up-to-date, giving their location, activities, and other valuable information, in order that they may be consulted without delay on problems of mutual interest.

Officers and trustees of the Alumni Association for 1971-72 are: James P. Poole, ’42, President; J. Frank Stovall, Jr., ’41, Vice President; Thomas V. Patton, ’43, Vice President; L. Travis Brannon, Jr., ’49, Treasurer; W. Roane Beard, ’40, Executive Secretary; Roger H. Brown, ’52; J. Doyle Butler, ’39; George A. Ewing, ’48; James T. Gresham, ’60; Joseph A. Hall, III, ’35; Morris E. Harrison, ’49; John S. Hunsinger, ’54; Robert R. Jinright, ’53; A. J. Land, ’60; J.
Charles Lockwood, '64; David D. Long, Jr., '37; John O. McCarty, '43; Dennis D. O'Brian, '38; James B. Ramage, '37; Chester A. Roush, Jr., '47; Dan P. Shepherd, '50; Wm. J. VanLandingham, '59; Norman J. Walton, '41; and Richard K. Whitehead, Jr., '57.
GEORGIA TECH FOUNDATION, INC.

Executive Secretary—Joe W. Guthridge; Accountant—Mrs. Jennie L. Bradley.

The Georgia Tech Foundation, Inc. is a non-profit corporation organized and operated solely for the purpose of soliciting and administering funds for the benefit of the Georgia Institute of Technology and its students. The Foundation is directed by a Board of outstanding alumni business leaders, who administer the funds received in such a way as in their judgment would most effectively improve the standard of the school.

The funds received by the Foundation are used presently for the following purposes:

1. To supplement the compensation of faculty members in order to obtain or retain outstanding faculty members and thus improve the standard of education at the Georgia Institute of Technology.

2. To undertake special programs, which cannot be financed by state funds, for the development of Georgia Institute of Technology.

3. To enable faculty members to improve their professional qualifications and standing by grants to obtain advanced degrees, etc.

The majority of donations received are unrestricted and are used by the Foundation at the discretion of its Board of Trustees. Some donations are received for designated purposes and are used by the Foundation only for the purpose designated, provided they are for the use of the Georgia Institute of Technology and within the charter purposes of the Foundation.

Members of the Foundation Board of Trustees are: Hal L. Smith, '26, Atlanta, President; L. L. Gellerstedt, Jr., '45, Atlanta, Vice President; Robert H. Ferst, '38, Atlanta, Treasurer; Joe W. Guthridge, Atlanta, Executive Secretary; Jack Adair, '33, Atlanta; Ivan Allen, Jr., '33, Atlanta; John P. Baum, '24, Milledgeville, Ga.; D. Braxton Blalock, Jr., '34, Atlanta; Fuller E. Callaway, Jr., '26, LaGrange, Ga.; Oscar G. Davis, '22, Atlanta; Dakin B. Ferris, '50, New York City; Alvin M. Ferst, '43, Atlanta; Jack F. Glenn, '32, Atlanta; Henry W. Grady*, '18, Atlanta; Ira H. Hardin, '24, Atlanta; George H. Hightower, '37, Thomaston, Ga.; Julian T. Hightower*, '19, Thomaston, Ga.; Wayne J. Holman, Jr., '28, New Brunswick, New Jersey; Howard B. Johnson, '34, Atlanta; J. Erskine Love, Jr., '49, Atlanta; George W. McCarty*, '08, Atlanta; John J. McDonough, '23, Atlanta; Walter M. Mitchell, '23, Atlanta; L. Allen Morris, '36, Miami, Florida; Frank H. Neely*, '04, Atlanta; William A. Parker*, '19, Atlanta; Hazard E. Reeves, '28, New York City; Glen P. Robinson, Jr., '48, Atlanta; I. M. Sheffield, Jr.*, '20, Atlanta; Charles R. Simons, '37, Flowery Branch, Ga.; John C. Staton, '24, Atlanta; Frederick G. Storey, '33, Atlanta; Howard T. Tellepsen, '34, Houston, Texas; William S. Terrell, '30, Charlotte, North Carolina; Robert Tharpe, '34, Atlanta; William C. Wardlaw, '28, Atlanta; George W. Woodruff*, '17, Atlanta; Charles R. Yates, '35, Atlanta.

*Trustee Emeritus
Income Tax Provisions of Contributions

Funds held by the Georgia Tech Foundation, Inc., are exempt from taxation by both State and Federal Government, because it is a non-profit educational organization. Contributions made by individuals and industries to the Foundation are deductible from income for income tax purposes. For full details about limitations and savings in income tax, latest State and Federal tax regulations should be consulted.

Bequests

There are various forms of bequests that can be used. Due to differences in the various state laws, an attorney-at-law should be consulted. A suggested simple form that will serve in some cases is as follows:

_I hereby give and bequeath to the GEORGIA TECH FOUNDATION, INC., Atlanta, Georgia, the sum of ......................... dollars to be used by the Board of Trustees in whatever way will best advance the interests of the Georgia Institute of Technology._

If the bequest is intended to leave the Foundation the remainder of any estate, the form may be: _All the rest, residue, and remainder of my real and personal property of any kind whatsoever, I give and bequeath to the GEORGIA TECH FOUNDATION, INC., Atlanta, Georgia, et cetera._

All money received by the Foundation will be administered and directed by the Board of Trustees according to the wishes of the donors and in the best interests of the Georgia Institute of Technology.

Georgia Tech Annual Alumni Roll Call

The rising cost of higher education has made it imperative that colleges and universities get all possible aid from outside sources. In 1947, the Foundation originated the Georgia Tech Annual Alumni Roll Call, a vehicle by which all Tech men can contribute to their Alma Mater according to their means. The annual Alumni Roll Call began its twenty-fifth year, July 1971.

The results of the first twenty-four years of the Roll Call have proved the soundness of this plan. The renewed spirit of giving to Georgia Tech by alumni has been very gratifying to all concerned. Additional support is being received from industry and foundations within the state. The Joint Tech-Georgia Development Fund is proving to be very helpful to both Georgia Tech and Georgia.

For four consecutive years, the Georgia Institute of Technology was recognized nationally with the first place award “for sustained alumni support” among all public institutions of higher learning. In 1967, the Institute also received the Alumni Service Award jointly with the University of Georgia for the Joint Tech-Georgia Development Fund. In 1968, the Association was honored
with the Alumni Administration Award and in 1969, it received the grand prize for "improvement in alumni giving for all institutions."

The aid realized through the Roll Call supports the work of the National Alumni Association as well as the Georgia Tech Foundation, Inc. The only use to which these funds are put by the Foundation is for the advancement and benefit of Georgia Tech. The work of the Georgia Tech Foundation, Inc. continues to be one of the most vital factors in the growth and development of the Georgia Institute of Technology.
Administrative Council—1972-1973*

JAMIE R. ANTHONY
Director of Public Safety

FORRESTER C. AUMAN
Professor of Naval Science

HARRY L. BAKER, JR.
Director of Research Administration

EWELL I. BARNES
Vice President for Business and Finance

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