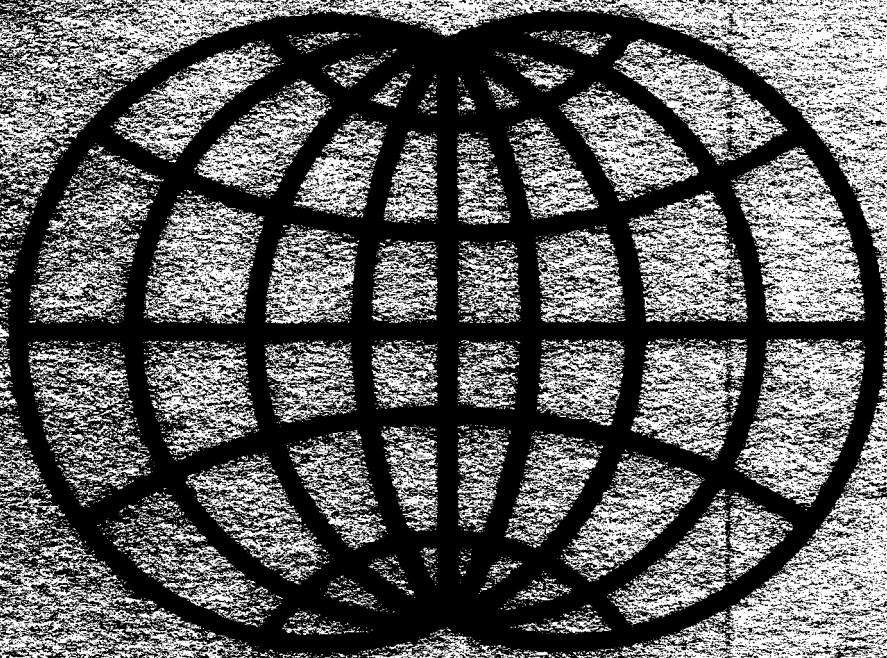


*The University of Texas at Arlington*

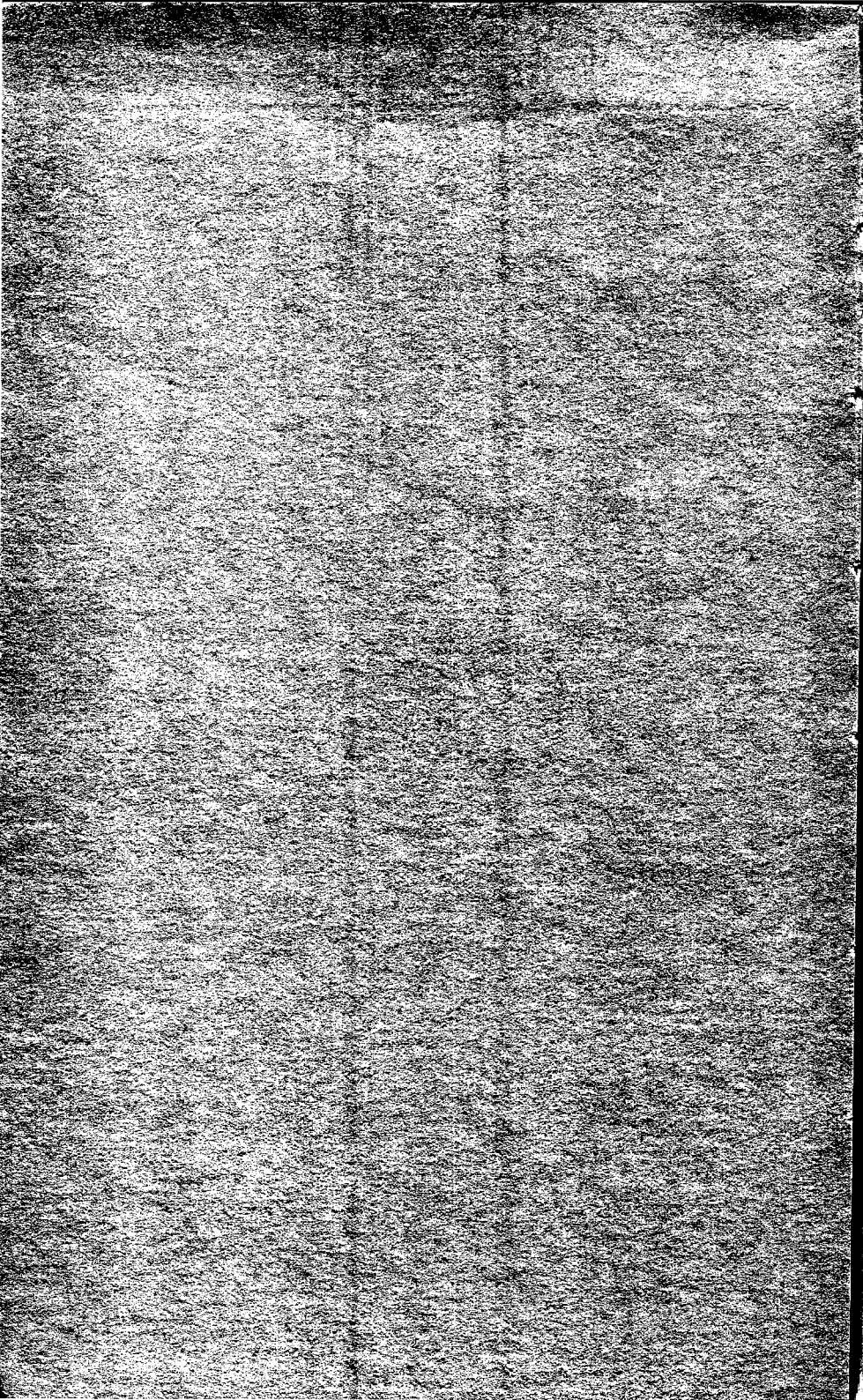


GRADUATE SCHOOL CATALOG 1968-69

Volume 11

No. 9

August 1968



**The  
University of  
Texas  
at Arlington**

**GRADUATE  
CATALOG**



**1968-1969**

**Vol. LI August 1968 No. 9**

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# 1968

JANUARY							MAY							SEPTEMBER							
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# 1969

JANUARY							MAY							SEPTEMBER							
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# CAMPUS CALENDAR

## Fall Semester 1968

September 16, 17, 18	Registration for Fall Semester 8 a.m. to 5 p.m. and 6 p.m. to 9 p.m.
September 19	Classes begin 8 a.m.
September 24	Late registration closes 9 p.m.
October 2	12th Day of Classes
November 12	Midsemester
November 27	Thanksgiving Holidays begin 10 p.m.
December 2	Thanksgiving Holidays end 8 a.m.
December 21	Christmas Holidays begin 12 noon
January 6	Christmas Holidays end 8 a.m.
January 20	Final examinations begin
January 31	Commencement

## Spring Semester

February 3, 4	Registration for Spring Semester 8 a.m. to 5 p.m. and 6 p.m. to 9 p.m.
February 5	Classes begin 8 a.m.
February 11	Late registration closes 9 p.m.
February 18	12th Day of Classes
March 26	Midsemester
April 3	Easter Holidays begin 10 p.m.
April 8	Easter Holidays end 8 a.m.
May 20	Final Examinations begin
May 31	Commencement

## Summer Sessions 1969

June 3	Registration for night students 6 - 9 p.m.
June 4	Registration for day students 8 a.m. - 5 p.m.
	Registration for night students continues 6 - 9 p.m.
June 5	Classes begin for day students 7 a.m.
June 9	Classes begin for night students 5:30 p.m.
June 10	Late registration closes 9 p.m.
	4th Day of Classes for day sections
June 12	4th Day of Classes for night sections
July 4	Holiday
July 12, 14	Final examinations for first summer day sessions
July 18	Registration for second summer day session
July 21	Classes begin for second summer day session 7 a.m.
July 24	4th Day of Classes for second summer day session
August 18	Final examinations begin for night sections
August 26, 27	Final examinations for second summer day session
August 29	End of Summer Session

# BOARD OF REGENTS THE UNIVERSITY OF TEXAS SYSTEM

## OFFICERS

Frank C. Erwin, Jr., Chairman  
Jack S. Josey, Vice-Chairman  
Betty Ann Thedford, Secretary

## MEMBERS

(Terms Expire January 1969)

Frank C. Erwin, Jr. . . . .	Austin
Mrs. J. Lee Johnson III . . . . .	Fort Worth
Levi. A. Olan . . . . .	Dallas

(Terms Expire January 1971)

Jack S. Josey . . . . .	Houston
William H. Bauer . . . . .	Port Lavaca
Edward Ximenes, M.D. . . . .	San Antonio

(Terms Expire January 1973)

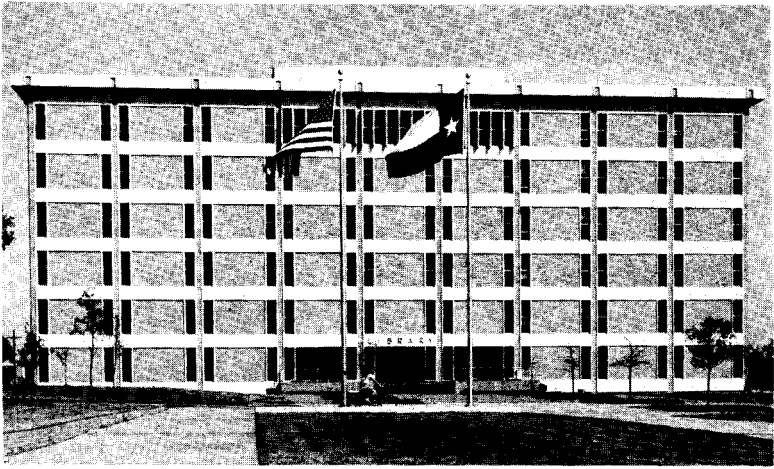
Frank Ikard . . . . .	Wichita Falls
Joe M. Kilgore . . . . .	Austin
John Peace . . . . .	San Antonio

## Administration of

## THE UNIVERSITY OF TEXAS AT ARLINGTON

Harry H. Ransom, Ph.D., Litt. D., LL.D . . . . .	Chancellor, UT System
*J. R. Woolf, Ph.D. . . . .	President, UT Arlington
S. T. Keim, Jr., Ph.D. . . . .	Vice-President for Academic Affairs
W. H. Nedderman, Ph.D. . . . .	Vice-President for Research and Graduate Affairs, Acting Associate Dean for Graduate Studies and Dean of Engineering
B. C. Barnes, M.A. . . . .	Vice-President for Fiscal Affairs
Wallace B. Nelson, Ph.D. . . . .	Dean of Business Administration
Charles H. Green, Ph.D. . . . .	Dean of Liberal Arts
Peter R. Girardot, Ph.D. . . . .	Dean of Science
Charles T. McDowell, M.A. . . . .	Dean of Student Life
Weldon Brewster, M.A. . . . .	Dean of Student Administration
A. L. von Rosenberg, B.S. . . . .	Business Manager
John A. Hudson, M.A., M.S. in L.S. . . . .	University Librarian
Elwood J. Preiss, M.A. . . . .	Registrar and Director of Admissions
W. J. Karraker, Ed.D. . . . .	Director of Testing and Counseling
Bcb Stephens, B.S. . . . .	Assistant to the President

\*Resigned effective Sept. 1, 1968



## GENERAL INFORMATION

### Government

The government of The University of Texas at Arlington is vested in a nine-member Board of Regents of The University of Texas System, selected from different portions of the state, nominated by the Governor, and appointed by and with the advice and consent of the Senate. The Chancellor is the chief administrative officer of The University of Texas System. The chief administrative officer for the operations of UT Arlington is the President, under the authority of the Chancellor and the Board of Regents. A complete statement of the authority and duties of the Regents and of the several officers, together with an account of the organization of the system, is published in the **"Rules and Regulations of the Board of Regents of The University of Texas."**

The **"Rules and Regulations"** includes the following statement:

"With respect to the admission and education of students, with respect to the employment and promotion of teaching and non-teaching personnel, with respect to student and faculty activities conducted on premises owned or occupied by the University, and with respect to student and faculty housing situated on premises owned or occupied by the University, neither The University of Texas nor any of its component institutions shall discriminate either in favor of or against any person on account of his or her race, creed, or color."

### Location

The Arlington campus is located in the center of the Fort Worth-Dallas metropolitan area, a business and industrial complex comprising the counties of Tarrant and Dallas. The campus is situated a few blocks southwest of the downtown business area of Arlington.

## **THE GRADUATE SCHOOL**

The Graduate School of The University of Texas is responsible for all graduate research and programs of instruction within the University system. All post-baccalaureate degrees (other than the Doctor of Medicine and Doctor of Dental Surgery degrees and the Master of Laws degree) awarded by the University are given by the Graduate School.

In each academic area in which graduate work is offered at The University of Texas at Arlington, there is a graduate advisor who acts as the representative of the Graduate School Administrator (Associate Dean for Graduate Studies) in advising students. The graduate advisor gives information to students about graduate work in his area, counsels with them regarding their plans and progress and guides their proposed work toward a graduate degree until they have selected a supervising professor.

### **THE PURPOSE AND NATURE OF GRADUATE WORK**

Graduate work is usually concentrated in one academic area (which may fall within a single undergraduate department or bridge several), with such advanced work in closely related areas as may be needed to support the field of specialization. The objective of the master's programs is to give the student experience in advanced study. The objective of the doctoral programs (not offered at UT Arlington) is to produce a scholar capable of conducting independent original investigation in his field, and capable of following the work of his colleagues with critical comprehension.

### **GENERAL REQUIREMENTS AND PROCEDURES**

#### **Admission to the Graduate School**

All correspondence concerning admission should be addressed to the Registrar and Director of Admissions. Applications for admission should be made on the appropriate printed form, which will be sent upon request.

An applicant for admission to the Graduate School must (1) hold a bachelor's degree from The University of Texas at Arlington or an equivalent degree or must have had equivalent training in a foreign university, (2) satisfy the grade average requirements specified below, and (3) make a satisfactory score on the Graduate Record Examinations Aptitude Test.

Each applicant for admission (or transfer) to the Graduate School must take, at his own expense, the Aptitude Test of the Graduate Record Examinations administered by the Educational Testing Service. The test scores will be used, with other data, to determine eli-



gibility for admission and to aid in counseling the applicant after admission. The test is given at various centers throughout the United States on regularly established dates, usually in October, December, January, February, April and July. It is administered on each of the six dates at approximately 25 colleges or universities in Texas and at approximately 395 other designated centers in the United States and abroad. A bulletin of information describing the test and a test application blank may be secured from the Educational Testing Service, Box 955, Princeton, New Jersey, 08540, or from the Testing and Counseling Center at UT Arlington. Since applications for the test must be received in Princeton about two weeks before each testing date, applicants should secure the bulletin of information at least a month in advance.

An applicant who holds a bachelor's degree from UT Arlington should apply to the Director of Admissions at least 30 days prior to the beginning of the semester or summer session in which he wishes to register. An applicant whose degree or degrees are from some other American college or university should file an application, with the required official transcripts of all previous college work, at least 60 days prior to the beginning of the semester or summer session in which he plans to register. A foreign student should apply early enough to allow ample time for correspondence to be completed 60 days prior to the beginning of the semester or summer session in which he plans to register. The Director of Admissions and, if appropriate, the Associate Dean and members of the academic area in which the applicant proposes to major will evaluate the record of work and will accept or reject the application for admission on the basis of the criteria outlined below.

**Admission**—The Director of Admissions will give regular admission to an applicant holding a bachelor's degree from UT Arlington or another institution approved by the appropriate accrediting agency if (1) according to the Catalog rules no conditions need to be imposed, (2) the applicant has at least a 2.0 grade-point average\* on all work of junior and senior level previously taken, and (3) the applicant has a satisfactory score on the Graduate Record Examinations Aptitude Test.

**Admission denied**—Admission to the Graduate School will be denied by the Director of Admissions if the grade-point average on advanced work of the applicant is below 1.80 and if the applicant's performance on the Graduate Record Examinations Aptitude Test is unsatisfactory.

**Consideration of applicants not accepted or rejected**—The Director of Admissions will refer the record of any applicant to the graduate advisor of the student's intended major department and to the

\*In computing this average the following point values per semester hour are used: A, 3 points; B, 2 points; C, 1 point; D or F, 0 points. Grade-point systems on transcripts from schools using other grading plans will be interpreted by the Director of Admissions.

Associate Dean for their recommendation for acceptance or rejection if (1) the applicant has at least a 1.8 grade-point average on all work of junior and senior level previously taken and a satisfactory score on the Graduate Record Examinations Aptitude Test, or (2) the applicant has at least a 2.0 grade-point average on all work of junior or senior level previously taken but does not have a satisfactory score on the Graduate Record Examinations Aptitude Test, or (3) the applicant's subject preparation does not conform to general UT Arlington policy.

Furthermore, upon request from either the appropriate graduate advisor or the Associate Dean, the record of any applicant will be referred for their consideration. In conformance with the recommendation of the graduate advisor and the Associate Dean, the Director of Admissions will accept the applicant, with or without conditions, or reject the applicant.

**Permit to register in Graduate School**—The Director of Admissions will issue a permit to register in the Graduate School to any applicant who holds a bachelor's degree from The University of Texas at Arlington or another institution approved by the appropriate accrediting agency even though he has not taken the Graduate Record Examinations Aptitude Test if the applicant has at least a 2.0 grade-point average on all work of junior and senior level previously taken. This permit is valid for one semester of the long session or one summer session only. It requires that the applicant take and achieve a satisfactory score on the Graduate Record Examinations Aptitude Test during the semester or summer session for which he is issued a permit to register.

NOTE: If the applicant applies for admission prior to the last scheduled administration of the Graduate Record Examinations Aptitude Test before his indicated admission date, he will not be admitted under the above provisions.

### **Procedure after Admission**

Upon approval of the application for admission, the Director of Admissions will notify the applicant, the Associate Dean, and the graduate advisor and also state in detail any conditions or prerequisites that must be absolved.

After being admitted, the student should confer with the graduate advisor of the proposed major area, preferably by personal interview, in order to become acquainted with specific departmental regulations, particularly in the case of areas that require additional examinations upon entrance. After receiving registration materials from the Registrar's Office, he should consult the graduate advisor in the proposed major area at the time and place indicated in his registration instructions concerning the details of registration, course program, and other routine. His course program must be approved by the graduate advisor and the Associate Dean.

## Restriction on Admission

Because there may be more applicants than facilities can accommodate, it may be necessary to limit the number of students accepted for graduate work in certain areas. See the prerequisites and requirements under each major area of concentration.

## General Information

**Grades of scholarship**—Subject to the following restrictions, graduate credit will be given for grades of A, B, or C for work done at UT Arlington:

- (1) The student must maintain a B average on all work in his major (not counting thesis).
- (2) He must maintain a B average on all work in his minor or minors.
- (3) He must maintain a B average on all advanced work (not counting thesis).

For graduate credit no term or semester grade may be raised except by repeating the course involved, in which case both grades will count on the student's average.

**Incomplete grade**—A student who has been unable to complete all the class or laboratory assignments in a semester or term may, at the discretion of the instructor, receive an X designating a temporary grade. The incomplete grade will be changed to an F if it has not been removed by the end of the following semester, exclusive of the summer session.

**Credit for research or thesis courses**—A final grade may be given in a research or thesis course if the work is completed during the semester in which the student initially registered in the course.

If the student is undertaking a research or thesis course and is not to receive a grade (other than X) at the completion of the semester, he may receive a grade designation of R (research in progress). This grade designation is a permanent grade, but is not included in any academic evaluation and does not carry any credit value. This grade may be issued only to graduate students for the above mentioned courses.

**Auditing**—Auditing is a privilege open to any person (if space is available) who has credit in the course or has a demonstrated need. Auditing grants the privilege of hearing and observing only, and does not grant credit. Audit applications may be secured from the Registrar's Office and require the approval of the Associate Dean or his representative. When the form has been completed and approved, the applicant pays a fee of \$5 per course.

**Adding and dropping courses**—A student who wishes to change his schedule by either dropping or adding a course should apply to the head of the department which offers the course. Students are

responsible for adhering to the following regulations concerning drops and adds:

- (1) A student may not add a course after the end of late registration.
- (2) A student may not drop a course during the last two weeks of a semester.
- (3) A student who desires to drop all courses for which he is enrolled is reminded that such action results in his withdrawal from the University. He should indicate his intention to withdraw and drop all courses by filing a properly executed resignation form in the Office of the Dean of Student Administration.

**Withdrawal**—A student who wishes to withdraw (resign) voluntarily from the University must execute the proper resignation form in the Office of the Dean of Student Administration.

**Maximum course load and work load**—The maximum course load for graduate students is 15 semester hours; registration in excess of this maximum will be approved by the Associate Dean only in exceptional circumstances. If the student is employed by UT Arlington as a teaching assistant, research assistant, or student assistant, the course load must be correspondingly reduced. The student should consult his graduate advisor about his combined course and work load.

### **Continuation in the Graduate School**

Regardless of conditions surrounding the student's admission, continuation from semester to semester in the Graduate School is permitted only if (1) satisfactory progress is made in absolving admission conditions, and (2) the student maintains a 2.0 grade average on all work undertaken while in Graduate School. If the student at any time fails to maintain an overall 2.0 grade point average on all work undertaken as a graduate student, he must during his next semester of attendance raise his average on all work taken while in Graduate School to a 2.0 grade point average. A graduate student undertaking less than a full academic load (nine semester hours of advanced course work) will have his record evaluated the semester that he completes his first nine semester hours of course work at this institution. His academic record will thereafter be evaluated at the conclusion of each additional nine semester hours of course work. Failure to meet the grade point requirement will result in automatic dismissal from Graduate School. Following such dismissal, the student may be readmitted for further graduate study in either the same or a different area only if his petition (accompanied by a complete record of all college or university work previously undertaken) has been approved by the Committee on Graduate Studies and the Associate Dean for Graduate Studies.

## EXPENSES

NOTICE: Due to conditions which may arise beyond the control of The University of Texas at Arlington, fees may be changed during the next year without notice. The University reserves the right to modify any fee in accordance with unforeseen conditions.

### TUITION

#### Regular Sessions

Semester Hours	Texas Resident*	Out-of-state*
12 or more	\$91.00	\$241.00
11	87.00	225.00
10	83.00	209.00
9	79.00	193.00
8	60.00	162.00
7	56.00	146.00
6	52.00	130.00
5	48.00	114.00
4	44.00	98.00
3 or less	41.00	82.00

\*Includes \$20.00 Building Use Fee. Nine or more hours includes \$21.00 Student Service Fee. Less than nine hours includes \$6.00 Student Service Fee.

#### Summer Day Sessions

Semester Hours	Texas Resident*	Out-of-state*
4 or more	\$38.00	\$113.00
3	34.00	88.00
2	30.00	63.00
1	28.00	38.00

\*Includes \$10.00 Building Use Fee and \$3.00 Student Service Fee.

#### Summer Night Sessions

Semester Hours	Texas Resident*	Out-of-state*
12 or more	\$76.00	\$226.00
11	71.00	211.00
10	67.00	194.00
9	63.00	177.00
8	59.00	160.00
7	55.00	143.00
4-6	51.00	126.00
3	47.00	101.00
2	43.00	76.00
1	41.00	51.00

\*Includes \$20.00 Building Use Fee and \$6.00 Student Service Fee.

## **Non-Residence Fee**

All students attending The University of Texas at Arlington who are non-residents of this state will be charged additional tuition in accordance with the state law.

According to interpretations by the Coordinating Board, Texas College and University System, of Article 2654c, Vernon's Civil Statutes, with amendments through 1965, the following information pertains: "A non-resident is hereby defined to be a student of less than twenty-one (21) years of age, living away from his family and whose family resides in another state, or whose family has not resided in Texas for twelve (12) months immediately preceding the date of registration; or a student of twenty-one (21) years of age or over who resides out of state or has not been a resident of this state twelve (12) months immediately preceding the date of registration."

Individuals of twenty-one (21) years of age or older who have come from outside the state and who register in an educational institution for more than one course per semester prior to having resided in the state for a period of twelve (12) months shall be classified as non-resident students and such non-resident student classification shall be presumed to be correct as long as the residence of such individuals in the state is during their attendance at educational institutions, regardless of whether such individuals have become qualified voters, registered motor vehicles and paid personal property taxes thereon, obtained Texas drivers' licenses, or otherwise attempted to establish legal residence within the state.

A married woman's legal residence is that of her husband regardless of her legal residence prior to her marriage.

The responsibility of registering under and maintaining the proper residence classification rests on the student. If there is any question concerning his classification as a resident of Texas at the time of registration, or anytime thereafter, it is the student's obligation to consult with the residence advisor in the Office of the Registrar and have his classification officially determined.

## **Student Service Fee**

The Student Service Fee is compulsory for both full-time and part-time students.

The Student Service Fee of \$21 for full-time students (nine or more hours) consists of admission to intercollegiate events, formal convocation events, a copy of the yearbook, health services, newspaper, magazine, and activity programs in the E. H. Hereford Student Center.

The \$6 fee for students taking less than nine hours entitles the student to health services, newspaper, magazine, and activity programs in the Student Center.

A student will be entitled to a yearbook for no additional fee only if he was registered for both Fall and Spring Semesters, excepting those who graduate at the end of the Fall Semester. Students paying \$21 for only one of the two regular semesters must pay an additional \$2.50 to receive a yearbook. Only those students taking nine hours or more will be entitled to have their pictures made and placed in the yearbook without additional charge.

### **Property Deposit Fee**

Every student registering at UT Arlington will be required to make and maintain a property deposit of \$10. The records will be reviewed from time to time, and if charges have been made against the deposit, the student will be required to bring the deposit up to \$10.

The deposit will be refunded only when the student withdraws from school or graduates.

### **Parking Fees**

Students will register their cars in a single payment for the entire school year or the balance of the school year in which they register, whichever is applicable (school year is September 1 through August 31). The following fees will be charged for autos at the initial period of registration: Fall Semester, day, \$15; night, \$8. Spring Semester, day, \$8; night, \$5. First Summer Session, day, \$4; night, \$3. Second Summer Session, day, \$3. For motorcycles, fees will be: Fall Semester, day, \$8; night, \$4. Spring Semester, day, \$4; night, \$2. First Summer Session, day, \$2; Summer night, \$2. Second Summer Session, day, \$1.

Commuting students have found that car pools are an economical way to travel between home and school. However, if the car pool rotates cars, each vehicle must be registered at the Parking Facilities Office in the Student Center.

In the event that a student wishes to register two motor vehicles in his own name, the student must present proof of ownership of both motor vehicles, plus a receipt from the Business Office for the required amount of registration for the first car and a receipt for \$1 for registration of the second motor vehicle to the Parking Facilities Office, Room 108, Student Union Building. Parking Facilities Office is open from 7 a.m. to 10 p.m. Monday through Friday, and 8 a.m. to noon on Saturday.

### **Late Registration Fee**

There shall be a compulsory fee for late registration of \$5 for the first day, plus \$2.50 for each additional late day, with the maximum amount being \$15 for any one semester or term.

## Refunds

A student who withdraws from the University on or before the 12th day of classes\* of a regular semester or the equivalent of a summer term (fourth day of classes) will be refunded 50 per cent of fees paid. A student resigning after the 12th day of classes or its equivalent will receive no refunds. This policy applies to tuition, laboratory fees, private instruction fees, building use fees, parking fees, fees for extension courses, and fees for the use of the bowling alley during regular physical training courses. The policy does not apply to residence hall rent and other fees not specifically mentioned.

No refunds will be made until 10 days have elapsed from the time the fees were paid. No refund of special course fees will be made after the beginning of class work.

A student who has registered and paid the student activity fee for one regular semester and who is withdrawing from the University is entitled to a student yearbook if he pays an additional \$2.50. No additional fee is required, however, if the student is resigning and has paid student activity fees for two consecutive regular semesters.

The unused portion of the housing deposit will be refunded if the resident's room has been thoroughly cleaned and no damage has been incurred, inventory card completed and room key returned to the residence hall office. The Business Office will mail the refund to the student at the address specified on the inventory card.

\*Oct. 2 in 1968 Fall Semester; Feb. 18 in 1969 Spring Semester; June 10 in 1969 Summer Semester (first day session); June 12 in 1969 Summer Semester (night session); July 24 in 1969 Summer Semester (second day session).

## THE LIBRARY

(Picture on Page 5)

The Library, housed in a six-story, air-conditioned building, contains a rapidly expanding collection of more than 290,000 books. In addition, the Library subscribes to more than 2,500 periodicals and newspapers and maintains a collection of recorded tapes, discs, microfilm, motion pictures, film strips, and slides. Equipment is available for photographic duplication of printed materials and microfilm at a nominal charge. Typewriters are available for use on a rental basis.

The Library also maintains an audio-visual service with listening-recording booths, listening rooms and a projection room for motion pictures. Library hours are:

Monday-Thursday	7:45 a.m.-11 p.m.
Friday	7:45 a.m.-6 p.m.
Saturday	10:00 a.m.-6 p.m.
Sunday	2:00 p.m.-10 p.m.

14 Schedules for holiday periods are posted.



# REQUIREMENTS FOR DEGREES

## General Regulations

**Residence**—Each degree candidate must spend two semesters, or the equivalent, of full-time study in residence at The University of Texas at Arlington.

**Registration**—Each candidate for a graduate degree must register in the University, according to the official calendar for the registration of graduate students, during the semester or summer session in which he is to receive his degree. Any student who is receiving advice and assistance from a member of the faculty in the preparation of his thesis must register for the appropriate course even if the student is not present on the campus. If he has completed all requirements for his degree, including thesis, he may register in absentia during the semester or summer session in which he expects to receive his degree.

Registration for the master's thesis course must have covered a longer period than one semester (a summer session will be counted as equivalent to one-half of one semester) unless in an exceptional case the candidate's supervising committee unanimously recommends and the Associate Dean approves acceptance of the thesis after a shorter time of preparation.

**Correspondence course**—Courses done by correspondence are not accepted for graduate credit.

**Extension**—Work done in extension classes may be allowed graduate credit to the extent of not more than six semester hours, provided that: (1) In each case both the course and the instructor are recommended by formal vote of UT Arlington faculty of the department or school directly concerned and approved by the appropriate committee on graduate studies, and (2) The applicant, before taking a course, be accepted by the Registrar for admission to the Graduate School and approved by the Associate Dean for the course desired.

**Reservation of work by undergraduates for graduate credit**—An undergraduate who needs not more than 12 semester hours in one semester (six semester hours in one summer session) to complete all of the requirements for a bachelor's degree may be allowed to register for work to count for graduate credit under the following conditions:

- (1) That all work for undergraduate credit be completed during that semester or summer session.
- (2) That the total registration for all work not exceed 15 semester hours in a semester (or 12 semester hours in a summer session).
- (3) That all work to be counted for graduate credit be ap-

proved before the end of the first two weeks of the semester or session by the graduate advisor and by the Associate Dean.

(4) That the Registrar certify to the Associate Dean the work in question will not be counted for undergraduate credit. A form reserving courses may be secured from the Graduate School Office.

**Courses counted for another degree**—No course to be counted toward an undergraduate degree may be counted toward any graduate degree, either directly or by substitution.

**Transfer credit**—Credit will not be granted toward a master's degree for work completed in other institutions except upon the approval of the Committee on Graduate Studies. A maximum of six semester hours of transfer credit will be considered for approval. Such work must have been completed no more than five years before enrollment in the UT Arlington graduate program.

## **Graduation**

Each graduate student must complete his degree requirements in accordance with the Catalog in force at the time he entered the Graduate School or the Catalog of any subsequent year in which he was a resident graduate student.

**Time limit**—All of the work for a master's degree must be completed within one six-year period, (time in military service excluded).

No honorary degree will be conferred by The University of Texas at Arlington.

No degree will be conferred except as listed in public commencement programs. Degrees are awarded at the end of the fall semester, the spring semester, and either summer session, but formal public ceremonies are held only at the conclusion of fall and spring semesters.

## **ROUTINE FOR ALL CANDIDATES FOR MASTER'S DEGREES**

File in the Graduate School Office during the first 30 calendar days of the final semester or first six days of the final summer session:

- (1) A diploma name card (this must be refiled in case of postponement).
- (2) An application for candidacy, if not filed in an earlier semester.
- (3) A program of work.

Submit the thesis or approved substitute to the supervising committee not later than 30 days before graduation day of the final semester.

File in the Graduate School Office bound final copies of the thesis (original and first carbon) not later than 15 days before graduation day of the final semester.

## THE DEGREE OF MASTER OF ARTS (M.A.)

(General)

**Prerequisite**—For the degree of Master of Arts one prerequisite is the degree of Bachelor of Arts from UT Arlington or its equivalent.

The prerequisite for majoring in any area is at least 12 semester hours of advanced courses in that area or school.

The departmental graduate school committee in the student's major area has the right to examine the candidate on the prerequisites to the major subject before his application for the degree is approved. The examination may be either written or oral, at the discretion of the committee. This examination will not be required in the case of students who have passed the major examination in the same subject for the bachelor's degree from The University of Texas at Arlington.

**Fields of study**—UT Arlington is authorized to offer the Master of Arts degree in the following areas:

Biology	History
Chemistry	Mathematics
Economics	Physics
English	Psychology

**Requirements**—For the degree of Master of Arts the equivalent of 30 semester hours of graduate instruction is required; the program shall include at least 21 semester hours of graduate work, including the thesis. The maximum number of semester hours of courses on the advanced level which may be included is nine, of which not more than six may be in either the major or minor. The proposed course of study must be approved by the Committee on Graduate Studies.

Of the required 30 semester hours of junior, senior, or graduate rank, 18 to 24, inclusive of the thesis, shall be in the major area of instruction (either in the field of concentration or in supporting courses within the major department). The thesis usually accounts for six semester hours, but with special approval may be expanded to nine. The thesis, and its evaluation as six or nine semester hours, must be approved by the instructor in charge and by a supervising committee appointed by the Associate Dean; the thesis is subject also to final approval by the Associate Dean. By specific approval of the Committee on Graduate Studies work of the major may be divided between more than one area approved for graduate instruction. The remaining six to 12 hours of the total master's degree program shall be in a supporting subject or subjects outside the major area and shall be designated a minor. The relative number of hours in the major and minor field, as well as the nature of the supporting work, must be approved by the departmental graduate studies committee within whose jurisdiction the major work of the student falls, and be subject to the approval of the Associate Dean.

In certain instances substitutions for the formal thesis may be recommended to the Associate Dean by the appropriate departmental graduate studies committee. Such substitutions may include internship reports (where the internship is approved as an essential part of the graduate program by the Associate Dean) or reports prepared in certain graduate seminar or conference courses.

Certain specific requirements in each area will be found in the section of the Catalog devoted to the departments.

**Candidacy Requirements**—Only those students who show promise of capacity to do work of the high standard set for graduate credit will be admitted as candidates for the master's degree. The departmental graduate studies committee of the student's major area has the right to inquire as to the applicant's undergraduate record and to examine him on the prerequisites for the major subject, and may require him to make up deficiencies in his undergraduate preparation before his application is approved. This examination may be either oral or written at the discretion of the departmental graduate studies committee. Application for candidacy must be approved by the Committee on Graduate Studies, Associate Dean of Graduate School and the major department Graduate Advisor.

## **THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION (M.B.A.)**

**Prerequisite**—A degree from The University of Texas at Arlington or an equivalent degree is required for admission. The general admission requirements of the Graduate School must also be met for admission to the Master of Business Administration program.

**Requirements**—The degree program has been designed to accommodate students of widely divergent backgrounds.

**Background Category I:** The first category includes those students who have had no prior academic work in business. They will enter the program of work and sequentially follow 60 semester hours of prescribed course work.

**Background Category II:** The second category includes those students with varying amounts of course work in business. For such individuals there is provided a mechanism for waiving certain of the courses contained in the first year of the program.

A required written comprehensive examination will be administered in the last semester of the Master of Business Administration program.

## THE DEGREE OF MASTER OF SCIENCE (M.S.)

(Engineering)

### **Branches of engineering in which master's degrees are offered**

—The degree of Master of Science in engineering, with designation of the major branch in which it is given, is offered in electrical engineering and engineering mechanics. (NOTE: as this catalog goes to press, authority has been granted to initiate master's programs in civil engineering, industrial engineering, and mechanical engineering. For further information regarding these new programs, contact the head of the appropriate department.)

**Prerequisite**—A degree of Bachelor of Science in engineering from The University of Texas at Arlington or the equivalent is prerequisite to the degree of Master of Science in engineering. The departmental graduate studies committee of the student's major department may recommend additional requirements to be met by the student (see departmental requirements). These will be sent to the Associate Dean for approval.

**Candidacy requirements**—A student desiring to become a candidate for the master's degree in any branch of engineering must make application to the Associate Dean prior to the deadline of the semester in which he desires to receive this degree. He will be recognized as a candidate when he has satisfied the scholarship requirements given below and when his application and course of study have been approved by the Committee on Graduate Studies, Associate Dean of the Graduate School and the major department Graduate Advisor. Only those students who show promise of capacity to do work of the high standard set for graduate credit will be admitted as candidates for the master's degree. The departmental graduate studies committee of the student's major area has the right to inquire as to the applicant's undergraduate record and to examine him on the prerequisites for the major subject, and may require him to make up deficiencies in his undergraduate preparation before his application is approved. This examination may be either oral or written, at the discretion of the departmental graduate studies committee.

**Course requirements**—Requirements in addition to those for the general master's degree are: At least one-half of the work, 15 semester hours, including a thesis or the equivalent, but not more than four-fifths, 24 semester hours, constitutes the major and must be done in one area of the School of Engineering. The remaining one-half, 15 semester hours, to one-fifth, six semester hours, depending upon the amount necessary to make up the total number of hours required, constitutes the minor, or minors, and must be selected outside the area in which the major is to be done but may be within the School of Engineering. Included in the major and minors must be at least 18 semester hours in engineering. The courses must be logically related and the whole section must be approved by the graduate advisor and Associate Dean.

## THE DEGREE OF MASTER OF SCIENCE IN SOCIAL WORK (M.S. in S.W.)

**Prerequisite**—An applicant for this degree must hold a bachelor's degree from The University of Texas at Arlington or an equivalent degree, must meet the requirements for admission to the Graduate School, and should have an extensive background of general education. Intellectual maturity, emotional stability, and ability and interest in working with people are among the necessary personal qualifications. A personal interview and letters of reference are required.

Applicants are admitted only at the beginning of the Fall Semester.

**Requirements**—The program leading to the degree of Master of Science in Social Work covers four semesters and requires the completion of 60 semester hours of graduate work.

# BIOLOGY

## Objective

The program, leading to the degree of Master of Arts in biology, is designed to provide graduate education which will prepare students to pursue vocations in industry, government, and teaching, and to pursue further graduate education leading to the doctorate.

## Degree Requirements

In order to be admitted to candidacy for the Master of Arts in biology a student must satisfy the general requirements stated elsewhere in this catalog and present to the department a satisfactory score on the Graduate Record Examination Advanced Test in biology. In addition, competency in a foreign language is required. This may be demonstrated by credit in an approved language at the sophomore level or by successful completion of an examination administered by the Foreign Language Department.

After completion of degree requirements the candidate will defend his thesis in a comprehensive examination to be administered by the student's committee at least three weeks prior to graduation.

**5101. CURRENT TOPICS IN BIOLOGY** (1-0) 1 hour credit—A seminar offering which deals with recent, significant biological research. May be repeated for credit. Prerequisite: permission of staff.

**5210. EVOLUTION** (2-0) 2 hours credit—A study of the origin of living systems and the mechanism of their evolution. Prerequisite: permission of instructor.

**5211. HISTORY OF BIOLOGY** (2-0) 2 hours credit—Trends of thought in the biological sciences with emphasis on notable contributors. Those philosophical systems dealing with biological concepts in western civilization are stressed. Prerequisite: permission of instructor.

**5301. BACTERIAL METABOLISM** (3-0) 3 hours credit—Study of the biosynthetic pathways producing major chemical components of the bacterial cell. Prerequisite: permission of instructor.

**5320. BIOGEOGRAPHY** (3-0) 3 hours credit—The role of natural and artificial transport, population pressure and limiting agencies are examined in the light of the patterns of distribution of living organisms. Prerequisite: permission of instructor.

**5340. ANIMAL ECOLOGY** (2-3) 3 hours credit—A study of the interrelationships of the environment and animal populations with emphasis on adaptive mechanisms, limiting factors and population phenomena. Prerequisite: permission of instructor. **\$2 lab fee.**

**5341. PLANT ECOLOGY** (2-3) 3 hours credit—Development and structure of plant communities; interactions of environmental factors and of organisms within a community; literature in plant ecology. Prerequisite: permission of instructor. **\$2 lab fee.**

**5342. ICHTHYOLOGY** (2-3) 3 hours credit—Classification, anatomy, physiology and natural history of fishes. Prerequisite: permission of instructor **\$4 lab fee.**

**5343. HERPETOLOGY** (2-3) 3 hours credit—Systematics, speciation and adaptive mechanisms of reptiles and amphibians. Prerequisite: permission of instructor. **\$4 lab fee.**

- 5344. MAMMALOLOGY** (2-3) 3 hours credit—Taxonomy, population dynamics, distribution and evolution of mammals. The laboratory includes preparation and identification of specimens and the practice of field techniques. Prerequisite: permission of instructor. **\$4 lab fee.**
- 5359. ADVANCED GENETICS** (2-3) 3 hours credit—In this course, linkage and crossing over, chromosome aberrations, gene mutations, extracellular inheritance, hereditary factors and development, and certain aspects of microbial genetics will be considered. The laboratory will include experiments with *Drosophila* and *Neurospora*. Prerequisite: permission of instructor. **\$4 lab fee.**
- 5350. PALYNOLOGY** (2-3) 3 hours credit—Emphasis is placed on modern pollen morphology and its application to systematics and pollen profiles. Prerequisite: permission of instructor. **\$4 lab fee.**
- 5291, 5391. INDIVIDUAL PROBLEMS IN BIOLOGY** 2-3 hours credit—Individual research projects supervised by a staff member. Prerequisite: permission of staff.
- 5446. GENERAL PHYSIOLOGY** (3-3) 4 hours credit—This is a study of functional mechanisms as they pertain to transport and transformation of energy in living systems. Characteristics of excitable tissues are studied including mechanisms of muscle contraction and impulse propagation. Prerequisite: permission of instructor **\$8 lab fee.**
- 5447. ADVANCED BACTERIOLOGY** (3-3) 4 hours credit—Chemical composition, structure, growth and variation of the procaryotic cell. Prerequisite: permission of instructor. **\$5 lab fee.**
- 5451. ACAROLOGY** (3-3) 4 hours credit—The taxonomy of mites and their near relatives, with particular emphasis on identification and biology. The laboratory deals with collection and processing of specimens as well as preparation of a collection. Prerequisite: permission of instructor. **\$4 lab fee.**
- 5698. THESIS**—Prerequisite: permission of staff.

The following courses may be taken for graduate credit subject to approval by the student's committee and the limitations stated in the General Requirements for the Master of Arts degree.

- 4342. BACTERIAL ECOLOGY** (2-3) 3 hours credit—The presentation considers the role performed by bacteria in various types of environments. Major emphasis will be given to the ecosystem concept. Laboratory activity will be directed toward studying and characterizing activities of bacteria from natural environments. Prerequisite: 12 hours of biology including microbiology, or permission of instructor. **\$4 lab fee.**
- 4348. AQUATIC BIOLOGY** (2-3) 3 hours credit—This course deals with biological, physical and chemical interrelationships in fresh waters. The lab is designed to acquaint the student with pond, stream and reservoir habitats of the Southwest. Prerequisite: six hours of general inorganic chemistry plus 12 hours of biology. **\$2 lab fee.**
- 4353. RADIATION BIOLOGY** (2-3) 3 hours credit—Studies of types of ionizing radiations, radioisotopes, half-life and radiological safety procedures will be followed by consideration of the effects of ionizing radiation on plants and animals at the organism, cellular and biochemical levels. The laboratory deals with use of radioactive isotopes in biological subjects, measurement, techniques of handling and study of radiation damage to living tissues. Prerequisite: 18 hours of biological science, six hours of physics and six of chemistry. **\$4 lab fee.**
- 4356. TECHNIQUES IN HISTOLOGY AND CYTOLOGY** (2-3) 3 hours credit—The lecture surveys current methods of studying cells and tissues emphasizing the physical and chemical principles upon which the methods are



based. The laboratory provides practical experience in the preparation of tissue sections, morphological and histochemical staining, and demonstrations of specialized methods. Prerequisite: general chemistry, general physics, 18 semester hours of laboratory biological science. **\$4 lab fee.**

**4440. BACTERIAL PHYSIOLOGY (2-6)** 4 hours credit—The presentation is an advanced level introduction to nutrition, composition, growth, enzymes and fermentative capacities of bacteria. Prerequisite: 12 hours of biology including microbiology and organic chemistry, or permission of instructor. **\$4 lab fee.**

## SUPPORTING COURSES

Supporting work outside the student's major area may be taken in botany, chemistry, geology, mathematics, microbiology, physics, and zoology. Approved courses in civil engineering, philosophy, psychology, and sociology may also be taken in support of the student's program.

Graduate courses in geology are listed below; other supporting graduate courses listed elsewhere in this catalog.

**Geology 5341. INTRODUCTION TO MICROPALAEONTOLOGY (2-3)** 3 hours credit—This course is a survey of selected marine, invertebrate taxa with emphasis upon the foraminifera. Prerequisite: permission of instructor. **\$2 lab fee.**

**Geology 5345. PALEOECOLOGY (2-3)** 3 hours credit—This course is a study of evidences of ancient environments and the applications of the evidences to geology and paleontology. Prerequisite: permission of instructor. **\$4 lab fee.**

## CHEMISTRY

### Objective

The Master of Arts Degree in chemistry is awarded to students who demonstrate knowledge of the essential disciplines of chemistry and show superior attainment in a chosen field of research.

### Degree Requirements

A candidate for graduate study must satisfy the general admission requirements of the Graduate School and his academic record must show preparation for advanced work in chemistry.

A minimum of 30 semester hours exclusive of seminar is required. Six hours will be earned by completion of a thesis. A minimum of 18 hours in chemistry from courses listed in the graduate catalog will be required. Six hours may be senior division or graduate physics, biology, or mathematics, and may be selected by the candidate with the approval of the Department of Chemistry graduate advisor.

**5101. SEMINAR IN CHEMISTRY (1-0)** 1 hour credit—Required of all graduate students in each semester of residence.

**5301. ADVANCED PHYSICAL CHEMISTRY (3-0)** 3 hours credit—Prerequisite: chemistry 3442.

- 5303. SELECTED TOPICS IN ADVANCED PHYSICAL CHEMISTRY (3-0) 3 hours credit**—May be repeated for credit when topics vary. Prerequisite: chemistry 5301, or equivalent with permission of instructor.
- 5305. ADVANCED ORGANIC CHEMISTRY (3-0) 3 hours credit**—Prerequisite: chemistry 3454 (Organic Chemistry), chemistry 3442.
- 5307. SELECTED TOPICS IN ADVANCED ORGANIC CHEMISTRY (3-0) 3 hours credit**—May be repeated for credit when topics vary. Prerequisite: chemistry 5305, or equivalent with permission of instructor.
- 5311. ADVANCED ANALYTICAL CHEMISTRY (3-0) 3 hours credit**—Prerequisite: chemistry 4451 or equivalent.
- 5313. SELECTED TOPICS IN ADVANCED ANALYTICAL CHEMISTRY (3-0) 3 hours credit**—May be repeated for credit when topics vary. Prerequisite: chemistry 5311, or equivalent with permission of instructor.
- 5315. ADVANCED INORGANIC CHEMISTRY (3-0) 3 hours credit**—Prerequisite: chemistry 4456 or equivalent.
- 5317. SELECTED TOPICS IN ADVANCED INORGANIC CHEMISTRY (3-0) 3 hours credit**—May be repeated for credit when topics vary. Prerequisite: chemistry 5315, or equivalent with permission of instructor.
- 5389. PROBLEMS IN CHEMISTRY 3 hours credit**—A conference course with laboratory. May be repeated for credit. Prerequisite: permission of instructor.
- 5698. THESIS 6 hours credit**—Prerequisite: permission of instructor.

A limited number of the following courses may be applicable toward the graduate program if approved in advance by the graduate advisor.

- 3441. PHYSICAL CHEMISTRY (3-3) 4 hours credit**—Solids, liquids, gases, thermochemistry, thermodynamics, and solutions. Prerequisites: chemistry 2451 (Quantitative Analysis), mathematics 2318 (Calculus), eight hours of physics. **\$8 lab fee.**
- 3442. PHYSICS CHEMISTRY (3-3) 4 hours credit**—Chemical equilibria, chemical kinetics, electrochemistry, colloids, quantum mechanics, and nuclear chemistry. Prerequisite: chemistry 3441. **\$8 lab fee.**
- 4311. GENERAL BIOCHEMISTRY (3-0) 3 hours credit**—Applications of chemistry to life processes. Prerequisite: chemistry 3454 (Organic Chemistry).
- 4312. GENERAL BIOCHEMISTRY (3-0) 3 hours credit**—Further study of the relation of chemistry to life processes. Prerequisite: chemistry 4311.
- 4347. QUALITATIVE ORGANIC ANALYSIS (1-6) 3 hours credit**—A systematic approach to the identification of organic compounds. Prerequisite: chemistry 3454 (Organic Chemistry). **\$8 lab fee.**
- 4451. ADVANCED QUANTITATIVE ANALYSIS (2-6) 4 hours credit**—Principles involved in the operation of modern analytical instruments and the laboratory use of such instruments. Prerequisite: chemistry 3442. **\$8 lab fee.**
- 4456. INORGANIC CHEMISTRY (3-3) 4 hours credit**—Selected topics in inorganic chemistry which will broaden the student's understanding of the mechanism of chemical reactions. Prerequisite: chemistry 3442. **\$8 lab fee.**

# ECONOMICS

## Objective

The general purpose of the Master of Arts in economics program is to provide students an opportunity to obtain a better understanding of the economic aspects of modern society and a greater depth of training in the discipline of economic science than is possible in a baccalaureate degree program. Specific objectives of the program are to prepare students for careers in government, business, research, and teaching and for further graduate study.

## Degree Requirements

Applicants meeting the general admission requirements of the Graduate School are automatically admitted to the program. Other applicants may be admitted if approved by the graduate advisor in economics and the Associate Dean. Applicants admitted but not having 12 semester hours of advanced courses in economics or not meeting prerequisite requirements for core courses are admitted subject to conditions assessed by the graduate advisor in economics.

A minimum of 30 semester hours, including credit for the thesis, is required. Normally, six hours of work shall be devoted to the thesis. Nine hours of the total course work may be advanced undergraduate courses, but not more than six hours of such courses may be in either the major or the minor. A total of 21 or 24 hours, including the thesis, shall be taken in economics, including a core of economics 5306, 5310, and 5312. The remaining six or nine hours shall be in a supporting field approved by the graduate advisor in economics.

**5301. ECONOMIC DEVELOPMENT (3-0)** 3 hours credit—Analysis of selected problems in the economic growth of countries at various stages of maturity. Prerequisite: permission of graduate advisor in economics.

**5304. ADVANCED PUBLIC FINANCE (3-0)** 3 hours credit—Application of welfare theory to government budget policy in terms of resource allocation and income distribution; economic effects of particular taxes. Prerequisite: permission of graduate advisor in economics.

**5306. STATISTICAL METHODS (3-0)** 3 hours credit—Emphasis is placed upon advanced topics in regression and correlation analysis and analysis of covariance, finite sampling, and Bayesian inference. Prerequisite: business administration 3322 (Business Statistics) or equivalent and permission of graduate advisor in economics.

**5308. ECONOMIC HISTORY OF THE UNITED STATES (3-0)** 3 hours credit—An analysis of the development of the major economic institutions accompanying the industrial growth of the U. S. economy in the 19th and 20th Centuries. Prerequisite: permission of graduate advisor in economics.

**5309. ECONOMIC ANALYSIS I (3-0)** 3 hours credit—This is an accelerated course in fundamental economic analysis for students enrolled in graduate programs other than the Master of Arts in economics. The basic analytical concepts of price theory and their application to managerial decisions are developed. The course includes the theory of consumer behavior, theory of the firm, and market structure. This course can only be counted toward the M.B.A. program.

**5310. MICROECONOMIC THEORY (3-0) 3 hours credit**—Theories of consumer choice and of the firm; marginal productivity and functional distribution; general equilibrium of production, consumption, and exchange. Prerequisite: permission of graduate advisor in economics.

**5311. ECONOMIC ANALYSIS II (3-0) 3 hours credit**—This is an accelerated course in fundamental economic analysis for students enrolled in graduate programs other than the Master of Arts in economics. The ideas of economics—related to aggregate production, income, the under-utilization or over-utilization of resources, and the operation of the monetary system—are developed carefully. This course can be counted only toward the M.B.A. program.

**5312. MACROECONOMIC THEORY (3-0) 3 hours credit**—A study of the aggregate approach to the economy and the tools of analysis used for the solving of national economic problems. Prerequisite: permission of graduate advisor in economics.

**5316. MATHEMATICAL ECONOMICS (3-0) 3 hours credit**—Mathematical methods useful in economics; differential calculus; determinants and matrices. Prerequisite: permission of graduate advisor in economics.

**5321. INTERNATIONAL ECONOMICS (3-0) 3 hours credit**—International trade and policy issues; balance-of-payments and adjustment processes; international monetary arrangements; contemporary problems in international economics. Prerequisite: permission of graduate advisor in economics.

**5324. MONETARY AND FISCAL ECONOMICS (3-0) 3 hours credit**—Analysis of the effects of central bank policy and government spending and taxation on income and employment; public debt management. Prerequisite: permission of graduate advisor in economics.

**5326. HISTORY OF ECONOMIC THOUGHT (3-0) 3 hours credit**—Traces the development of economic ideas and systems of thought from earliest times to the founding of political economy as a distinct discipline, with emphasis upon the classical school, marginalism, socialism, institutionalism, and the Keynesian analysis. The various schools of thought are set against the social and political events of their times. Prerequisite: permission of graduate advisor in economics.

**5335. ADVANCED LABOR ECONOMICS (3-0) 3 hours credit**—An analysis of the major forces influencing the supply of and the demand for labor and the economic rationale governing the determination of factor income. Prerequisite: permission of graduate advisor in economics.

**5336. ECONOMETRICS (3-0) 3 hours credit**—Adaption of mathematical and statistical methods to analysis of economic problems; estimation problems in time-series, e. g., autocorrelation, least square bias and colinearity; contemporary econometric work. Prerequisite: permission of graduate advisor in economics.

**5337. BUSINESS AND SOCIETY (3-0) 3 hours credit**—An examination of the interaction of the organizations of industry and commerce, government, labor and other institutions within our society. (This course can only be counted toward the M.B.A. program). Prerequisite: permission of graduate advisor.

**5338. SEMINAR (3-0) 3 hours credit**—Topics covered to vary from semester to semester. Prerequisite: permission of graduate advisor in economics.

**5191, 5291, 5391. RESEARCH AND SPECIAL TOPICS IN ECONOMICS** (Variable credit as arranged).

**5398, 5698, or 5998. THESIS 3, 6 or 9 hours credit.** Prerequisite: permission of graduate advisor in economics.

## ACCOUNTING

**5301. ACCOUNTING ANALYSIS I (3-0) 3 hours credit**—Concepts, terminology, statements, measurement of income, basic cost accounting; profit planning

and control; statement analysis. Prerequisite: permission of graduate advisor in economics.

**5302. ACCOUNTING ANALYSIS II (3-0) 3 hours credit**—Continuation of Accounting Analysis I. Prerequisite: accounting 5301 or equivalent and permission of graduate advisor in economics.

## MANAGEMENT

**5301. BEHAVIORAL SCIENCES IN MANAGEMENT (3-0) 3 hours credit**—An examination of the managerial uses of concepts and findings from the disciplines of sociology, psychology and cultural anthropology. Consideration is given to the functions of the personnel administration area, and to supervision-leadership, morale motivation problems, communication and labor relations. Prerequisite: permission of instructor and graduate advisor in economics.

A limited number of the following advanced undergraduate courses may be applicable toward the graduate program if approved in advance by the graduate advisor.

## ECONOMICS

**3304. PUBLIC FINANCE (3-0) 3 hours credit**—This course is a study of how government policies as to expenditures, revenues, debts, and financial administration may contribute to achievement of the goals of the national economy. It includes a study of the political process by which government fiscal decisions are made and economic analysis and evaluation of alternative government fiscal actions. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.

**3313. INDUSTRIAL ORGANIZATION AND PUBLIC POLICY (3-0) 3 hours credit**—This course examines the status and character of industrial firms with stress placed on their efficiency and technological processes. Changing problems and policies are related to industrial operation, market structure and economic concentration. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.

**3328. PRINCIPLES OF TRANSPORTATION (3-0) 3 hours credit**—The course is a study of the function of transportation in the economic system and social organization, the relative fitness of different modes of transport to meet present-day economic and social needs, the economic principles underlying transport service and rates, the factors shaping public regulation of transport, economic evaluation of regulatory policies, and the need for effective solutions to modern problems of urban transport and coordination of competing modes of transport. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.

**3335. LABOR ECONOMICS (3-0) 3 hours credit**—This course deals with the history and philosophy underlying trade union organization and collective bargaining, wages, unemployment and inflation, and the concentration of economic and political power in unions and management. Emphasis is also placed upon the major labor legislation of the United States. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.

**4191, 4291, 4391. STUDIES IN ECONOMICS (Variable credit from 1 to 3 semester hours as arranged)**—This course, given on an individual basis, is made up of advanced studies in the various fields of economic literature. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.

- 4301. THE ECONOMICS OF GROWTH AND DEVELOPMENT (3-0)** 3 hours credit—This course surveys theoretical explanations and historical factors of economic development and underdevelopment. Policies for accelerating development in poor countries and in rich countries are analyzed. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.
- 4304. STATE AND LOCAL FINANCE (3-0)** 3 hours credit—A study of fiscal problems at the state and local levels of government including the division of functions and revenues between these levels of government, the taxing, spending, and borrowing structures of state and local government. Prerequisite: economics 3304 (Public Finance) or equivalent.
- 4306. COMPARATIVE ECONOMIC SYSTEMS (3-0)** 3 hours credit—This course surveys the economic institutions of capitalism, socialism, communism and fascism to provide a basis for analyzing the ideas and philosophies with which each is associated. A comparison is made of the theoretical and actual operation of these alternative economies. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent
- 4313. PUBLIC UTILITY ECONOMICS (3-0)** 3 hours credit—The character of public utility industries is examined with emphasis on regulation, valuation, rate-making and financing. Legislative enactments, the growth of regulatory commissions and significant judicial decisions are surveyed to provide a framework for understanding the major problems in this field. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.
- 4317. BUSINESS CYCLES (3-0)** 3 hours credit—This course analyzes recurrent historical fluctuations in national income, production, and employment, with reference to causes, measurement, forecasting and control of economic instability. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.
- 4320. REGIONAL ECONOMIC ANALYSIS (3-0)** 3 hours credit—The analysis of intranational regions including consideration of regional accounts, regional income determination, regional growth, interregional trade, and public policy for development of regions. Prerequisite: economics 3312 (Macroeconomics) or equivalent.
- 4321. INTERNATIONAL TRADE (3-0)** 3 hours credit—This course examines the principles underlying economic relations among nations. Emphasis is placed upon investment and capital movements, foreign exchange, balance of trade, population changes, tariff policies and recent developments in international trade or monetary policies. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.
- 4324. MONETARY AND FISCAL POLICY (3-0)** 3 hours credit—This course involves study of the effects of money on production and national income; quantity and commodity theories of money; various theories of interest rates; instruments and policies of Federal Reserve monetary action; proposals for monetary reform. Central bank systems are compared. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.
- 4326. HISTORY OF ECONOMIC THOUGHT (3-0)** 3 hours credit—This course surveys economic ideas from ancient times to the present, with particular emphasis on mercantilism, the classic school, and marginal theory. The Keynesian and institutional schools are examined as major intellectual forces which are shaping contemporary economic thinking. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.
- 4331. SEMINAR IN ECONOMICS (3-0)** 3 hours credit—This course is made up of readings and discussion and is concerned with special topics in economics. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.

## ACCOUNTING

**4311. ADVANCED ACCOUNTING (3-0)** 3 hours credit—This course is a study of advanced accounting theory and procedures applicable to partnerships, installment and consignment sales, branch office operations and consolidations. Prerequisite: accounting 3312 (Intermediate Accounting) or equivalent.

**4313. ACCOUNTING THEORY (3-0)** 3 hours credit—An examination of the fundamental structure of accounting theory through the study of the concepts, principles, and postulates upon which accounting theory rests. Prerequisite: permission of instructor.

**4335. INFORMATION AND CONTROL SYSTEMS (3-0)** 3 hours credit—An analytical and quantitative approach to the problems encountered by controllers and other financial executives in supplying the information needs of high-level business management. The course involves the study of cost and cash budgeting, inventory planning and control, capital investment decisions, and marginal cost analysis, including the applications of correlation and linear programming in these areas. Emphasis is placed on integrating the disciplines of accounting, statistics, finance, and microeconomics. Prerequisite: accounting 3313 (Intermediate Accounting) or 3301 (Managerial Cost Accounting) and business administration 3322 (Business Statistics).

## BUSINESS ADMINISTRATION

**3328. PRINCIPLES OF TRANSPORTATION (3-0)** 3 hours credit—This course is a study of the function of transportation in the economic system and social organization, the relative fitness of different modes of transport to meet present-day economic and social needs, the economic principles underlying transport service and rates, the factors shaping public regulation of transport, economic evaluation of regulatory policies, and the need for effective solutions to modern problems of urban transport and coordination of competing modes of transport. Prerequisite: economics 2305 and 2306 (Principles of Economics) or equivalent.

## FINANCE

**4313. INVESTMENTS (3-0)** 3 hours credit—This course deals with the principles governing the proper investment of personal and institutional funds, information sources, security analysis, exchanges and regulations. Prerequisite: finance 3313 (Business Finance).

**4314. FINANCIAL INSTITUTIONS AND MARKETS (3-0)** 3 hours credit—Study of the flow of funds in the aggregate financial system, the structure of financial markets and the interaction of aggregate financial factors and the policies and operations of financial institutions. Topics to be covered are accounting for flow of funds, structure and interaction of demand and supply of funds in money and capital markets, structure of interest rates, the role of financial intermediaries in the financial system, impact of Federal Reserve and U. S. Treasury monetary policies on the money market and impact of government regulation of securities markets on capital markets. Prerequisite: economics 3303 (Money and Banking) and finance 3313 (Business Finance).

**4315. ADVANCED BUSINESS FINANCIAL ANALYSIS (3-0)** 3 hours credit—The purpose of this course is to develop an ability to recognize financial problems, analyze financial data, formulate alternative solutions, and render financial decisions. Case materials are used in studying financial problems. Types of financial problems studied are management of investment in current and fixed assets, planning of profits, forecasting of cash requirements, capital budgeting, planning of methods of financing and capital structure, dividend policy, valuation of assets and mergers. Prerequisite: finance 3313 (Business Finance).

## MANAGEMENT

**4321. OPERATIONS ANALYSIS (3-0) 3 hours credit**—This course involves the study of activity networks and examines the interrelationships of planning, organizing and controlling. Prerequisite: Three hours of management, business administration 3321 (Business Statistics).

**4322. BUSINESS POLICY AND ADMINISTRATION (3-0) 3 hours credit**—This course provides an integrative learning experience through the solving of numerous business policy cases and the use of other decision simulation methods. Policy consideration will be given to the organic business functions and to management functions with particular attention to administrative control. Prerequisite: Six hours of management.

## MARKETING

**4311. MARKETING RESEARCH (3-0) 3 hours credit**—Students investigate the methods and techniques used for the solution of marketing problems. A combination of text readings and case analysis offers a management perspective on the contribution research can make to the solution of marketing problems. Areas covered include research design, the use of statistical sampling in data collection, sales analysis, advertising and new product development. Prerequisite: marketing 3321 (Principles of Marketing) and business administration 3322 (Business Statistics).

**4322. ADVANCED MARKETING (3-0) 3 hours credit**—This is a capstone course which stresses the integration of the firm's marketing program. Emphasis is placed on the investigation of markets, market behavior, new product planning, dynamics of channel interaction, pricing policy, effectiveness of promotional expenditures and government influence on marketing action. Prerequisite: marketing 3321 (Principles of Marketing) and six semester hours of marketing.

## ENGLISH

### Objective

The Master of Arts program in English at The University of Texas at Arlington aims at professional competency in literature and language. In literature the student is directed toward sound critical judgment and informed appreciation of English and American writings in context. He is trained in the techniques of research, teaching, and writing as preparation for a career suited to his talents and personal inclinations. In language he is schooled in historical and contemporary approaches to the development and description of English. The aims are an understanding of linguistic phenomena and the application of this knowledge to teaching at various levels and to using the language precisely, appropriately, and imaginatively. Sufficient choice in course offerings allows the student to slant his degree plan toward a terminal Master of Arts or toward further graduate study for the doctorate.



## **Degree Requirements**

For the Master of Arts degree in English 30 semester hours are required: a six-hour thesis and 24 hours of course work, of which at least 18 must be in 5000-level courses (six hours maximum in 4000-level courses, in which the student must satisfy special graduate requirements).

The course work of the master's candidate will be approved in advance (at the beginning of each semester or summer term) by the graduate advisor. Similarly, the thesis topic will be selected with the approval of the directing committee.

With the prior permission of the graduate advisor, the master's candidate may submit six hours of course work in an appropriate graduate minor field outside the Department of English.

Each graduate course in English emphasizes reading in depth at least one major writer, together with appropriate study of other writers in the period or genre and of pertinent scholarship. In a given semester the specific topic, as determined by the instructor, will be announced in the official schedule of classes. Graduate standing is prerequisite for taking the courses listed below. Any course may be repeated for credit as often as its subject matter changes.

**5301. MEDIEVAL ENGLISH LITERATURE (3-0)** 3 hours credit—Intensive study of poetry, tales, romances, chronicles, legends, plays; and of background material for the Old and Middle English periods.

**5302. TUDOR AND JACOBAN LITERATURE (3-0)** 3 hours credit—Selected genre studies, for example the pastoral, the sonnet, the verse translation, or concentrated work in a major figure (Spenser, Donne, Jonson).

**5303. 17TH-CENTURY ENGLISH LITERATURE (3-0)** 3 hours credit—A survey of major developments in prose criticism, prose fiction, and poetry. Special attention given to major non-dramatic writers (John Milton, George Wither, John Taylor).

**5304. 18TH-CENTURY ENGLISH LITERATURE (3-0)** 3 hours credit—Study of the interrelationship of the artist, his art, and his time during the Age of Enlightenment. Focus on an author, a work, a genre, an idea, a creative principle, an aesthetic theory.

**5305. THE ROMANTIC PERIOD (3-0)** 3 hours credit—Detailed study in the work of one or more major romantic poets (Wordsworth, Coleridge, Southey, Keats, Shelley, Byron), together with wide reading in the general literature of the period.

**5306. THE VICTORIAN PERIOD (3-0)** 3 hours credit—The poetry and related expository prose of the major Victorians (Tennyson, Browning, Arnold, Swinburne, Wise, Locker).

**5307. 20TH-CENTURY ENGLISH LITERATURE (3-0)** 3 hours credit—New views of man. Attention given to the increased use of symbolic technique, innovations in "time" concepts, experimentation with language and rhythm in the major contemporary genres.

**5308. SHAKESPEARE (3-0)** 3 hours credit—Independent and directed study in selected plays.

**5309. ENGLISH DRAMA EXCLUSIVE OF SHAKESPEARE (3-0)** 3 hours credit—Intensive study of representative period drama (Tudor and Elizabethan, 17th Century, Restoration and 18th Century, Victorian, and Modern, the period chosen by the instructor for the current semester.

- 5310. THE ENGLISH NOVEL (3-0) 3 hours credit**—The major novelists Defoe to Amis: developments in philosophy, lyricism, and narrative technique.
- 5321. AMERICAN LITERATURE, 1800-1860 (3-0) 3 hours credit**—Studies in the literature of the American Romantic Period, placing emphasis on major writers such as Poe, Cooper, Hawthorne, Melville, Emerson, Thoreau, and Whitman, and giving consideration to selected minor writers.
- 5322. AMERICAN LITERATURE, 1860-1910 (3-0) 3 hours credit**—An intensive study of the literature of the period focusing on the representative novels of Howells and James, the lesser realists (such as De Forest, Garland, Frederic), or the emergence of naturalism (Crane, Norris, Dreiser).
- 5323. AMERICAN LITERATURE, 1910 TO THE PRESENT (3-0) 3 hours credit**—In-depth study of drama, poetry, fiction. Normally a semester will be devoted to a single genre.
- 5331. HISTORY OF THE ENGLISH LANGUAGE (3-0) 3 hours credit**—Diachronic treatment of various problems in vocabulary, pronunciation, accentuation, and syntax in Old English, Middle English, and Modern English dialects.
- 5333. APPLIED ENGLISH LINGUISTICS (3-0) 3 hours credit**—Synchronic treatment of various problems in the phonology, morphology, and syntax of present-day English. Constant reading to keep the student abreast of current research and experimentation in language study.
- 5335. RESEARCH METHODS AND BIBLIOGRAPHY (3-0) 3 hours credit**—An introduction to descriptive, analytical, and critical bibliography, investigating the relationship between bibliography, scholarship, and criticism in English and American literature. Intensive study of form, content, and method in the thesis.
- 5391. GRADUATE READINGS IN LITERATURE (3-0) 3 hours credit**—Arranged to meet the needs of individual students. Prerequisite: permission of instructor and graduate advisor.
- 5698. THESIS (6-0) 6 hours credit**—The graduate student must be registered for this course (a) when in consultation over the thesis with the supervisory committee, and (b) in the semester or term in which the Master of Arts degree will be conferred. Prerequisite: permission of graduate advisor in English.

A limited number of the following courses, not to exceed a total of six credit hours, may be applicable to the 30-hour requirement if approved in advance by the graduate advisor.

- 4301. HISTORY AND DEVELOPMENT OF THE ENGLISH LANGUAGE (3-0) 3 hours credit**—A rapid survey of the history and development of the English language, emphasizing the traditional principles of English grammar. A thorough study of grammatical principles as they apply to problems of current English usage.
- 4302. CONTEMPORARY SYSTEMS OF ENGLISH LANGUAGE STUDY (3-0) 3 hours credit**—Familiarization of the student with developments growing out of recent research in linguistics and semantics. Concentration on grammars devised by experimentalists from Bloomfield through Chomsky.
- 4310. CHAUCER (3-0) 3 hours credit**—Required reading of Chaucer's poetry in the original, with constant attention to the language of the time.
- 4312. MILTON (3-0) 3 hours credit**—A study of all of Milton's English poetry, and consideration of related prose works and foreign-language poetry.
- 4320. COLONIAL AND EARLY FEDERAL WRITING (3-0) 3 hours credit**—Designed to acquaint the student with American writers of the Colonial and Early National Periods and to relate their work to social, political, and literary tendencies of the time. Excluded: major writers of the Early Romantic Period.

- 4321. THE ROMANTIC TEMPER IN AMERICA (3-0)** 3 hours credit—Intensive study of major literary works, prose and poetry, produced in American during the Romantic Period. Excluded: transcendental writers as such.
- 4322. THE TRANSCENDENTALISTS (3-0)** 3 hours credit—A primary consideration of the derivation, scope, and impact of the transcendental movement. An examination of selected works of representative writers.
- 4323. MARK TWAIN AND THE FRONTIER HUMORISTS (3-0)** 3 hours credit—An explanation of the characteristics of influential humorists of the 19th Century, showing that Twain in his career developed from a regional writer to a spokesman of national and international stature.
- 4324. THE RISE OF REALISM (3-0)** 3 hours credit—Intensive study of the realistic temper in America, beginning with a review of the local-color movement and ending with the transition into naturalism (major figures: Howells and James).
- 4325. LITERARY CRITICISM IN ENGLAND AND AMERICA (3-0)** 3 hours credit—A study of the principles of literary criticism and their historical development.
- 4330. RENAISSANCE AND PURITAN PROSE AND POETRY (3-0)** 3 hours credit—Advanced reading in selected prose and poetry, exclusive of Shakespeare and Milton. Stressing Spenser, a coverage from the early English Renaissance to the Restoration.
- 4331. AUGUSTAN PROSE AND POETRY (3-0)** 3 hours credit—Emphasizing Dryden, Swift, Johnson, Boswell, and their circles, a study of the prose and poetry in the Restoration and 18th Century.
- 4332. MODERN BRITISH AND AMERICAN POETRY (3-0)** 3 hours credit—Studies in poetry since 1912, with special emphasis on Elliot and Yeats.

## HISTORY

### Objective

The general purpose of the Master of Arts in history program is to provide the student with a greater breadth of understanding of both the past and the contemporary world and a greater depth of experience in the methods and techniques of the discipline. Specific objectives are to prepare the student for a career in business, government, research, teaching and further graduate study.

### Degree Requirements

A total of 30 semester hours of credits beyond the baccalaureate degree (24 hours of course work and six hours of thesis preparation) is required. Nine hours of the total 30 hours may be advanced undergraduate courses as approved by the Graduate Advisor but not more than six hours of such courses may be in either the major or the minor.

All applicants shall pass a reading examination in one foreign language. The language requirements must be absolved at least 60 days before the completion of all other required academic work.

Six semester hours of graduate and/or advanced courses in a discipline other than history approved by the graduate advisor in history are required.

No credit will be granted for courses in which the grade is lower than B.

**NOTE: Graduate standing is a prerequisite to all of the following courses.**

A course may be repeated for credit when the topic changes.

**5301. COLONIAL HISTORY (3-0) 3 hours credit**—The causes of European colonization of America, and the political, economic, religious, social, intellectual and ethnic aspects of American colonial history to 1783.

**5303. EARLY NATIONAL PERIOD (3-0) 3 hours credit**—The political, economic, social and religious development of the United States from 1783 to the Civil War.

**5307. SOUTHERN HISTORY (3-0) 3 hours credit**—Developments which have distinguished the South from other sections with special emphasis on the contemporary South.

**5309. AGE OF ENTERPRISE, 1876-1900 (3-0) 3 hours credit**—The post-Reconstruction period with emphasis on agricultural, industrial, diplomatic, and intellectual developments which shaped present-day America.

**5310. 20TH CENTURY AMERICAN HISTORY (3-0) 3 hours credit**—Progressivism, World War I, Normalcy, the New Deal, World War II, and domestic and diplomatic crises of the 1950s and 1960s.

**5311. AMERICAN EXPANSION AND DIPLOMATIC HISTORY (3-0) 3 hours credit**—The genesis of Manifest Destiny, and the history of territorial acquisitions by the United States with emphasis on the effects of those acquisitions upon domestic issues and foreign policy.

**5312. AMERICAN SOCIAL AND INTELLECTUAL HISTORY (3-0) 3 hours credit**—The dominant patterns of American thought, both serious and popular, as well as the life and works of selected American intellectuals.

**5321. ANCIENT HISTORY (3-0) 3 hours credit**—The beginnings of civilization in Mesopotamia and Egypt, developments in Asia Minor, the rise and decline of Greece, the Hellenic world, and the Roman Empire to the reign of Constantine the Great.

**5324. MEDIEVAL AND RENAISSANCE HISTORY (3-0) 3 hours credit**—Developments from Constantine the Great to the eve of the Protestant Reformation, including the decline of the Roman Empire, Byzantium, Islamism, the Crusades, Feudalism, and the rise of the nation-state system.

**5326. MODERN EUROPE (3-0) 3 hours credit**—The history of Europe from 1600 to 1950, with emphasis on the political, economic, social, and intellectual currents which formed Modern Europe.

**5331. BRITISH HISTORY (3-0) 3 hours credit**—A study of British political, social, economic, religious, and intellectual life, emphasizing constitutional developments and the growth of the common law.

**5336. LATIN AMERICAN HISTORY (3-0) 3 hours credit**—The history of Mexico and Peru; the ABC Powers; the Caribbean; and the United States and Latin America.

**5337. RUSSIA AND THE MIDDLE EAST (3-0) 3 hours credit**—The national and international problems and issues of Modern Russia, and the development of the Middle East since the introduction of the Islamic faith.

**5338. FAR EAST (3-0) 3 hours credit**—Political, social and cultural issues in Far Eastern national and regional histories since the 19th Century.

**5339. HISTORIOGRAPHY (3-0) 3 hours credit**—A survey of historical writings and the contributions of leading American and European historians with emphasis on research techniques.

**5698. THESIS (6-0) 6 hours credit**—Original research on a problem of some significance including a written report of findings.

# MATHEMATICS

## Objective

The objective of the Mathematics Department's program at the master's level is to develop the student's ability to do independent research and prepare him for more advanced study in mathematics, to give advanced training to professional mathematicians, mathematics teachers, and those employed in engineering, scientific and business areas in which mathematics at this level is requisite for efficient performance.

Graduate work will be offered in algebra, complex and real variables, differential equations, functional analysis, topology, geometry, numerical analysis, logic, probability and statistics.

There are graduate assistantships and fellowships available in teaching and research. Inquiries should be addressed to the head of the Mathematics Department.

## Degree Requirements

Admission to the master of arts program in mathematics is based upon the completion of the general admission requirements of the Graduate School.

The general degree requirements for the Master of Arts may be found in another section of this catalog. However, students wishing to major in mathematics must satisfy the following additional requirements:

Upon entering graduate school, it is the student's responsibility to consult with the mathematics graduate advisor.

The student must at some time during his undergraduate or graduate studies complete mathematics 3321, 4317, and at least one of mathematics 4318, 4321, and 4331.

Not more than 12 semester hours from mathematics 5391, 5392, 5398, and 5698 will be applicable toward a graduate mathematics program.

A graduate mathematics program must include at least one sequence of six semester hours. This sequence shall be chosen from those graduate mathematics courses in which such a sequence is available but will not include mathematics 5391, 5392, 5398, and 5698.

After the student has submitted the thesis (or approved substitute) to his supervising committee, an oral examination over course work and thesis (or approved substitute) will be given by the committee.

**5303. FOUNDATIONS OF TOPOLOGY I (3-0) 3 hours credit**—The foundations of topology are developed by means of careful study of the properties of certain sets of points. These properties will be derived axiomatically. Prerequisite: mathematics 4303 or 4317.

**5304. GENERAL TOPOLOGY (3-0) 3 hours credit**—This course is an introduction to the fundamentals of general topology. The topics to be studied

include product spaces, the Tychonoff theorem, Tietzes Extension theorem, and metrization theorems. Prerequisite: mathematics 4304 or 4317.

**5306. FOUNDATIONS OF TOPOLOGY II** (3-0) 3 hours credit—A continuation of mathematics 5303. Prerequisite: mathematics 5303.

**5311. ADVANCED PROBABILITY THEORY** (3-0) 3 hours credit—The course includes a systematic development of the theory of random variables as well as a discussion of the classical probability distributions by means of the method of characteristic functions. The basic limit theorems are developed. Applications of basic theory are made to Markov chains and stochastic processes. Prerequisite: mathematics 4311 and 4317.

**5312. ADVANCED MATHEMATICAL STATISTICS I** (3-0) 3 hours credit—This is a study of the Foundations of Probability theory as well as detailed development and study of discrete and continuous distributions, mathematical expectation, moments, sampling distributions, point estimation and maximum likelihood estimations. Prerequisite: mathematics 3311 (Statistical Analysis) and 4317.

**5313. ADVANCED MATHEMATICAL STATISTICS II** (3-0) 3 hours credit—An introduction to multivariate statistical analysis. Emphasis is placed on the multivariate normal. Matrix theory and maximum likelihood estimation theory are utilized. Prerequisite: Mathematics 3330 (Introduction to Matrix Algebra) and 5312.

**5317. REAL VARIABLES I** (3-0) 3 hours credit—This course includes the study of such topics as point sets, measurable sets, measurable functions Lebesgue integral, Stietjes integral, and indefinite Lebesgue integral. Prerequisite: mathematics 4318.

**5318. REAL VARIABLES II** (3-0) 3 hours credit—This is a continuation of Real Variables I with an introduction to abstract measure theory. Prerequisite: mathematics 5317.

**5320. DIFFERENTIAL EQUATIONS** (3-0) 3 hours credit—This course is a study of linear and non-linear systems. The asymptotic behavior of solutions and the concept of stability are investigated as well as some important existence and uniqueness theorems. Prerequisite: mathematics 4318.

**5321. PARTIAL DIFFERENTIAL EQUATIONS** (3-0) 3 hours credit—This course is the classification of second order partial differential equations, characteristics, canonical forms, the Fredholm alternative, and Green's functions. Prerequisite: mathematics 4318.

**5322. COMPLEX VARIABLES I** (3-0) 3 hours credit—Fundamental theory of analytic functions, residues, conformal mapping and applications. Prerequisite: mathematics 4318.

**5323. COMPLEX VARIABLES II** (3-0) 3 hours credit—Analytic continuation. Riemann surfaces, velocity and stream functions with applications, elliptic functions. Prerequisite: mathematics 5322.

**5325. OPERATIONAL MATHEMATICS** (3-0) 3 hours credit—This course will be concerned with the study of integral transformations such as the Laplace, Bilateral Laplace, and Hankel. The applications of these transforms to Boundary value problems will also be investigated. Prerequisite: mathematics 4317 or 4325.

**5326. OPERATIONAL MATHEMATICS** (3-0) 3 hours credit—This course consists of a study of Fourier Analysis: including Fourier Series, Fourier integrals, and special functions: including gamma functions, Bessel functions and other orthogonal functions. Prerequisite: mathematics 4317 or 4325.

**5327. FUNCTIONAL ANALYSIS I** (3-0) 3 hours credit—This course is the study of basic topological and metric properties with emphasis toward normed linear spaces, closed graph theorem, theorems of uniform boundedness, Hahn-Banach theorem and their application. Prerequisite: mathematics 4318.

**5328. FUNCTIONAL ANALYSIS II** (3-0) 3 hours credit—A continuation of mathematics 5327. Prerequisite: mathematics 5327.

- 5331. ABSTRACT ALGEBRA I** (3-0) 3 hours credit—This course will investigate groups, rings, fields and modules with emphasis on structure theorems. Prerequisite: mathematics 4321.
- 5332. ABSTRACT ALGEBRA II** (3-0) 3 hours credit—This course will investigate linear and multilinear algebra of modules with emphasis on structure theorems. Prerequisite: mathematics 5331.
- 5333. CONVEX SETS** (3-0) 3 hours credit—An introduction to the geometry of convex sets in linear space. Topics to be covered include the Hahn-Banach theorem, the Minkowski metric, convex functions, and special convex sets in finite dimensional spaces. Prerequisite: mathematics 4318 and 4331.
- 5334. DIFFERENTIAL GEOMETRY** (3-0) 3 hours credit—This course is an introduction to the theory of curves and surfaces in three dimensional Euclidean space. Prerequisite: mathematics 4317.
- 5336. LOGIC** (3-0) 3 hours credit—The concept of a normal system and propositional and functional calculi are considered. Prerequisite: mathematics 3336 (Introduction to Mathematical Logic) or 4317.
- 5338. NUMERICAL ANALYSIS I** (3-0) 3 hours credit—This course is a rigorous treatment of the solution of equations, interpolation and approximation, numerical differentiation and quadrature, and the solution of ordinary differential equations. Prerequisite: mathematics 4345.
- 5339. NUMERICAL ANALYSIS II** (3-0) 3 hours credit—This course is a rigorous treatment of numerical aspects of linear algebra and the numerical solution of boundary value problems in ordinary differential equations: also, an introduction to the numerical solution of partial differential equations. Prerequisite: mathematics 4345.
- 5391. SPECIAL TOPICS IN MATHEMATICS** (3-0) 3 hours credit—Topics in mathematics are assigned individual students or small groups. Faculty members closely supervise the students in their research and study. In areas where there is only three hours offered, the special topics may be used by students to continue their study in the same area. Prerequisite: permission of instructor.
- 5392. SELECTED TOPICS IN MATHEMATICS** (3-0) 3 hours credit—The material covered may vary from a semester to semester depending upon need and interest of the students. This course may be repeated for credit. Prerequisite: permission of instructor.
- 5398 or 5698. THESIS** 3 or 6 hours credit—Prerequisite: permission of graduate advisor.

A limited number of undergraduate mathematics courses may be applicable to a graduate program in mathematics if approved in advance by the graduate advisor. These must be chosen from the following list.

- 4303. INTRODUCTION TO TOPOLOGY** (3-0) 3 hours credit—This is a first course in the topology of plane sets of points developed from the axiomatic point of view.
- 4304. INTRODUCTION TO GENERAL TOPOLOGY** (3-0) 3 hours credit—This course is an introduction to the fundamentals of general topology. The topics to be studied include topological spaces, continuity, connectedness, compactness, separation axioms, metric spaces and sequences. Prerequisite: mathematics 4317.
- 4311. MATHEMATICAL PROBABILITY** (3-0) 3 hours credit—An introduction to the fundamentals of discrete and continuous probability distributions is provided for application to operational problems. Prerequisite: mathematics 3317 (Calculus III).

- 4317. ADVANCED CALCULUS (3-0)** 3 hours credit—Properties of functions involved in continuity, differentiability and integration are considered. Prerequisite: mathematics 3317 (Calculus III).
- 4318. ADVANCED CALCULUS (3-0)** 3 hours credit—The study of the concepts presented in mathematics 4317 is continued, and the applications of integration are extended to the use of integral transforms. Prerequisite: mathematics 4317.
- 4320. ADVANCED DIFFERENTIAL EQUATIONS (3-0)** 3 hours credit—This is a study of the existence and properties of solutions of differential equations. Prerequisite: mathematics 3318 (Differential Equations).
- 4321. INTRODUCTION TO ABSTRACT ALGEBRA II (3-0)** 3 hours credit—This course is a continuation of mathematics 3321. Prerequisite: mathematics 3321 (Introduction to Abstract Algebra I).
- 4322. INTRODUCTION TO COMPLEX VARIABLES (3-0)** hours credit—This course is an introduction to the theory of functions of a complex variable and also an introduction to the theory of functions of a complex variable and also an introduction to applications including uses of the residue theory, contour integration, and conformal mapping. Prerequisite: mathematics 3317 (Calculus III).
- 4325. OPERATIONAL MATHEMATICS (3-0)** 3 hours credit—This course is a study of Laplace and Fourier Transforms, partial differential equations, Bessel Functions and Orthogonal Polynomials such as Hermite and Legendre. Prerequisite: mathematics 3317 (Calculus III) and 3318 (Differential Equations)
- 4327. FOUNDATIONS OF ANALYSIS (3-0)** 3 hours credit—Fundamental concepts of analysis are derived from a set of axioms to aid in the development of mathematical maturity.
- 4331. INTRODUCTION TO LINEAR ALGEBRA (3-0)** 3 hours credit—This course is a study of the theory of finite dimensional vector spaces and linear transformations. Prerequisite: mathematics 3321 (Introduction to Abstract Algebra I).
- 4336. MATHEMATICAL LOGIC (3-0)** 3 hours credit—This course consists of an axiomatic treatment of the predicate calculus, consistency, independence and completeness, decision procedures and formalization of (non-logical) theories. Prerequisite: mathematics 3336 (Introduction to Mathematics Logic).
- 4345. NUMERICAL METHODS (2-2)** 3 hours credit—A study of methods for finding roots of polynomials with complex coefficients, eigenvalues and eigen vectors of matrices, solutions of partial differential equations, optimization problems, and Monte Carlo methods, a consideration of various types of errors arising in numerical problems. Prerequisite: mathematics 3345 (Numerical Analysis and High Speed Computer Applications). **\$4 lab fee.**



## PHYSICS

The two programs of study in physics are detailed below. Course offerings apply to either but must be approved in advance by the graduate advisor.

## PHYSICS

### Objective

The objectives of the Physics Department's program at the master's level is to prepare the student for either industrial employment or further educational endeavors. This objective is accomplished by formal course offerings and laboratory research, including theoretical investigations. The courses are of sufficient quantity that a student may develop an interest in particular areas, while the active research programs are of sufficient breadth to allow a student to accomplish research in his selected areas of interest.

### Degree Requirements

For admission to the Master of Arts program in physics, the candidate must satisfy the general admission requirements of the Graduate School. In addition, the candidate must have satisfactorily completed at least 24 hours of advanced physics and supporting courses. Deficiencies must be removed.

A minimum of 30 hours is required for the Master of Arts degree, of which 18 hours, including a six hour thesis, will be in physics, six hours will be in mathematics and six hours may be in physics, another science, or engineering as approved by the graduate advisor.

## RADIOLOGICAL PHYSICS

### Objective

The objective of the radiological physics program is to prepare candidates to fill the existing needs for radiological physicists in medical centers.

### Degree Requirements

For admission to the radiological physics program, the applicant must satisfy the general admission requirements of the Graduate School. In addition, he must be accepted for the program by an appointed committee from the Physics Department of The University of Texas at Arlington and the Department of Radiology of the Southwestern Medical School at Dallas. The applicant's undergraduate major should be in physics or mathematics, or he must have an acceptable background in a closely related field.

A minimum of 30 semester hours is required of which at least 18 hours, inclusive of the thesis, will be in the major area, and at least six hours will be in supporting subjects outside physics or radiology areas.

The program is a cooperative effort between The University of Texas at Arlington and the Southwestern Medical School, and is designed to be completed in two academic years. The first will provide courses in advanced physics and mathematics, radiological physics, introductory radiation biology, and courses necessary to overcome deficiencies. The second year, together with the intervening summer, will involve applied radiological physics, in physical and biological research techniques, seminar, research and thesis courses. Appropriate investigative problems will be designated, and will be supervised by a group selected from the Southwestern Medical School and The University of Texas at Arlington faculties with the research to be conducted on either or both campuses.

Students will be expected to have or to establish a background in electronic circuits, statistical analysis, biology, and computer techniques. Courses by which this background may be met are available at The University of Texas at Arlington.

**5305. QUANTUM MECHANICS II (3-0) 3 hours credit**—Angular momentum, theory of radiation, matrix formulation, relativistic quantum mechanics. Prerequisite: physics 4326 or permission of graduate advisor.

**5306. CLASSICAL MECHANICS (3-0) 3 hours credit**—The general principles of analytical mechanics, the kinematics of rigid bodies, canonical transformations, Hamilton-Jacobi theory. Prerequisite: physics 4319 (Advanced Mechanics) or permission of graduate advisor.

**5309. ELECTROMAGNETIC THEORY I (3-0) 3 hours credit**—A modern tensorial treatment of classical electrodynamics, force on and field of a moving charge, derivation and application of 4-vector potential, Maxwell's equations in tensor form, field momentum, and radiation. The mathematical tools are developed as needed. Prerequisite: physics 4324 (Advanced Electricity and Magnetism) or permission of graduate advisor.

**5310. STATISTICAL MECHANICS (3-0) 3 hours credit**—Fundamental principles of statistical mechanics, Liouville theorem, entropy, Fermi-Dirac distribution, Bose-Einstein distribution, Einstein condensation, density matrix, quantum statistical mechanics, kinetic methods, and transport theory. Prerequisite: physics 4315 (Heat and Thermodynamics) or permission of graduate advisor.

**5313. SOLID STATE II (3-0) 3 hours credit**—Free electron theory of metals, the band theory of solids, magnetic and optical properties of solids. Prerequisite: physics 4325, physics 4326 or permission of graduate advisor.

**5314. ELECTROMAGNETIC THEORY II - ADVANCED OPTICS (3-0) 3 hours credit**—Electromagnetic wave equations, waves in isotropic and anisotropic media, reflection, refraction, and polarization; wave solutions in the presence of metallic boundaries; theory of diffraction, radiation scattering, and dispersion. Prerequisite: physics 5309 or permission of graduate advisor.

**5317. RELATIVITY (3-0) 3 hours credit**—Special theory of relativity, invariance of electromagnetic equations, Minkowski's interpretation of relativity, fundamental ideas of general relativity, general relativistic mechanics with applications. Prerequisite: physics 5306 or permission of graduate advisor.

- 5318. ADVANCED NUCLEAR PHYSICS** (3-0) 3 hours credit—Properties of nuclei, nuclear two-body problems, meson theory of nuclear forces, nuclear models, nuclear structure, and nuclear transitions. Prerequisite: physics 3446 (Nuclear Physics), physics 4326, or permission of graduate advisor.
- 5320. THEORETICAL PHYSICS** (3-0) 3 hours credit—Meaning of physical theory, space and time in physics, the foundations of mechanics, probability and statistics, and continua. Prerequisite: physics 5306 or permission of graduate advisor.
- 5321. MODERN PHYSICS** (3-0) 3 hours credit—This course will present a unified approach to the principle fields of modern physics, relativity, quantum mechanics, atomic spectroscopy, quantum statistics, solid state physics, particle physics, and nuclear physics. Prerequisite: permission of graduate advisor.
- 5391. SPECIAL TOPICS IN PHYSICS** (3-0) 3 hours credit—Topics in physics, particularly from areas in which active research is being conducted, are assigned to individuals or small groups for intensive investigations. This course may be repeated for credit. Prerequisite: permission of graduate advisor.
- 5392. SELECTED TOPICS IN PHYSICS** (3-0) 3 hours credit—Topics in this course may be varied from semester to semester depending on the needs and interest of the students. This course may be repeated for credit. Prerequisite: permission of graduate advisor.
- 5698. THESIS** (6-0) 6 hours credit—Prerequisite: permission of graduate advisor.

The following courses may be applicable toward the graduate program if approved in advance by the graduate advisor.

- 4326. QUANTUM MECHANICS I** (3-0) 3 hours credit—This course includes the study of the need for quantum mechanics to describe modern experiments adequately. Schrodinger's equation and implications, the free particle, the one-electron atom, potential barrier, and perturbation theory are introduced. Prerequisite: physics 4319 (Advanced Mechanics).
- 4325. SOLID STATE I** (3-0) 3 hours credit—Empirical classification of solid types, the structure and vibration of crystals, crystal bindings, elastic constants, specific heats of simple solids, dielectric and optical properties of insulators, ferroelectrics. Prerequisite: physics 4315 (Heat and Thermodynamics).

## PSYCHOLOGY

### Objective

The objective of graduate work in psychology is to educate the student in the methods and basic content of the discipline and to give him an apprenticeship in the execution of creative research.

Graduate work in the Master of Arts will be offered in general experimental. Student's individual programs may be arranged to give emphasis to a particular aspect of the general program.

### Degree Requirements

In addition to the general requirements, the Psychology Department will require a satisfactory score on the Miller Analogies Test and will review each applicant's file prior to admission. Before

entering graduate work in psychology a student is required to have a basic core of knowledge in the field. Undergraduate courses in statistics and in experimental methods are required but may be taken as deficiency courses. If the student's record indicates inadequate preparation in other major areas of psychology, the student may be required to make up such deficiencies through additional course work or through supervised readings and conferences.

Some financial support for graduate students is available through the department in the form of assistantships.

As soon as practicable a student should decide on his area for concentration and research. After discussion with a staff member, and with the staff member's consent, the student selects a supervising professor. With the aid and advice of the supervising professor the student will prepare and present a proposed program to the proper committee within the department. The objective of the program is to give the student a broad exposure to various areas in psychology in addition to his area of concentration.

The program is organized around a core of four areas. Students will be required to take advanced statistics and at least one course from each of the other three areas. Completion of the master's degree will require a minimum of 30 semester hours of acceptable work: 24 hours will be taken in the Psychology Department; 18 hours will come from the regular course work with an additional six hours devoted to the thesis. A minimum of six hours of supporting work will be required.

- |          |                                                                                                                  |
|----------|------------------------------------------------------------------------------------------------------------------|
| AREA I   | (1) Advanced Statistics                                                                                          |
| AREA II  | (1) Personality and Behavior Dynamics<br>(2) Advanced Social Psychology<br>(3) Advanced Developmental Psychology |
| AREA III | (1) Perceptual Processes<br>(2) Sensory Processes<br>(3) Advanced Physiological Psychology                       |
| AREA IV  | (1) Learning Theory<br>(2) Animal Learning<br>(3) Cognitive Processes                                            |

- 5301. ADVANCED STATISTICS** (3-0) 3 hours credit—Area I—A study of parametric and nonparametric statistical techniques with emphasis on statistical inference.
- 5302. EXPERIMENTAL DESIGN** (3-0) 3 hours credit—A study of the statistical aspects of complex experimental designs used in psychological research. Prerequisite: Psychology 5301.
- 5303. QUANTITATIVE METHODS** (3-0) 3 hours credit—A survey of techniques for analyzing multivariate data; particular topics include partial and multiple correlation, factor analysis, and the linear discriminant function.
- 5304. MATHEMATICAL MODELS IN PSYCHOLOGY** (3-0) 3 hours credit—Elementary probability theory, matrix algebra, and theory of linear difference equations applied to theoretical problems in learning, signal detection, decision processes, and social interactions.
- 5311. LEARNING THEORY** (3-0) 3 hours credit—Area IV—A survey of the basic theories of learning.
- 5312. ANIMAL LEARNING** (3-0) 3 hours credit—Area IV—A survey of contemporary problems in animal learning.
- 5313. COGNITIVE PROCESSES** (3-0) 3 hours credit—Area IV—An application and extension of basic concepts of psychology to more complex behavior. An investigation of such behaviors as concept formation, problem solving, and creative thinking.
- 5314. PSYCHOLINGUISTICS** (3-0) 3 hours credit—An investigation of language in terms of its function, content and structure, with an emphasis on learning, perception, and generation of linguistic units.
- 5321. PERSONALITY AND BEHAVIOR DYNAMICS** (3-0) 3 hours credit—Area II—Research in personality processes; particular topics include unconscious processes, anxiety, and conflict.
- 5322. ADVANCED SOCIAL PSYCHOLOGY** (3-0) 3 hours credit—Area II—Problems in social psychology emphasizing integration of experimental design, research findings and theoretical formulations.
- 5323. ADVANCED DEVELOPMENTAL PSYCHOLOGY** (3-0) 3 hours credit—Area II—A survey of development of behavior in both humans and sub-humans.
- 5325. THEORIES OF MOTIVATION** (3-0) 3 hours credit—This course surveys the current literature and theory on emotion and the neural and physiological basis for motivation. Material to be covered will include both biological drives, such as hunger and thirst, and interpretations of drive less immediately related to the underlying biological processes.
- 5331. PERCEPTUAL PROCESSES** (3-0) 3 hours credit—Area III—A survey of methods and findings dealing with perception; emphasis will be upon behavioral rather than physiological considerations; particular topics include signal detection theory, form and pattern recognition, and attentional mechanisms.
- 5332. SENSORY PROCESSES** (3-0) 3 hours credit—Area III—Structure, function, and neural processes in the various sense modalities. Emphasis is placed upon the current literature and theory on vision, audition, somathesis, taste and smell and their relationship to perception and behavior.
- 5333. ADVANCED PHYSIOLOGICAL PSYCHOLOGY** (3-0) 3 hours credit—Area III—The biological and physical processes underlying behavior. Emphasis is placed upon neurophysiological, biochemical and endocrinological mechanisms serving as a foundation for behavior. Other topics covered are the neural and chemical basis for conditioning and learning, intelligence and language, reflexes and motor performance, and abnormal behavior.
- 5335. ANIMAL BEHAVIOR** (3-0) 3 hours credit—A phylogenetic approach to some basic problems in behavior, with special emphasis on unlearned behavior.
- 5337. MAN-MACHINE SYSTEMS** (3-0) 3 hours credit—The study of man-machine systems and human factors research; topics include response latency as a factor in equipment design, tracking behavior, vigilance decrement, and absolute judgment phenomena.

- 5389. CONTEMPORARY PROBLEMS IN PSYCHOLOGY** (3-0) 3 hours credit—Topics vary; may be repeated for credit with permission of graduate advisor.
- 5181. LABORATORY IN PHYSIOLOGICAL PSYCHOLOGY** (0-2) 1 hour credit—A laboratory examination of research techniques and methodology in physiological psychology. Includes neurological and psychopharmacological procedures.
- 5182. INSTRUMENTATION IN PSYCHOLOGY** (0-3) 1 hour credit—An introduction to the basic principles of mechanics, electricity, and electronics with emphasis upon their application to psychological research. Includes a survey of and familiarity with psychological apparatus.
- 5191, 5291, 5391. RESEARCH IN PSYCHOLOGY** (variable credit from 1 to 3 semester hours as arranged)—Independent research under the supervision of an individual faculty member; may be repeated for credit with permission of graduate advisor.
- 5698. THESIS** (6-0) 6 hours credit—Prerequisite: 12 hours of advanced psychology and permission of the graduate advisor.

A limited number of the following courses may be applicable toward the graduate program if approved in advance by the graduate advisor.

- 3315. SOCIAL PSYCHOLOGY** (3-0) 3 hours credit—Area IV—This course will treat many aspects of the individual in relation to the socio-cultural environment. Topics included are social theory of learning and behavior, the impact of the culture on the belief system of the individual, interpersonal and intergroup relationships, sociometrics and the nature of prejudice.
- 3316. TESTS AND MEASUREMENTS** (3-0) 3 hours credit—Area III—The student will become familiar with a wide variety of both group and individual tests, through the experiences of actually constructing, taking, scoring and interpreting tests. Statistical interpretation will be emphasized in terms of validity, reliability, objectivity, item analysis, correlation and other pertinent criteria. Prerequisite: psychology 2348 (Basic Statistics).
- 3317. INDIVIDUAL AND GROUP DIFFERENCES** (3-0) 3 hours credit—Area III—Survey and analysis of research and major findings concerning genetic and environmental influences on behavior.
- 3326. COMPARATIVE PSYCHOLOGY** (3-0) 3 hours credit—Area I—This is a survey of research and theory comparing behavior at various phyletic levels.
- 3327. PERCEPTION** (3-0) 3 hours credit—Area II—A survey of theory and research in perceptual processes.
- 3329. PHYSIOLOGICAL CORRELATES OF MOTIVATION** (3-0) 3 hours credit—Area II—A survey of research and theory in motivation from the standpoint of the underlying physiological processes.
- 3330. BEHAVIOR AND MOTIVATION** (3-0) 3 hours credit—Area I—Theory and research involving relation of motivation to learning theory, social behavior, personality and development.
- 3331. SENSORY PROCESSES** (3-0) 3 hours credit—Area II—Research and theory regarding sensory processes. Primary emphasis on vision and audition.
- 4301. ABNORMAL PSYCHOLOGY** (3-0) 3 hours credit—Area IV—This is a study of the causes, incidence, prophylaxis and treatment of psychopathology.
- 4302. INTRODUCTION TO CLINICAL AND COUNSELING PSYCHOLOGY** (3-0) 3 hours credit—Area III—This course is a survey of both counseling and clinical psychology. The student is introduced to psychodiagnostic procedures and the basic approaches of counseling and psychotherapy.

- 4304. APPLIED EXPERIMENTAL PSYCHOLOGY** (3-0) 3 hours credit—Area III—A survey of application of various psychological principles and techniques. Particular emphasis will be given the man-machine complex.
- 4313. PSYCHOLOGY OF LEARNING** (3-0) 3 hours credit—Area I—This course is a study of the factors influencing modifications of behavior, and the underlying theoretical explanations.
- 4314. PSYCHOLOGY OF PERSONALITY** (3-0) 3 hours credit—Area IV—This course is a survey of all the major theories of personality.
- 4326. THE HISTORY OF PSYCHOLOGY** (3-0) 3 hours credit—Any Area—This course is a study of the evolution of psychology as a science, leading up to and including contemporary developments.
- 4336. THOUGHT AND COMMUNICATION PROCESSES** (3-0) 3 hours credit—Area I—This is a survey of research and theory in the areas of thinking, judgment and both linguistic and non-linguistic communication.
- 4337. PHYSIOLOGICAL PSYCHOLOGY** (3-0) 3 hours credit—Area II—This course is a study of the physical structures and processes underlying the behavior of the animal kingdom and of human beings.

## MASTER OF BUSINESS ADMINISTRATION

### Objective

The Master of Business Administration program is broad in nature and is aimed at general competence for overall management.

Modern managers increasingly move across functional lines as they reach higher positions of responsibility. The ability to reason and solid habits of learning aid in the creation of a general management frame of reference and balanced managerial performance.

The professional manager's ability to contribute constructively to change in business, and to make and successfully execute wise decisions, is in large part derived from his sensitivity to the factors which make up the problems with which he is faced. Management competence increasingly requires a willingness to face the challenge of living in an environment of uncertainty, in which innovation occurs at an ever-increasing rate and in which interindividual and intergroup relationships are becoming more complex.

### Degree Requirements

Admission to the Master of Business Administration program is based upon the completion of the general admission requirements of the Graduate School.

The program has been designed to accommodate students of widely divergent backgrounds.

**BACKGROUND CATEGORY I:** The first category includes those students who have had no prior academic work in business. They will enter the program of work listed for Semester I and will continue sequentially through the 60 semester hours of work as listed for the four semesters.

**BACKGROUND CATEGORY II:** The second category includes those

students with varying amounts of work in the business area; for such individuals there is provided a mechanism for waiving certain of the courses contained in the first year of the program.

A required written comprehensive examination will be administered in the last semester of the Master of Business Administration program.

Many people in business seek to enhance their career opportunities by broadening their knowledge and understanding of the overall management field. Since it is impossible for them to leave their responsibilities and return to academic work on a full-time basis, the School of Business Administration offers a complete program in the evening as a service to the community. Evening classes are taught by full-time faculty members and the same academic standards required of full-time students are maintained. The same course sequence is planned for evening students as for the full-time students. All of the course work required for the degree is offered in the evening hours. It is expected that the student will progress through the program at a pace that is commensurate with the time available for him to study.

### FIRST YEAR PROGRAM

Areas	Semester I	Semester II
Quantitative	(1) Accounting Analysis I (2) Statistics (3) Mathematics for Management Science	(1) Accounting Analysis II
Behavioral Science	(4) Behavioral Science in Management	
Economics Functional	(5) Economic Analysis I	(2) Economic Analysis II (3) Finance (4) Production (5) Marketing

### SECOND YEAR PROGRAM

Areas	Semester III	Semester IV
Behavioral Science	(1) Organization Theory and Administration	(1) Business Policy
Economics Concentration and Electives	(2) Business and Society (3) Elective (4) Elective (5) Concentration Seminar	(2) Elective (3) Elective (4) Research Colloquium (5) Thesis

Concentration may be obtained with electives in finance, management, management science, marketing, and production. Graduate level courses in economics, together with certain graduate level courses in other departments of this university may be elected by the student, subject to approval.



## ACCOUNTING

**5301. ACCOUNTING ANALYSIS I** (3-0) 3 hours credit—Concepts, terminology, statements, measurements of income, basic cost accounting; profit planning and control; statement analysis.

**5302. ACCOUNTING ANALYSIS II** (3-0) 3 hours credit—Continuation of Accounting Analysis I.

**5322. MANAGERIAL PLANNING AND CONTROL** (3-0) 3 hours credit—An in-depth study of the information and reporting needs of contemporary management for planning, organizing, controlling, and other decision-making purposes. The view taken is that of the firm's chief financial officer couched within an interdisciplinary approach to the solution of information problems. Quantitative and qualitative techniques offered are traditional budgeting; simulation of the firm using computerized budget models, including development and applications of the models, supplemented by multiple regression analysis for model refinement; economic and motivational aspects of responsibility accounting; and capital budgeting concepts. Prerequisite: accounting 5301 and accounting 5302 or equivalent.

**5324. CASES IN ADVANCED MANAGERIAL ACCOUNTING** (3-0) 3 hours credit—A case-oriented course exploring the chief financial officer's responsibility and opportunity for satisfying management information needs, the problems encountered, and the tools available. Among the problem areas to be covered are cash flow determination, capital budgeting, estimates of future capital requirements, PERT-Cost systems, profit maximization through control, special problems in product pricing, and intracompany pricing. Conventional methods, regression analysis, absorbing Markov chains, and linear programming are some of the techniques offered. Prerequisite: economics 5306 and either accounting 5322 or accounting 4335 (Information and Control Systems).

**5327. CONTEMPORARY ISSUES IN ACCOUNTING THEORY** (3-0) 3 hours credit—Financial accounting, at any point in time, is confronted with a variety of unresolved issues. This course is designed to familiarize the student with the significant problems currently facing the accounting profession, to examine in depth the various solutions proposed by accounting scholars and others, and to strengthen and mature the student's understanding of today's critical issues in accounting theory. Prerequisite: A minimum of 21 semester hours in accounting at the undergraduate level.

**5329. INFORMATION SYSTEM ANALYSIS** (3-0) 3 hours credit—Studies in the structure, organization, functions, and objectives of accounting and related information systems. Both theoretical and implementive aspects of systems are explored. Special consideration is given to the impact of system structure on individual and group motivation. Prerequisite: limited knowledge of programming.

## BUSINESS ADMINISTRATION

**5301. STATISTICS** (3-0) 3 hours credit—An introduction to statistics designed to prepare the student for quantitative analysis of business problems. Topics include probability, random variables, sampling distributions, confidence intervals, tests of hypotheses, regression theory and application, and Bayesian inference.

**5302. MATHEMATICS FOR MANAGEMENT SCIENCES** (3-0) 3 hours credit—A study of the quantitative techniques of use in the functional courses and operations research. Topics include matrix algebra, linear systems, differential and integral calculus, and difference equations.

**5311. BEHAVIORAL SCIENCES IN MANAGEMENT** (3-0) 3 hours credit—An examination of the managerial uses of concepts and findings from the disciplines of sociology, psychology and cultural anthropology. Consideration is given to the functions of the personal administration area, and to supervision-leadership, morale-motivation problems, communication and labor relations.

**5326. SIMULATION AND BUSINESS MODELS** (3-0) 3 hours credit—A study of the theory and practices in the simulation of stochastic and mathematical models of business and industrial processes. An application of mathematical methods to problems of resource allocation, economic analysis, inventory systems, management planning models, queuing systems. Investigation of mathematical and statistical methods such as Monte Carlo simulation, process generators, and other simulation techniques. Emphasis will be placed on the formulation, construction and simulation of realistic business problems. Prerequisites: management science 5324.

**5333. BUSINESS POLICY** (3-0) 3 hours credit—This course provides an integration of the master's of business administration curriculum into a cohesive whole. The several elements of business administration are treated by use of business policy cases and decision simulation methods. Prerequisite: management 5322.

**5190, 5290, 5390. CONCENTRATION SEMINAR** 1, 2, or 3 hours credit—In this course the students explore in depth some of the key problems in their area of concentration. Research effort is initiated for the investigation of critical problems in the area. Prerequisite: permission of the instructor.

**5191, 5291, 5391. RESEARCH COLLOQUIUM** 1, 2, or 3 hours credit—Provides the vehicle for presentation of research by the candidate and an arena for his examination by faculty and other candidates. (On occasion the Concentration Seminar plus the Research Colloquium may, with appropriate permission, be used as a substitute for the traditional type of thesis work). Prerequisite: business administration 5190.

**5398, 5698, 5998. THESIS** 3, 6, or 9 hours credit. Prerequisite: permission of graduate advisor.

## ECONOMICS

**5309. ECONOMIC ANALYSIS I** (3-0) 3 hours credit—This is an accelerated course in fundamental economic analysis for students enrolled in graduate programs other than the Master of Arts in economics. The basic analytical concepts of price theory and their application to managerial decisions are developed. The course includes the theory of consumer behavior, theory of the firm, and market structure.

**5311. ECONOMIC ANALYSIS II** (3-0) 3 hours credit—This is an accelerated course in fundamental economic analysis for students enrolled in graduate programs other than the Master of Arts in economics. The ideas of economics—related to aggregate production, income, the underutilization or overutilization of resources, and the operation of the monetary system—are developed carefully.

**5337. BUSINESS AND SOCIETY** (3-0) 3 hours credit—An examination of the interaction of the organizations of industry and commerce, government, labor, and other institutions within our society. Prerequisite: permission of graduate advisor.

## FINANCE

**5311. BUSINESS FINANCIAL MANAGEMENT** (3-0) 3 hours credit—This course is a study of the function of providing the business firm with funds necessary for its operation and of achieving effective utilization of funds. Primary emphasis is on financial decision-making within the business firms, and techniques of financial analysis and forecasting that aid in optimum decision-making. Subject matter is developed to focus attention on the nature and significance of the variable factors involved in the main types of financial decisions and on methods of analyzing and evaluating these factors.

**5322. ADVANCED BUSINESS FINANCIAL PROBLEMS** (3-0) 3 hours credit—Analysis of financial problems of business concerns, presented in case materials. Types of problems considered are: determination of capital needs,

choosing among alternative capital investments, planning methods of financing new capital expenditures, and planning recapitalizations, mergers, and reorganizations.

**5323. INVESTMENT MANAGEMENT PROBLEMS (3-0) 3 hours credit**—Application of principles and techniques of investment management in solving investment problems of individuals and financial institutions. Types of problems considered are: apportionment of investment funds among alternative types of securities in planning portfolios, analysis of risk exposure in particular securities, valuation of securities, timing of security acquisitions, and shifting funds among classes of securities held in portfolios.

**5324. FINANCE SEMINAR (3-0) 3 hours credit**—Intensive research in selected areas of business finance, investment analysis and management, financial markets, commercial banking, and non-bank financial institutions.

## MANAGEMENT

**5322. ORGANIZATION THEORY AND ADMINISTRATION (3-0) 3 hours credit**—This course analyzes the human elements, both individual and group, which influence administrative decision-making and the implementation of decisions once made. Attention is given to an examination of theoretical concepts and research. Prerequisite: business administration 5311.

**5325. INDUSTRIAL RELATIONS (3-0) 3 hours credit**—Examines union-management relations and considers the structure and functioning of the economic and social forces of importance at the policy level within both the firm and the union. Non-union employee relationships are also considered.

**5326. THE DEVELOPMENT OF MANAGEMENT THOUGHT (3-0) 3 hours credit**—This course is concerned with an analysis of the development of management philosophy primarily from the Industrial Revolution to the present time.

**5327. SEMINAR IN MANAGEMENT (3-0) 3 hours credit**—Independent research by the student with emphasis upon depth of penetration into the chosen topic.

## MANAGEMENT SCIENCE

**5322. APPLIED DECISION THEORY I (3-0) 3 hours credit**—An in-depth study of the theory and application of the classical statistical concepts introduced in STATISTICS, as well as a detailed investigation of traditional treatment of subjective probability and utility theory. This is followed by an introduction to the application of the various concepts of problems in decision making. Prerequisite: business administration 5302 and economics 5306.

**5323. APPLIED DECISION THEORY II (3-0) 3 hours credit**—A thorough investigation of the analysis of decision under uncertainty. Concepts of both Classical and Bayesian statistics will be integrated and applied in the decision-making process. The course will include the study of Monte Carlo simulation concepts as relevant to such techniques as risk analysis, decision trees, and stochastic decision trees. Prerequisite: management science 5322.

**5324. INTRODUCTION TO MANAGEMENT SCIENCES (3-0) 3 hours credit**—An introduction to the scientific approach to management problems. Special topics with applications taken from the areas of probability theory, linear programming, game theory, simulation, queuing theory, inventory theory, Markov chains, network analysis, and other areas of management sciences and operations research. Prerequisites: business administration 5302 and economics 5306.

**5327. APPLIED MATHEMATICAL PROGRAMMING (3-0) 3 hours credit**—A study of optimization techniques including linear, quadratic, non-linear, dynamic integer, and geometric programming. Emphasis will be on problem identification, technique association, and solution formulation. Applications of game theory will also be investigated. Prerequisites: management science 5324.

## MARKETING

**5311. MARKETING** (3-0) 3 hours credit—A survey of all the activities involved in marketing. Emphasis is placed on developing a managerial point of view in planning and evaluating marketing decisions of the firm. Decisions with respect to products, price, channel, and promotional variables are analyzed, and questions relating to cost, efficiency, demand, and regulations are appraised.

**5322. PLANNING AND POLICY MAKING IN MARKETING** (3-0) 3 hours credit—This course stresses the design and development of marketing programs. Communication problems, channel questions, and price and product policies are covered in depth. Emphasis is on developing a substantive framework within which alternative marketing decisions can be considered and evaluated.

**5323. MARKETING STRATEGY** (3-0) 3 hours credit—A case course designed to give the student an opportunity to utilize the material and analytical tools that he has acquired. Detailed case studies are used which require a realistic diagnosis of company problems, development of alternative courses of action, and the formulation of specific recommendations. Stress is placed on developing a more tangible recognition of the interrelationships of the various aspects of the marketing mix as well as showing how marketing operations affect and are affected by other functional areas.

**5324. SEMINAR: CONTEMPORARY MARKETING PROBLEMS** (3-0) 3 hours credit—Emphasis is placed on projects based on a wide range of marketing developments and trends. Each student is required to write and present a research paper dealing in depth with marketing topics of current or potential interests.

## PRODUCTION

**5311. PRODUCTION** (3-0) 3 hours credit—An analysis of managerial decisions in the production function with consideration of the planning and design of systems and processes. An introduction to information systems; topics include mathematical model formation and decision simulation.

**5322. MANUFACTURING PLANNING AND CONTROL** (3-0) 3 hours credit—This course critically examines projected use of material, financial and human resources and control of such use. Treatment is quantitative.

**5323. ANALYSIS OF PRODUCTION PROBLEMS** (3-0) 3 hours credit—This is a manufacturing policy course with detailed consideration given to an analysis of the industrial framework within which a given firm operates. Topics include consideration of mathematical and simulation methods.

**5324. SEMINAR IN PRODUCTION** (3-0) 3 hours credit—Directed research effort by the student in the examination of a selected topic in which recent theoretical and empirical findings are included.

# ELECTRICAL ENGINEERING

## Objective

The course offerings provide the student with an opportunity to broaden as well as to intensify his knowledge in a number of areas of electrical engineering. The student, with the aid of a faculty advisor, may plan a program in any one of a number of fields of specialization within electrical engineering or from the offerings of related departments in science and engineering.

Graduate study and research are offered in the areas of:

1. Analysis and Synthesis of Circuits, Networks and Systems
2. Electromagnetic Fields and Related Topics
3. Electronics—Solid State Theory, Device and System Theory
4. Power System Analysis—Computer Applications and Transform Theory
5. Information Transmission and Communication Systems
6. Interdisciplinary Programs in Materials Science, Direct Energy Conversion, and Stability and Control/Automatic Controls

The program is designed to satisfy the needs of students planning to continue graduate work after the completion of the master's degree program and to provide for the student seeking to increase his knowledge in areas of electrical engineering related to his engineering profession.

## Degree Requirements

The general degree requirements for the Master of Science degree have been presented in another section. Students wishing to major in electrical engineering should have the Bachelor of Science degree in electrical engineering from an approved school. Students with degrees in other disciplines may qualify for graduate study in electrical engineering after the completion of a faculty-approved program of undergraduate courses.

No senior courses required in the present program for the Bachelor of Science degree in electrical engineering may be used in a graduate electrical engineering program.

**5303. SEMICONDUCTOR ELECTRONICS** (3-0) 3 hours credit—Quantitative description of physical processes relevant to semiconductor diode and transistor performance, including large signal and high frequency performance.

**5312. PROPAGATION OF ELECTROMAGNETIC WAVES** (3-0) 3 hours credit—Diffraction, reflection and refraction of electromagnetic waves at plane and spherical boundaries; propagation in ionized media. Prerequisite: electrical engineering 4217 (Engineering Applications of Electromagnetic Field Theory) or equivalent.

**5313. ADVANCED ENGINEERING ANALYSIS** (3-0) 3 hours credit—A problem course dealing with selected analytical methods not normally included in undergraduate electrical engineering curricula.

**5314. NON-LINEAR SYSTEMS ANALYSIS** (3-0) 3 hours credit—Introduction to analytical and topological methods of non-linear analysis, including phase plane, limit cycles, describing functions, sub-harmonic oscillations, etc.

- 5316. STATISTICAL DESIGN OF LINEAR SERVOMECHANISMS (3-0) 3 hours credit**—Analysis and synthesis techniques applicable to feedback control systems in which portions of the system and/or its input signals are non-deterministic. Prerequisite: electrical engineering 4314 or equivalent.
- 5317. DISCRETE DATA SYSTEMS (3-0) 3 hours credit**—The analysis of non-continuous dynamic systems described by difference equations, Z-transform theory, and including applications of signal flow graph theory. Prerequisite: electrical engineering 4314 or equivalent.
- 5318. NETWORK SYNTHESIS II (3-0) 3 hours credit**—A continuation of passive network driving point and transfer function synthesis, extending the introductory material of electrical engineering 4317. Prerequisite: electrical engineering 4317 and mathematics 4322.
- 5320. MODERN CONTROL THEORY (3-0) 3 hours credit**—Linear algebra, Euclidean spaces, properties of sets, vector functions, function space and related mathematical notions. The concept of system state, finding the state representation for dynamical systems, definition of the control problem, and the concepts of controllability and observability. Conditions for optimality, the variational approach to the control problem, the maximum principle of Pontryagin, and the Hamilton-Jacobi equation. Prerequisite: electrical engineering 4314 or equivalent.
- 5321. MODERN CONTROL DESIGN TECHNIQUES (3-0) 3 hours credit**—Minimum time problems, minimum fuel problems, minimum energy problems and the derivation of necessary conditions. The design of time optimal and fuel optimal systems, and the design of optimal linear systems with quadratic criteria. Prerequisite: electrical engineering 5320.
- 5324. LOGIC CIRCUITS I (3-0) 3 hours credit**—Fundamental theory of logic circuits, including binary arithmetic, Boolean algebra, Karnaugh map, minimization and synthesis methods.
- 5325. ADVANCED COMMUNICATION THEORY I (3-0) 3 hours credit**—Basic probability and statistics, correlation functions, properties of noise sources, signal detection, design of optimum filters, etc.
- 5326. ADVANCED COMMUNICATION THEORY II (3-0) 3 hours credit**—Continuation of study of communications problems and techniques, with emphasis shifting to specific areas such as radar detection, space communications, etc.
- 5331. INTRODUCTION TO PLASMA DYNAMICS (3-0) 3 hours credit**—Plasma as the fourth state of matter. Particle orbits in electric and magnetic fields. Individual and collective phenomenon, collision processes. Debye shielding distance, plasma frequency, ambipolar diffusion, wave phenomena in plasmas, mirror effect magnetic bottle, plasma confinement and stability.
- 5332. KINETIC THEORY OF PLASMA (3-0) 3 hours credit**—Kinetic theory of ionized gases. Fluid and particle models. Equations state, change and flux. Macroscopic motions of plasma, Boltzman, Liouville, Langevin, Vlasov, BBGKY, Fokker-Planck equations, transport processes of plasma. Prerequisite: electrical engineering 5331.
- 5333. MAGNETOHYDRODYNAMICS (3-0) 3 hours credit**—Magnetofluid-dynamics equations, Alfvén and shock waves. Magnetohydrodynamic channel flows: Hartman, Couette, Boundary layers, MHD propulsion, MHD power generation, Faraday and Hall generators, gaseous and liquid-metal media, thermonuclear reactions, fusion power. Prerequisite: electrical engineering 5331.
- 5335. MICROWAVE SYSTEMS ENGINEERING (3-0) 3 hours credit**—Study of the relationships between system parameters and system performance in pulsed, C-W, doppler and monopulse radars.
- 5337. ADVANCED COMPUTER METHODS FOR POWER ANALYSIS (3-0) 3 hours credit**—The material covered in this course includes incidence and network matrices, algorithms for formation of network matrices, short circuit

studies, load flow studies, economic load dispatching, and other current topics. May be repeated for credit with the consent of the instructor.

**5338. CIRCUIT ANALYSIS OF ELECTRIC POWER SYSTEMS** (3-0) 3 hours credit—Matrix algebra and linear transformations as applied to the polyphase power system problem. Basic principles of symmetrical components for use in steady state analysis and alpha-beta-zero (Clarke) components for use in transient analysis.

**5339. TRANSIENTS IN POWER SYSTEMS** (3-0) 3 hours credit—Study of over-voltage conditions and system recovery during faults, switching surges, and sudden losses of load.

**5392. SELECTED TOPICS IN ELECTRICAL ENGINEERING** (3-0) 3 hours credit—The material covered may vary from semester to semester. Topics included will be from one of the following fields:

1. Electronics
2. Power Systems Analysis
3. Information Theory
4. Plasma Engineering
5. Servomechanisms and Controls
6. Electromagnetic Theory and Practices
7. Engineering Analysis

This course may be repeated for credit if different topics are covered for each registration.

**5440. NON-LINEAR OSCILLATIONS IN ELECTRIC POWER SYSTEMS** (3-3) 4 hours credit—Analysis of steady-state and transient stability of electric power systems, with emphasis on numerical solutions. Digital computer laboratory included. **\$5 lab fee.**

**5444. ADVANCED SEMICONDUCTOR DEVICES** (3-3) 4 hours credit—Theory, construction and application of semiconductor devices such as field effect transistors, MOS transistors, silicon controlled rectifiers, double-base diodes, tunnel diodes, etc. Laboratory included. **\$5 lab fee.**

**5445. SYNTHESIS OF LINEAR SERVOMECHANISMS** (3-3) 4 hours credit—An extension of the introductory material in electrical engineering 4314, with emphasis on compensation techniques and a-c carrier systems. Laboratory included. Prerequisite: electrical engineering 4314 or equivalent. **\$5 lab fee.**

**5447. LOGIC CIRCUITS II** (3-3) 4 hours credit—Application of logic circuit fundamentals to design of digital subsystems such as counters, storage and shift registers, coding circuits, etc. Laboratory included. **\$5 lab fee.**

**5452. ELECTROMAGNETIC RADIATION** (3-3) 4 hours credit—The theory of electromagnetic radiation at microwave frequencies. **\$5 lab fee.**

**5191, 5291, 5391. RESEARCH IN ELECTRICAL ENGINEERING** (Variable credit from 1 to 3 semester hours as arranged)—Individually approved research projects leading to preparation and submission of a master's thesis in electrical engineering.

**5398 or 5698. THESIS** 3 or 6 hours credit—Prerequisite: graduate standing in electrical engineering.

A limited number of the following courses may be applicable toward the graduate program if approved in advance by the graduate advisor.

**4312. ELECTROMAGNETIC FIELDS** (3-0) 3 hours credit—This course is a study of the application of advanced mathematical techniques for the formulation and solution of problems in electromagnetic fields. Prerequisite: electrical engineering 4217 (Engineering Applications of Electromagnetic Field Theory).

- 4314. SERVOMECHANISMS AND CONTROLS (3-0)** 3 hours credit—This course is a study of transfer functions and the analysis of closed loop systems utilizing frequency response analysis. Design analysis and synthesis techniques are developed for the study of system performance. Electrical, mechanical and hydraulic systems are considered. Prerequisite: mathematics 4322.
- 4317. INTRODUCTION TO NETWORK SYNTHESIS (3-0)** 3 hours credit—A major portion of this course is concerned with the realizability conditions and systematic realization procedures for 1-port and 2-port networks. Generally, the discussion is restricted to passive networks. Prerequisite: electrical engineering 3316 (Circuits).
- 4326. MICROWAVES (3-0)** 3 hours credit—This course is a study of microwave generators, modulators, detectors and transmission systems. Prerequisite: electrical engineering 4217 (Engineering Applications of Electromagnetic Field Theory).
- 4327. THEORY AND DESIGN OF ANTENNAS (3-0)** 3 hours credit—This course is a study of the basic theory of antennas and is presented with emphasis on design factors and the engineering application of antennas. Prerequisite: electrical engineering 4217 (Engineering Applications of Electromagnetic Field Theory).
- 4331. EFFECTS OF NOISE IN COMMUNICATION SYSTEMS (3-0)** 3 hours credit—Introduction to statistical methods, sources of electrical noise, analysis methods for noisy circuits, signal-to-noise comparison for common modulation methods, threshold detection, matched filtering, power spectral density, correlation functions.
- 4332. ELECTRONIC DEVICES (3-0)** 3 hours credit—This course is a study of various important electronic devices which are not covered in detail in earlier electronics courses. Included are field-effect transistors, controlled rectifiers, photoelectric devices, integrated circuit devices, and others. Both theory of device operation and important circuit applications are discussed.
- 4333. INTRODUCTION TO THREE-PHASE POWER SYSTEMS (3-0)** 3 hours credit—This course is a study of the network matrices, representation of power systems, theory of network transformation, and application of symmetrical components and alpha-beta-zero components to solution power system problems.
- 4334. COMPUTER METHODS FOR POWER SYSTEM ANALYSIS (3-0)** 3 hours credit—This course is a study of load flow, short circuit calculation, power system stability and economic operation of power systems. Prerequisite: electrical engineering 4333.
- 4339. DESIGN OF ELECTRONIC CIRCUITS (3-0)** 3 hours credit—This course is a study of the design of circuits utilizing tubes and semiconductors. Methods of measurement and engineering applications are included.
- 4444. PULSE AND DIGITAL CIRCUITS (3-3)** 4 hours credit—The analysis and design criteria for pulse and digital circuits will be presented. The laboratory will complement the theory by means of a series of design and design evaluation projects. Prerequisite: electrical engineering 3304 (Electronic Circuits) \$2 lab fee.



# ENGINEERING MECHANICS

## Objective

The graduate program in engineering mechanics is designed to provide students with an understanding of the fundamentals of mechanics and prepare them for additional graduate work at the doctorate level or for careers in research or industry. Students desiring to study mechanics should have a high level of interest and aptitude in mathematics and analysis.

Candidates for a Master of Science Degree in engineering mechanics may elect programs emphasizing solid mechanics, fluid mechanics or dynamics and vibrations. A degree program emphasizing materials science is also available in which the areas of physical metallurgy, ceramics and the chemistry and physics of solids is combined into a unified discipline.

## Degree Requirements

Prior to admission as a degree candidate, the student must have, as a minimum, credit for statics, dynamics, mechanics of materials, advanced calculus, differential equations, basic fluid mechanics, and thermodynamics. In addition, each student must consult his graduate advisor to plan his program of course work and research.

**5302. ENGINEERING MECHANICS SEMINAR (3-0)** 3 hours credit—Semi-formal discussion between faculty and students on progress and results of current research and on significant developments in the mechanics field. Prerequisite: permission of instructor.

**5311. THEORY OF ELASTICITY I (3-0)** 3 hours credit—Theories of stress, strain equilibrium and compatibility in three dimensions are developed. Plane stress and plane strain, and their application, included. Prerequisite: permission of instructor.

**5312. THEORY OF ELASTICITY II (3-0)** 3 hours credit—Continuation of Theory of Elasticity I, curvilinear coordinates, variational methods, axially symmetric stress distribution problems, stress waves in solids studied. Prerequisite: engineering mechanics 5311.

**5313. THEORY OF PLASTICITY (3-0)** 3 hours credit—Stress-strain relations in three dimensions presented. Three-dimensional yield conditions and flow law, thick-walled tube and sphere discussed; limit analysis and approximate theories. Prerequisite: permission of instructor.

**5314. THEORY OF PLATES AND SHELLS (3-0)** 3 hours credit—The theory is developed for the stress analysis of elastic plates and shells of revolution. Composite structures are considered in addition to the homogeneous and isotropic case. Prerequisite: permission of instructor.

**5315. AEROELASTICITY (3-0)** 3 hours credit—This course is a study of the interaction of aerodynamic (or hydrodynamic), inertia and elastic forces acting on vehicles moving through a fluid such as airplanes, missiles or submarines. Investigations of flutter and divergence are included. Prerequisite: engineering mechanics 4301 (Mechanical Vibrations) or equivalent; aerospace engineering 3303 (Aerodynamics I) or equivalent.

**5316. STRUCTURAL MECHANICS AND ANALYSIS (3-0)** 3 hours credit—Force and deformation methods used with matrix solutions of solid and framed structures. Arches, rings and buckling are studied. Prerequisite: permission of instructor.

- 5321. ADVANCED DYNAMICS (3-0)** 3 hours credit—Hamilton's Principle, Lagrange's Equation and Hamilton—Jacobi Equation are introduced. Dynamics of rigid body and theory of gyroscope are studied. Prerequisite: engineering mechanics 4336 (Intermediate Dynamics) or equivalent.
- 5322. THEORY OF ELASTIC STABILITY (3-0)** 3 hours credit—Elastic stability of bars, buckling of plates and shells are discussed. Both classical and numerical solutions included. Prerequisite: permission of instructor.
- 5323. ADVANCED MECHANICAL VIBRATIONS (3-0)** 3 hours credit—A continuation of engineering mechanics 4301, Mechanical Vibrations. Application of generalized coordinates and Lagrange equations are studies. Free and forced vibration of elastic systems with many degrees of freedom are considered including damping effects. Prerequisite: engineering mechanics 4301 (Mechanical Vibrations) or equivalent.
- 5324. ENERGY METHODS IN APPLIED MECHANICS (3-0)** 3 hours credit—Virtual displacements, minimum potential energy, principle of complementary energy, Castigliano's Theorem, action integral, variational principles, Hamilton's principles and Lagrange's equations presented. Applications are made to solve problems in stress analysis, elastic stability, vibration and related topics. Prerequisite: permission of instructor.
- 5325. DYNAMIC STABILITY OF ELASTIC SYSTEMS (3-0)** 3 hours credit—The regions of dynamic instability of elastic systems due to parametric excitation are presented. Influence of damping is included. Prerequisite: permission of instructor.
- 5326. INTRODUCTION TO NONLINEAR MECHANICS (3-0)** 3 hours credit—Nonlinear differential equations governing various phenomena of mechanics are derived. Physical and mathematical implications of linearizations discussed. Analytical, graphical and numerical methods of solutions to the free oscillations of systems having nonlinear characteristics are discussed. Response curves and stability considerations for forced oscillations included. Prerequisite: permission of instructor.
- 5327. DYNAMICS OF SPACE VEHICLES (3-0)** 3 hours credit—The two-body problem, geometry of spatial orbits, orbit determination, trajectory modification, introduction to perturbation theory, equation of motion for thrusting rocket, boost trajectories and related topics will be treated. Prerequisite: engineering mechanics 4336 (Intermediate Dynamics) or equivalent.
- 5328. FLUID DYNAMICS (3-0)** 3 hours credit—An advanced study of the kinematics and dynamics of Newtonian fluid motion, stresses in fluids, and surface flow. Prerequisite: mechanical engineering 3313 (Fluid Mechanics) or equivalent.
- 5330. NUMERICAL VIBRATION ANALYSIS (3-0)** 3 hours credit—In this course, the theories developed in engineering mechanics 5323 are applied to practical situations where numerical answer are required. All widely used methods for solving linear, nonlinear, and transient vibration problems numerically will be utilized in connection with computer programming. Prerequisites: engineering mechanics 5323 and a reasonable proficiency in computer programming and the consent of the instructor.
- 5331. SIMILITUDE AND THEORY OF MODELS (3-0)** 3 hours credit—Similitude models, dimensional analysis, nomographs and graphical aids to analysis. Prerequisite: permission of instructor.
- 5332. MECHANICAL PROPERTIES OF METALS (3-0)** 3 hours credit—Theories of the mechanical properties of metals based upon dislocation theory with emphasis on fatigue, creep and fracture. Prerequisite: permission of instructor.
- 5333. PHYSICS OF ENGINEERING MATERIALS (3-0)** 3 hours credit—The free electron and zone theories of metals and their application to electrical conductivity, ferromagnetism, cohesion and crystal structure will be developed. Prerequisite: permission of instructor.

**5334. NUCLEAR MATERIALS (3-0)** 3 hours credit—Physical, chemical and nuclear properties of materials for nuclear reactor applications. Effects of radiation damage, corrosion and heat transfer. Prerequisite: permission of instructor.

**5335. THEORY OF ALLOYS (3-0)** 3 hours credit—Thermodynamic and structural approach applied to metallic alloys. Topics include equilibrium, free energy of alloy phases, electron compounds, intermediate phases, and order-disorder. Prerequisite: permission of instructor.

**5336. PHASE DIAGRAMS AND TRANSFORMATIONS (3-0)** 3 hours credit—Preparation and interpretation of phase diagrams. Kinetics and mechanisms of thermal and athermal transformations. Allotropic order-disorder, precipitation, martensitic transformations, nucleation and growth. Prerequisite: permission of instructor.

**5337. CORROSION (3-0)** 3 hours credit—Quantitative application of electrochemical principles to corrosion reactions. Effect of metallurgical factors, environmental effects, oxidation and tarnish, erosion protection, materials selection. Prerequisite: permission of instructor.

**5341. EXPERIMENTAL MECHANICS (2-3)** 3 hours credit—This course includes experimental and analytical methods in structural mechanics. Various analogies are studied. Experimental methods of determining stress strain force and displacement are studied. Prerequisite: permission of instructor.

**5342. X-RAY METALLURGY (2-3)** 3 hours credit—The theory and techniques of X-ray as applied to the study of crystalline solids. Production of X-rays, their scattering, absorption and diffraction. Special topics, such as stress analysis, crystal perfection, precision lattice determination and phase diagrams, will be studied. Prerequisite: permission of instructor.

**5191, 5291, 5391. ADVANCED STUDIES IN ENGINEERING MECHANICS (Variable credit from 1 to 3 semester hours as arranged)**—Topics selected from various branches of engineering mechanics, particularly those in which active research is being conducted. Prerequisite: permission of instructor or graduate advisor.

**5398 or 5698 THESIS (3 or 6 hours credit)**—Prerequisite: 12 hours of advanced engineering mechanics and approval of graduate advisor.

# SOCIAL WORK

## Objectives

The two-year program leading to the master's degree is designed to develop skilled practitioners and community leaders for responsible entry into practice. The program of instruction includes an intensive academic phase integrated with a practicum phase allowing the student to learn and apply theory concurrently. The curriculum reflects the social, economic and emotional needs of man in today's world. It includes:

An understanding of social policy and the social institutions established to translate policy into services.

The behavioral, social, economic and political sciences which rationalize practice and the administrative and managerial concepts and principles needed to administer programs.

Etiology and prevention of social pathology.

The methods, techniques and tools needed to identify and reduce social problems.

Practice under supervision.

## Degree Requirements

The specific requirements for admission to the Graduate School of Social Work are the same as those for general admission to graduate study at The University of Texas at Arlington, but in addition, a personal interview is required.

The Master's Degree in Social Work requires the completion of 60 semester hours of class and field instruction, and the preparation of a thesis based on individual or group research. All work must be completed within one six-year period.

**5301. HUMAN BEHAVIOR AND THE SOCIAL ENVIRONMENT I (3-0) 3 hours credit**—The concern of this course will be on the development of the individual from infancy to old age, and as it is affected by physical, intellectual, emotional, spiritual, social influences and attributes. Emphasis will be placed on the factors which affect social functioning of the individual within the social context of the family, group relationships, occupational settings and community structures.

**5302. HUMAN BEHAVIOR AND THE SOCIAL ENVIRONMENT II (3-0) 3 hours credit**—A continuation of 5301, with a deepening and expansion of the above content. Emphasis is placed on the inter-relatedness of the physical, social and psychological systems related to the stages of human development. The behavior of the individual under stress, the maturational process, and the use of adaptive mechanisms will also be studied. Prerequisite: social work 5301.

**5305. SOCIAL WELFARE POLICY AND SERVICES I (3-0) 3 hours credit**—This course will deal with the characteristics, structures, functions and obligations of social work as a socially sanctioned profession and the responsibilities and professional contributions of social workers, the agencies, programs and fields of practice. Emphasis will be placed on the American social welfare system, the history and present structure of social services from the standpoint of social, political and economic systems in society.

**5306. SOCIAL WELFARE POLICY AND SERVICES II (3-0)** 3 hours credit—This course will investigate in greater detail the present state of the American Welfare System with emphasis on interplay of public, voluntary, social welfare programs from the standpoint of identification of unmet needs, improvement of the delivery system in providing services. Prerequisite: social work 5305.

**5309. SOCIAL CASEWORK I (3-0)** 3 hours credit—An introduction to the fundamental concepts and principles of the casework method. Emphasis will be placed on work with individuals and families from the standpoint of the casework process. This process consists of social study, diagnosis, and treatment.

**5310. SOCIAL CASEWORK II (3-0)** 3 hours credit—This is a continuation of Social Casework I, designed to deepen the student's understanding of the client, and the constellation of tasks or problems, develop professional judgment and skill in working with the recipients of social work services, and to explore these services in relation to the types and characteristics of agencies and programs. Prerequisite: social work 5309.

**5215. SOCIAL GROUP WORK I (2-0)** 2 hours credit—This introductory course is designed to help the student acquire knowledge of basic concepts, principles, techniques in the method of social group work. Emphasis is placed on the analysis and evaluation of group process.

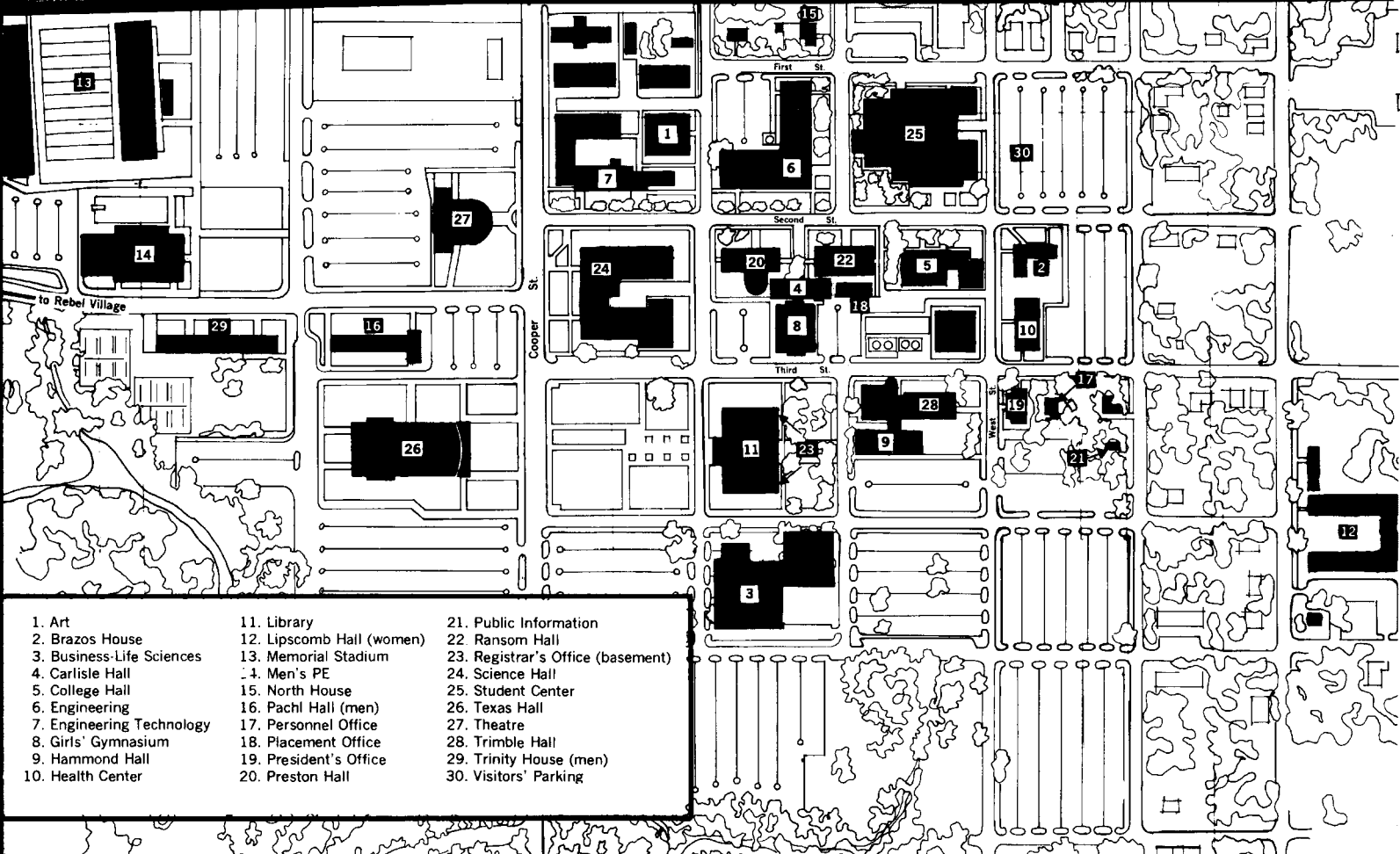
**5218. COMMUNITY ORGANIZATION AND ADMINISTRATION (2-0)** 2 hours credit—This is a study of the processes of administration and community organization as methods in social work practice. Analysis is made of the role of the social worker in the agency and in the community particularly to community organization agencies in terms of their structures, functions and activities. Techniques of community problem identification and analysis for intervention and action will be explored.

**5291. SOCIAL WORK RESEARCH (2-0)** 2 hours credit—A study of the methodology of social work research which includes the logic and procedures of the various phases of the research process. These include the formulation of researchable hypotheses design, collection, analysis and interpretation of data. Critical evaluation of research studies considered relevant to social work will be made in relation to research concepts. Recommended prerequisite: Statistics.

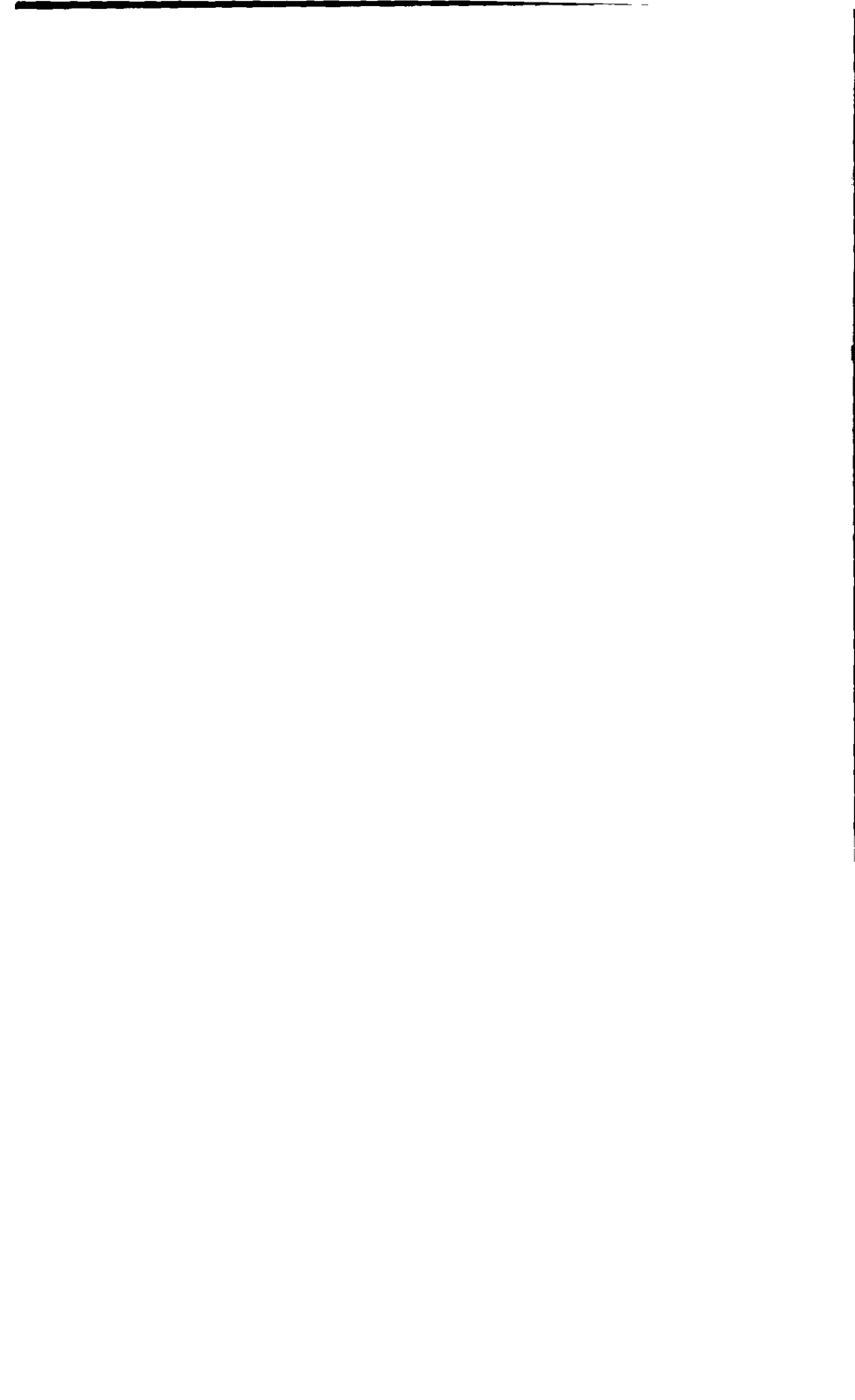
**5481. FIELD INSTRUCTION (0-16)** 4 hours credit—Field instruction is a controlled educational experience in an area of social work practice under the supervision of practitioner or faculty member. Field instruction will be offered concurrently with classroom instruction. This offers an opportunity for a student to integrate classroom content with actual practice.

Courses for the second year program in the Graduate School of Social Work will be offered beginning September 1969.





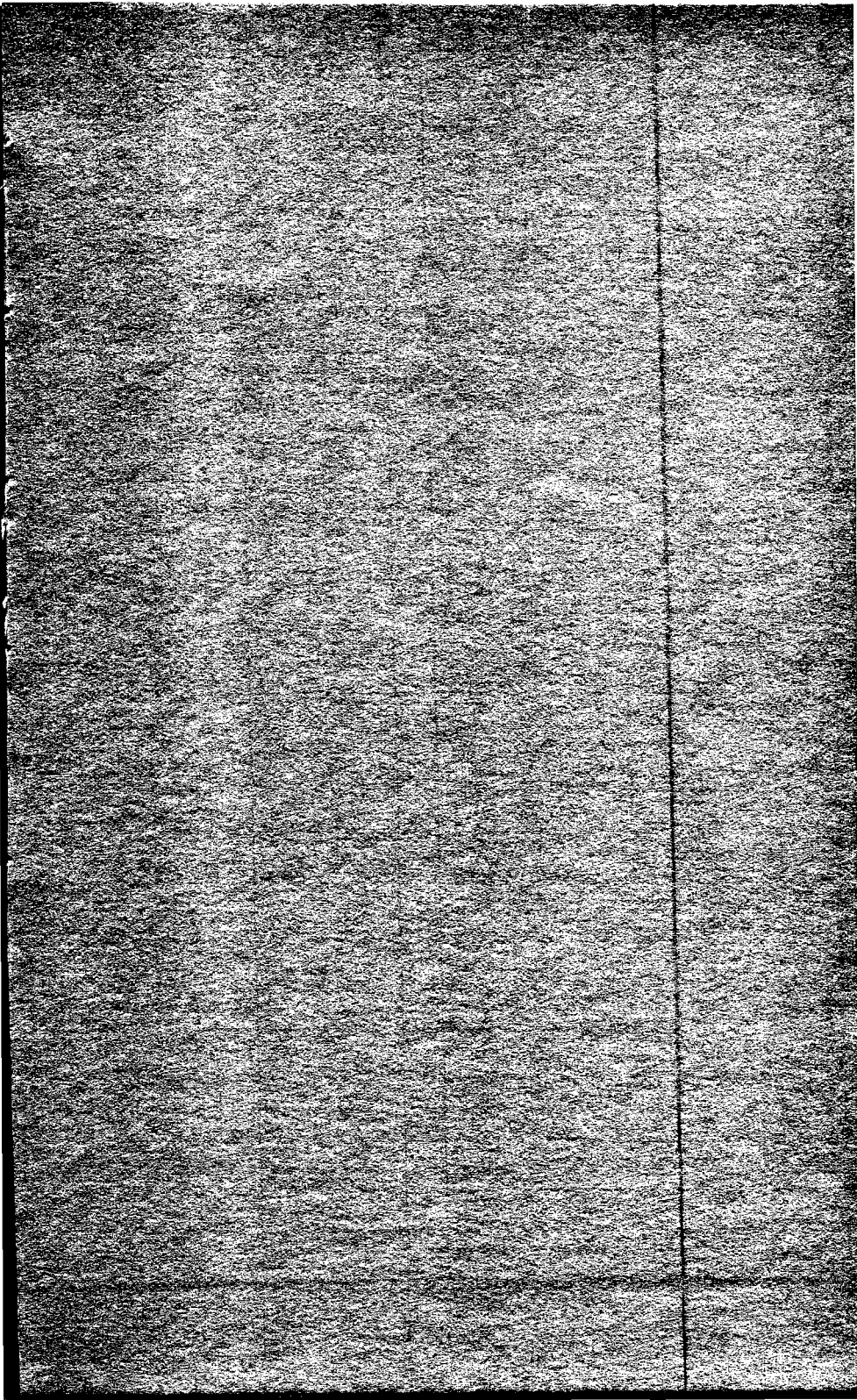
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|---------------------------|---------------------------|-----------------------------------|
| 1. Art                    | 11. Library               | 21. Public Information            |
| 2. Brazos House           | 12. Lipscomb Hall (women) | 22. Ransom Hall                   |
| 3. Business-Life Sciences | 13. Memorial Stadium      | 23. Registrar's Office (basement) |
| 4. Carlisle Hall          | 14. Men's PE              | 24. Science Hall                  |
| 5. College Hall           | 15. North House           | 25. Student Center                |
| 6. Engineering            | 16. Pahl Hall (men)       | 26. Texas Hall                    |
| 7. Engineering Technology | 17. Personnel Office      | 27. Theatre                       |
| 8. Girls' Gymnasium       | 18. Placement Office      | 28. Trimble Hall                  |
| 9. Hammond Hall           | 19. President's Office    | 29. Trinity House (men)           |
| 10. Health Center         | 20. Preston Hall          | 30. Visitors' Parking             |

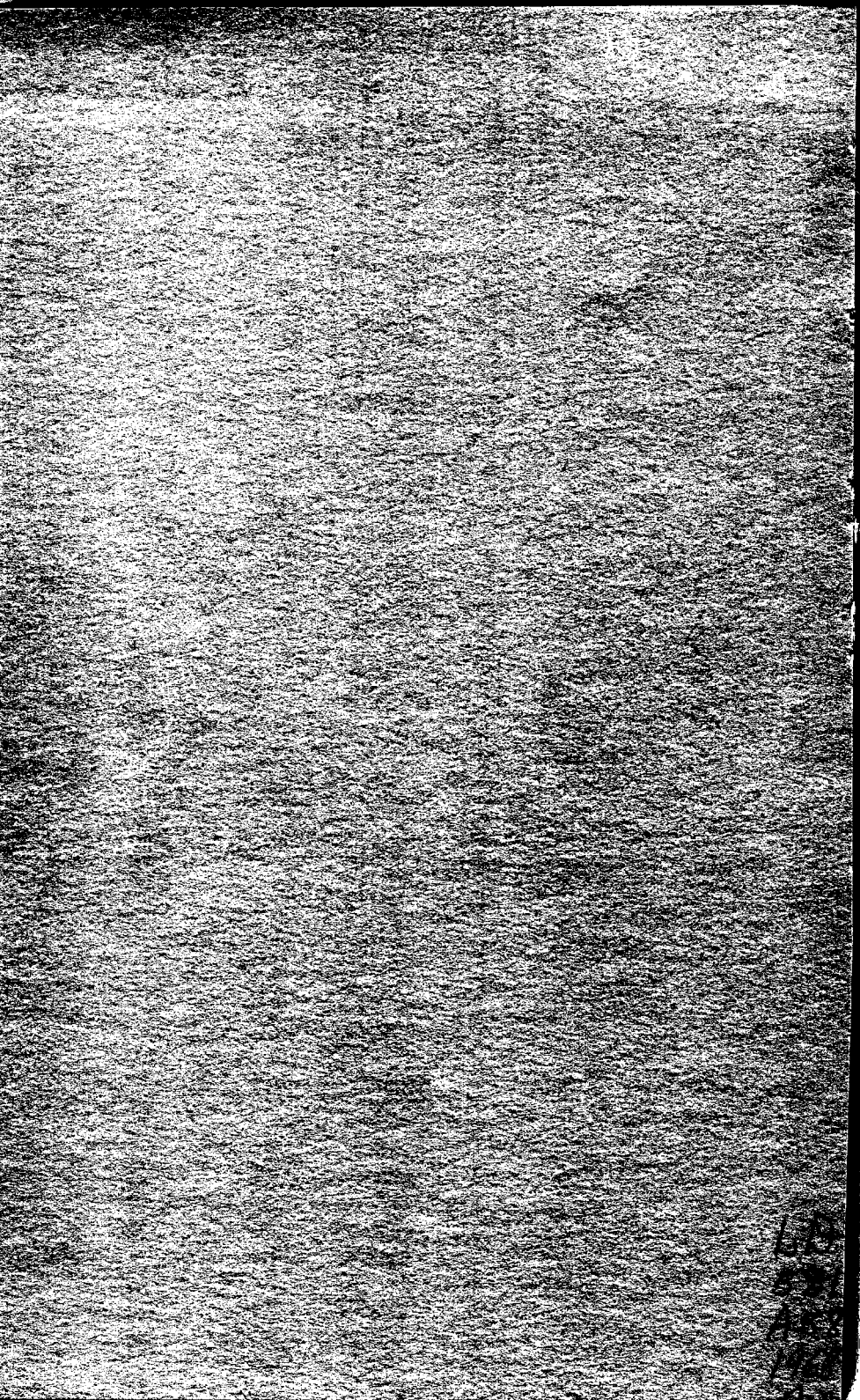




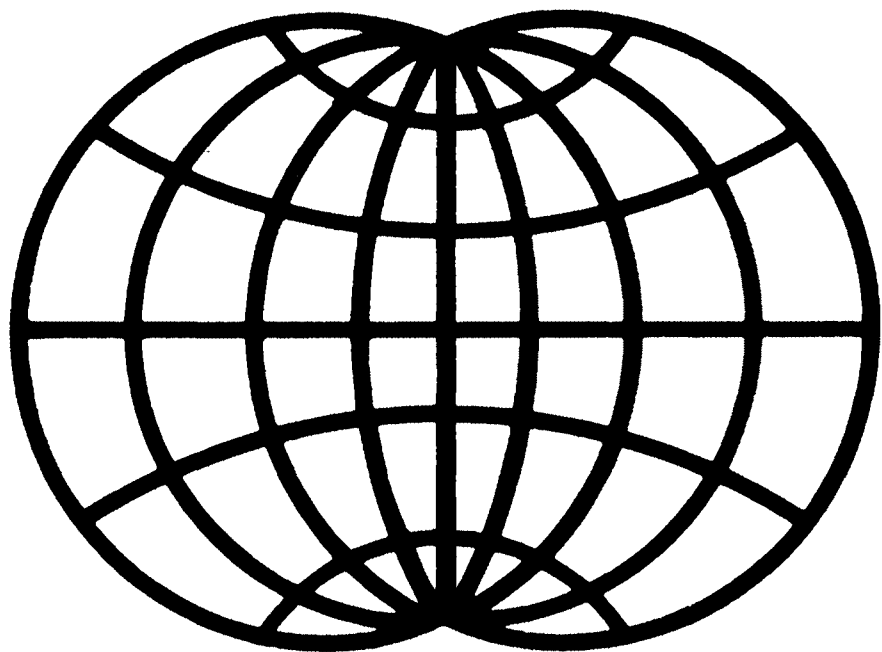








*The University of Texas at Arlington*



**SUPPLEMENT**  
to

**GRADUATE SCHOOL CATALOG 1968-69**

Volume LI

No. 9

August 1968

Authority was granted to initiate master's programs in civil engineering, industrial engineering, and mechanical engineering after the 1968-69 Graduate School Catalog was in print. This supplement is intended to provide information concerning programs in these three disciplines. For information concerning details of the Graduate School and degree requirements, refer to the Graduate School Catalog, Volume LI, No. 9, August 1968.

# CIVIL ENGINEERING

## Objective

The course offerings provide the graduate student with an opportunity to strengthen his knowledge in one or more areas of civil engineering. The student, with the assistance of a faculty advisor, may plan a program in the following fields of specialization within civil engineering:

1. Environmental Health and Sanitary
2. Highways and Traffic
3. Hydraulics and Hydrology
4. Soil Mechanics and Foundations
5. Structures
6. Urban Planning

The program is designed to satisfy the needs of those planning to continue graduate work beyond the master's degree as well as those who seek to increase their specialized knowledge related to their engineering profession.

## Degree Requirements

The general degree requirements for the Master of Science degree have been presented in another section. Students wishing to major in civil engineering should have the Bachelor of Science degree in civil engineering from an approved school. Students with degrees in other disciplines may qualify for graduate study in civil engineering after the completion of a faculty approved program of undergraduate courses.

**5310. NUMERICAL METHODS IN STRUCTURAL DESIGN** (3-0) 3 hours credit—Numerical methods that make possible the solution of difficult and complex problems will be taught. Newmark's numerical methods and the finite difference method will be emphasized.

**5311. ADVANCED TOPICS IN STRUCTURAL STEEL** (3-0) 3 hours credit—Plastic analysis and design of frames, arches, trusses, and multistory steel structures are considered as well as current column theories.

**5312. ADVANCED TOPICS IN STRUCTURAL CONCRETE** (3-0) 3 hours credit—Design and analysis, by ultimate strength theory and yield line theory, of long columns, flat slabs, beams curved in plan, arches, and continuous beams and frames are considered.

**5313. STRUCTURE - SOIL INTERACTION** (3-0) 3 hours credit—Methods of analysis of structure-soil behavior are considered. Numerical techniques are included. Physical problems reviewed include beams and slabs on elastic and inelastic foundations.

**5314. SLOPES, EMBANKMENTS, AND EARTH STRUCTURES** (3-0) 3 hours credit—A study will be made of the states of stress and analysis techniques associated with cuts, fills, dams, and retaining structures. Conventional analytical and graphical approaches will be considered along with numerical techniques.

**5315. FOUNDATION ANALYSIS AND DESIGN** (3-0) 3 hours credit—Behavior characteristics of several types of foundations will be studied. Foot-

ings, rafts, piles and piers will be covered. Bearing capacity, settlement and behavior of working load levels will be considered.

**5323. SUPPLY AND TREATMENT OF WATER** (3-0) 3 hours credit—An introduction to the applied science of water supply engineering. It involves a study of the principles and techniques of hydraulics, hydrology, statistics, biology, and chemistry applied to the supply and treatment of water.

**5324. IMPROVEMENT OF WATER QUALITY** (3-0) 3 hours credit—This course presents the physical, chemical, and biological fundamentals which form the framework of sewage treatment and water quality improvement.

**5325. ENGINEERING HYDROLOGY** (3-0) 3 hours credit—Ground Water—This course will consider the occurrence and movement of ground water from a geologic viewpoint as preparation for the application of general hydrologic equations to such problems as safe yield, hydraulics of wells, well design, and artificial recharge.

**5326. ADVANCED HYDROLOGY** (3-0) 3 hours credit—Hydrologic characteristics of large storms, storm maximization, design flood determination, flood characteristics and flood damage alleviation methods will be presented as a basis for further studies concerning surface water yield, flood control, reservoir design, and the multiple-purpose concept, cost allocation and project feasibility. Such special topics as evaporation suppression, weather modification, statistical methods and computer applications will be considered as related to the subjects formerly mentioned.

**5333. TRAFFIC FLOW THEORY** (3-0) 3 hours credit—Mathematical models describing traffic phenomenon are reviewed including both deterministic and stochastic processes. Methods of verification of models are reviewed and applications of flow theory to traffic engineering practice are considered.

**5334. TRANSPORTATION SYSTEMS** (3-0) 3 hours credit—Geometrics of streets, highways, waterways, airfields, railroads, and pipelines are considered. Operational analyses of transit and other systems are included.

**5335. URBAN PLANNING STUDIES** (3-0) 3 hours credit—This course consists of planning studies and forecasting design of residential, commercial, and industrial areas, public buildings, and subdivision control. Included also are environmental engineering, transportation geography, and aesthetics.

**5336. METROPOLITAN PLANNING ADMINISTRATION** (3-0) 3 hours credit—This course consists of the study of the organization and administration of local planning agencies, governmental fragmentation problems, capital improvement programs, housing and urban development, and municipal public works administration.

**5344. ADVANCED METHODS IN SANITARY ENGINEERING** (2-3) 3 hours credit—An introduction to advanced theories and practices in sanitary engineering with emphasis on current research frontiers.

**5347. ADVANCED HYDRAULIC ENGINEERING** (2-3) 3 hours credit—Advanced concepts concerning water transmission via confined and free surface systems will lead to design problems for unsteady flow in open channels, surges and fluid transients in closed conduits, energy dissipation, spillway flows and similar topics.

**5350. ADVANCED HIGHWAY ENGINEERING** (2-3) 3 hours credit—This course includes economic feasibility studies of highway links, the types and operational characteristics of various highway interchanges. Highway planning techniques and the design and analysis of highway pavement systems are also covered.

**5191, 5291, 5391. ADVANCED STUDIES IN CIVIL ENGINEERING** (Variable credit from 1 to 3 semester hours as arranged)—It may be repeated for credit when the topics change.

**5398 or 5698. THESIS** 3 or 6 hours credit—Research and preparation pertaining to the master's thesis. Prerequisite: graduate standing in civil engineering.



A limited number of the following courses may be applicable toward the graduate degree if approved in advance by the graduate advisor.

**4310. ANALYSIS OF INDETERMINATE STRUCTURES (3-0) 3 hours credit—**

This course is a study of statically indeterminate structures such as continuous trusses, continuous arches, on elastic piers, non-prismatic members, continuous beam columns, and cable-supported structures. These studies include such effects as sidesway, settlement of supports, temperature, flexibility, and dynamic response to earthquakes or blast forces. Numerical methods for solving simultaneous and differential equations, as well as iteration techniques are considered.

**4313. TRAFFIC ENGINEERING (3-0) 3 hours credit—**This is a study of vehicle characteristics, traffic flow, traffic control and the geometric design of intersections and interchanges; traffic speed, volume and density relationships.

**4315. ENVIRONMENTAL HEALTH ENGINEERING (3-0) 3 hours credit—**This course presents the engineering aspects of public health and environmental sanitation. Sources and vectors of infection, epidemiology, toxicology, collection and disposal of municipal refuse, industrial hygiene and air pollution are included.

**4318. CITY PLANNING (3-0) 3 hours credit—**This course includes a study of the development of cities, forms of municipal government, functions of the city manager, urban land-use planning, city finance, public services and utilities, public health and welfare, and housing. The procedures utilized in the formulation and execution of master plans are included.

**4321. FOUNDATION ENGINEERING (3-0) 3 hours credit—**Several aspects of foundations are considered. These include slopes and embankments, interaction between soils and structures, bearing capacity theories, consolidation and settlement and seepage problems. In addition, numerical analysis techniques are applied to some of these problems.

**4344. SOIL STABILIZATION (2-3) 3 hours credit—**Techniques and procedures used to improve the rheological properties of foundation materials are studied. Both mechanical processes and chemical additives are considered.

**4346. SELECTED TOPICS IN STRUCTURAL ENGINEERING (2-3) 3 hours**—This course includes the design and analysis of engineering structures utilizing reinforced concrete, structural steel and timber. The current developments in structural engineering techniques are covered such as prestressed concrete design, ultimate strength design, limit design, plastic analysis and related topics. The course entails the use of matrix algebra and electronic computers for solutions of problems involving multistory buildings and frames, continuous bridges and arches, and structures having variable moments of inertia.

**4351. WATER RESOURCES: SANITARY ENGINEERING DESIGN (2-3) 3 hours credit—**This course involves the study of principles of design used by civil engineers in planning the water supplies, water distribution systems, sewers, and sewage treatment facilities. Short problems concerning the design and construction of such facilities are included.

**4353. PRESTRESSED CONCRETE (2-3) 3 hours credit—**This course is a study of the principles of linear and circular prestressing and the study of materials and equipment used in prestressing. Stress losses, cable friction, straight and draped cables, continuous prestressing, pre-tensioned and post-tensioned members are considered. Ultimate strength and elastic design methods are utilized.

**4355. PAVEMENT ANALYSIS AND DESIGN (2-3) 3 hours credit**—The theory of rigid and flexible pavement design, design criteria such as traffic loads, natural forces and materials are studied and supplemented by the use of current laboratory design practices.

**4357. WATER RESOURCES: ENGINEERING HYDROLOGY (2-3) 3 hours credit**—Hydrographs of runoff, streamflow routing, frequency and duration studies, and sedimentation theories will be studied. The acquired fundamentals will then be applied to solution of problems encountered in the provision of water supplies and control of flood flows.

**4358. WATER RESOURCES: CONVEYANCE SYSTEMS (2-3) 3 hours credit**—Further theories are introduced for solution of more complex closed conduit and open channel flow problems. Theories will be applied to the analysis and design of water conveyance systems, open and closed aqueducts, and pumpage facilities.

# INDUSTRIAL ENGINEERING

## Objective

This program makes available the study in depth of the areas of 1) human factors, 2) operations research, 3) systems design, and 4) economic decisions. The pursuit of graduate work in these areas will provide the student with a quantitative understanding leading to sound operating decisions.

## Degree Requirements

The general degree requirements for the Master of Science degree have been presented in another section. Students with degrees in other disciplines may qualify for graduate study in industrial engineering after the completion of a faculty-approved program of undergraduate courses. Applicants are expected to have by way of formal course work or by industrial experience the content of introductory courses in operations research, probability theory, and human factors.

**5301. ADVANCED OPERATIONS RESEARCH** (3-0) 3 hours credit—The principles and techniques of operations research are extended into original areas of actual current industrial problems.

**5302. ADVANCED HUMAN FACTORS I** (3-0) 3 hours credit—A study and application of the principles of systems analysis, human factors and systems evaluation to man-machine systems with emphasis upon the human component as he interacts with the machine.

**5303. ADVANCED HUMAN FACTORS II** (3-0) 3 hours credit—A continuation of the problems taken up in Advanced Human Factors I.

**5304. MODELS OF MAN** (3-0) 3 hours credit—This course uses probability, statistics, servo and control theory and other areas of engineering and mathematics to build models to represent such human group relations and machine control.

**5305. LINEAR AND NON-LINEAR PROGRAMMING** (3-0) 3 hours credit—A study of the theory programming including the simplex method, duality, transportation, and flow through networks. Extensions to optimization, convex programming, quadratic programming, and integer programming are made. Applications to industrial and economic problems are presented.

**5306. DYNAMIC PROGRAMMING** (3-0) 3 hours credit—This course consists of a study of dynamic programming with applications to multistage production and allocation processes.

**5307. THEORY OF QUEUES** (3-0) 3 hours credit—This course continues the study of the theory of queues with particular emphasis on its application to inventory, production and maintenance as well as direct applications.

**5308. ADVANCED RESEARCH METHODS** (3-0) 3 hours credit—The purpose of this course is to provide the theory and methodology of experimental research so that valid conclusions can be formulated in research work. Methods and theory of planning experiments and evaluating results are presented.

**5309. ANALYSIS OF STOCHASTIC PROCESSES** (3-0) 3 hours credit—The course provides a background for other work using probability model building. Such topics as stationary and non-stationary processes, counting processes, renewal theory, Markov chains, and random walk are studied.

**5310. PRODUCTION SYSTEMS DESIGN** (3-0) 3 hours credit—A study of problems and methods of systems design will be made. Particular emphasis is given to the construction of models representing the system, their optimization and the presentation of results.

**5311. STATISTICAL METHODS FOR INDUSTRIAL DECISIONS** (3-0) 3 hours credit—This course is a study of statistical decision theory with applications.

**5312. ADVANCED PRODUCTION AND INVENTORY CONTROL SYSTEMS** (3-0) 3 hours credit—A continuation of the undergraduate course. The emphasis will be placed on mathematical model building and optimization.

**5313. SYSTEM RELIABILITY AND MAINTAINABILITY** (3-0) 3 hours credit—Methods of reliability and maintainability analysis, measurement, and prediction are presented. Studies will be made on the economics relating to reliability, maintainability and logistics problems.

**5314. SYSTEMS AND CONTROL PRACTICE** (3-0) 3 hours credit—This course embodies the study and evaluation of current concepts and trends in planning, design, and control of large scale systems. Methods for analyzing and evaluating industrial, governmental, and military systems will be presented.

**5315. DATA PROCESSING IN OPERATIONS RESEARCH** (3-0) 3 hours credit—A study of selected topics in the application of electronic computers to operations research activities. Emphasis is on the use of simulation techniques.

**5316. ECONOMIC DECISION MAKING** (3-0) 3 hours credit—A study of the criterion used for making decisions about proposed capital investments and the implementation of selected criteria in engineering design and investment decisions. Emphasis is on model building and optimization.

**5341. DESIGN WITH HUMAN FACTORS** (2-3) 3 hours credit—A study is made of those factors that affect the design of a system at the man/machine interface. Topics include physiological limitations and capabilities, anthropometry, decision making and performance capability under normal and hostile environments. Design and research projects will be undertaken.

**5342. JOB DESIGN AND STANDARDIZATION** (2-3) 2 hours credit—An advanced study of work center design and methods of improving human work. Factors affecting work, such as fatigue, learning and physiological, will be considered.

**5191, 5291, 5391. ADVANCED STUDIES IN INDUSTRIAL ENGINEERING** (Variable credit from 1 to 3 semester hours as arranged)—Individually approved research projects selected from the various branches of industrial engineering.

**5398 or 5698. THESIS** 3 or 6 hours credit—Prerequisite: graduate standing in industrial engineering.

A limited number of the following courses may be applicable toward the graduate program if approved in advance by the graduate advisor.

**3313. RELIABILITY** (3-0) 3 hours credit—This course provides the fundamental theory of reliability in complex systems. The practical means of evaluating the reliability of components and systems are considered separately in the context of reliability design. Prerequisite: industrial engineering 3301 (Engineering Probability) or approval of head of department.

**4304. THEORY OF QUEUES** (3-0) 3 hours credit—This course presents an introduction to the theory of queues with particular emphasis on its application to inventory, production and maintenance as well as direct applications. Prerequisite: industrial engineering 3301. (Engineering Probability), 3342 (Operations Research).

- 4306. ANALYSIS, PLANNING AND CONTROL OF PRODUCTION SUPPORT FUNCTIONS** (3-0) 3 hours credit—A study is made of the problems and methods of attack in the planning, management, conduct and control of operations in such areas as research and development, maintenance, etc. Prerequisite: industrial engineering 4305 (Human Factors Engineering).
- 4307. INFORMATION THEORY** (3-0) 3 hours credit—This course is concerned with the development of measures of information, and its rate of transfer under various conditions. Consideration is given to sampling, encoding, in discrete and continuous systems and the noise problems. Prerequisite: industrial engineering 3301 (Engineering Probability).
- 4308. STATISTICAL QUALITY CONTROL** (3-0) 3 hours credit—This course includes a study of process control plans, control charts for non-normal distributions, economics of sampling, sequential and continuous sampling plans. Prerequisite: industrial engineering 3241 (Quality Control), 3301 (Engineering Probability), and 4205 (Engineering Research Methods).
- 4309. ECONOMICS DECISION MAKING** (3-0) 3 hours credit—This is a study of the theoretical basis for decision criteria used in engineering economy, capital budgeting, and other economic problems. Prerequisite: industrial engineering 3301 (Engineering Probability) and 3342 (Operations Research).
- 4342. ADVANCED OPERATIONS RESEARCH** (2-3) 3 hours credit—The principles and techniques of operations research are extended into original areas of actual current industrial problems. Prerequisite: industrial engineering 3342 (Operations Research), and 4441 (Measurement and Analysis). **\$2 lab fee**

## SUPPORTING AREA

### Computer Science

- 3341. SYMBOLIC AND ALGORITHMIC PROCESS** (2-2) 3 hours credit—This course is a study of various programming systems as well as the numerical and computer techniques involved in the solution of many engineering problems. Prerequisite: computer science 3101 (Introduction) or computer science 3201 (Fundamentals) and mathematics 2318 (Calculus).
- 4301. ANALYSIS AND COMPUTATION METHODS FOR ENGINEERS AND SCIENTISTS** (3-0) 3 hours credit—This course is designed to give the engineer or scientist the computer methods necessary for the solution of a wide variety of practical applications. These include simultaneous equation solutions applied to various engineering and scientific areas, integration methods, root finding, derivatives and differential equations, solutions of linear systems of differential equations, series approximations and error analysis. A number of the engineering applications discussed will be run on a high-speed digital computer in the computer laboratory. Credit will not be given for both computer science 4301 and mathematics 3345. Prerequisite: mathematics 3318 (Differential Equations) and either computer science 3101 (Introduction) or consent of instructor.
- 4302. SURVEY OF ALGORITHMIC LANGUAGES** (3-0) 3 hours credit—A study of the various types of algorithmic languages. A study of the formal description of these languages and problem solutions utilizing them is included. Included are languages for scientific purposes (i.e. ALGOL), accounting applications (i.e. COBOL), list processing (i.e. SLIP) and others. Prerequisite: computer science 4301 (Analysis and Computation Methods) or mathematics 3345 (Computer Applications)
- 4303. SIMULATION AND OPTIMIZATION TECHNIQUES** (3-0) 3 hours credit—Extremal properties of multivariate functions with and without constraints, convex functions, linear programming. Computer simulation utilizing logical, numerical and Monte Carlo modeling. The generation, termination,

and flow of entities through storage and processing facilities. Prerequisite: computer science 4301 (Analysis and Computation Methods) or concurrent or mathematics 3345 (Computer Applications) or concurrent, and industrial engineering 3301 (Engineering Probability) or mathematics 4311 (Mathematical Probability).

**4304. COMPUTER AND PROGRAMMING SYSTEMS (3-0) 3 hours credit—** A study of input-output and storage systems, structures and transformations or data bases, and executive systems. Also included are the structures of program libraries, program intercommunication, batch processing executive systems, multiprogramming executive systems, interrupt systems, and on-line console time sharing systems. Prerequisite: computer science 4341 (Information Structures).

**4305. ALGORITHMIC LANGUAGES AND COMPILERS (3-0) 3 hours credit—** Formal description of algorithmic languages such as ALGOL and the techniques used in writing compilers for such (e.g. Backus normal form). A study of syntax, semantics, ambiguities, procedures, iteration, and recursion in these languages. Would include the definition and writing of compilers for simple languages including some having a nonalgebraic base. Prerequisite: computer science 3341 (Symbolic and Algorithmic Processes) and 4302 (Survey of Algorithmic Languages).

**4341. INFORMATION STRUCTURES (2-2) 3 hours credit—** Study of information representations and relationships between the forms of representation and processing techniques. The generation, development, and processing of structures such as lists and trees will be developed to illustrate interrelationships of data structures. Prerequisite: computer science 3341 (Symbolic and Algorithmic Processes).

# MECHANICAL ENGINEERING

## Objective

Graduate course offerings in mechanical engineering encompass study of the thermal sciences and systems and controls. The student with the aid of a faculty advisor may plan a program in a number of fields of specialization in mechanical engineering or in various interdisciplinary areas.

Graduate study and research are offered in the areas of:

1. Heat Transfer
2. Fluid Mechanics
3. Thermodynamics
4. Systems Engineering
5. Automatic Controls

## Degree Requirements

General degree requirements for the Master of Science degree are presented in another section. Students wishing to major in mechanical engineering should have the Bachelor of Science degree in mechanical engineering from an approved school. Students with degrees in other disciplines may be required to take certain undergraduate courses depending on their particular graduate program.

**5301. TRANSPORT PROCESSES (3-0) 3 hours credit**—The theory and application of the transport processes, heat, mass, and momentum, are covered in this course. May be repeated for credit as topics change. Prerequisite: mechanical engineering 3302 (Heat Transfer) and 3311 (Thermodynamics I).

**5302. ADVANCED THERMODYNAMICS (3-0) 3 hours credit**—Such topics as thermostatics, micro and macro thermodynamics, energetics and their applications are covered. The course may be repeated for credit as topics change. Prerequisite: mechanical engineering 3312 (Thermodynamics II).

**5304. ADVANCED MECHANICAL ENGINEERING SYSTEMS (3-0) 3 hours credit**—This course is a continuation of the undergraduate mechanical engineering systems course. Topics covered in greater depth are fluid control system, optimization methods, and methods of synthesis. This course may be repeated for credit as topics change. Prerequisite: mechanical engineering 4311 (Mechanical Engineering Systems).

**5305. SYNTHESIS OF MECHANICAL ENGINEERING SYSTEMS (3-0) 3 hours credit**—This is an advanced course in systems synthesis with the emphasis on optimization methods. Random inputs and adaptive systems are considered.

**5306. FLUID POWER CONTROL (3-0) 3 hours credit**—Control systems are designed using gases or liquids as working fluids. Components are synthesized to meet specified system requirements.

**5308. NONLINEAR PROBLEMS IN ENGINEERING (3-0) 3 hours credit**—This is a survey of nonlinear problems arising in mechanical engineering systems, and the methods of characterizing such typical nonlinearities as friction, backlash, and preload.

- 5309. SYSTEMS OPTIMIZATION (3-0)** 3 hours credit—Methods of optimization, suboptimization and decision-making are introduced based on calculus of variations and the Pontryagin maximum principle and are applied to engineering.
- 5311. GAS DYNAMICS (3-0)** 3 hours credit—The laws of mechanics and thermodynamics are applied to problems of fluid flow. One-dimensional phenomena such as shock, flow with friction, diabatic flow and subsonic and supersonic flows are treated.
- 5312. PHYSICAL GAS DYNAMICS (3-0)** 3 hours credit—The fundamentals of high-speed, high-temperature flow of a gas are presented from the molecular view. Simple kinetic theory, chemical thermodynamics, and the physical and chemical bases of rate processes are presented.
- 5313. FLUID DYNAMICS (3-0)** 3 hours credit—Fluid Dynamics is an advanced study of the kinematics and dynamics of fluid motion, stresses in fluids and surface flow.
- 5314. MAGNETOGASDYNAMICS II (3-0)** 3 hours credit—Magnetogasdynamics II is a continuation of mechanical engineering 4304 Magnetogasdynamics I. Wave phenomena and plasma oscillations are introduced. Prerequisite: mechanical engineering 4304 or equivalent.
- 5316. THERMAL CONDUCTION (3-0)** 3 hours credit—Thermal Conduction is a study of the fundamental laws, initial and boundary conditions, basic equations for isotropic and anisotropic media, related physical problems and steady and transient temperature distributions in solid structures.
- 5317. CONVECTION HEAT TRANSFER (3-0)** 3 hours credit—The equations of motion of viscous fluids are reviewed and the energy equations are introduced. Exact and approximate solutions are made for forced convective problems with non-isothermal and unsteady boundaries. Free convection and combined free and forced-convection problems are solved.
- 5318. RADIATIVE TRANSFER (3-0)** 3 hours credit—The general equations of radiative transfer are derived and solved for special problems. and the elements of atomic, molecular and continuum radiation are introduced.
- 5319. HEAT TRANSFER DESIGN (3-0)** 3 hours credit—Heat transfer design is the application of fundamental principles toward the analysis and synthesis of complex thermal systems such as rocket nozzles, nuclear reactors and ablation heat shields.
- 5321. ADVANCED CLASSICAL THERMODYNAMICS (3-0)** 3 hours credit—The fundamentals of thermodynamics are reviewed. Different treatments of principles are studied, compared and formal relationships are developed and applied to chemical, magnetic, electric and elastic systems.
- 5323. STATISTICAL THERMODYNAMICS (3-0)** 3 hours credit—Statistical mechanics and kinetic theory are related to thermodynamics and Maxwell-Boltzman, Bose-Einstein and Fermi-Dirac statistics are introduced and applied.
- 5325. COMBUSTION (3-0)** 3 hours credit—Combustion is the fundamental treatment of problems involving simultaneous occurrence of chemical reaction and transfer of heat, mass, and momentum.
- 5326. PROPULSION (3-0)** 3 hours credit—Air-breathing and rocket engines are analyzed and advanced propulsion systems including nuclear and electrical are introduced. Component and system performance calculations are stressed.
- 5332. ENGINEERING ANALYSIS (3-0)** 3 hour credit—Engineering Analysis involves the construction of mathematical models of physical situations of interest to the engineer and the subsequent reduction of the mathematical problem to a numerical solution.
- 5341. CONTROL SYSTEM COMPONENTS (2-3)** 3 hours credit—Hydraulic, pneumatic, and electromechanical component and system characteristics are determined; component reliability is related to system reliability, and systems are simulated on analog and digital computer equipment.
- 5398 or 5698. THESIS** 3 or 6 hours credit—Prerequisite: graduate standing in mechanical engineering.



## SUPPORTING AREA

### Aerospace Engineering

**5301. ADVANCED AERODYNAMICS** (3-0) 3 hours credit—Such topics as hypersonic flow, viscous theory, unsteady aerodynamics, and turbulent flow are considered. This course may be repeated for credit as topics change. Prerequisite: permission of department.

**5302. ADVANCED FLIGHT MECHANICS** (3-0) 3 hours credit—Topics covered are basic dynamics of vehicles, the role of environment in the control of space and aerospace vehicles, flight trajectory analysis and optimization. This course may be repeated for credit as topics change. Prerequisite: permission of department.

**5311. ASTRONAUTICS II** (3-0) 3 hours credit—This course is a continuation of aerospace engineering 3302 (Astronautics). It considers the more sophisticated aspects of orbital mechanics, gyro dynamics, inertial navigation, and centers on the space vehicle as a spinning, variable mass body stabilized by passive means.

**5312. DYNAMICS OF FLIGHT II** (3-0) 3 hours credit—This course is a continuation of aerospace engineering 4305 (Dynamics of Flight). It discusses methods of determining the response of a flight vehicle to control inputs and atmospheric turbulence, methods of synthesis and analysis of flight vehicle stabilization and control systems and the dynamics of spinning vehicles.

A limited number of the following undergraduate courses may be applicable toward the graduate program if approved in advance by the graduate advisor.

### Mechanical Engineering

**4301. SYSTEMS ENGINEERING** (3-0) 3 hours credit—This course provides a basis for the understanding of large scale systems engineering problems and the tools for solving them. Topics introduced are: mathematical models, evaluation and testing, tools for optimization, control, and system design. Prerequisite: senior standing in engineering.

**4302. SYSTEMS ENGINEERING II** (3-0) 3 hours credit—This course is a continuation of mechanical engineering 4301 with particular emphasis on performance improvement. Prerequisites: mechanical engineering 4301, 4311, (Mechanical Engineering Systems).

**4304. MAGNETOGASDYNAMICS I** (3-0) 3 hours credit—Magnetogasdynamics I is a study of the applicable conservation equations, kinetic theory of plasmas and Maxwell's equations for moving media with some engineering applications. Prerequisite: consent of instructor.

**4305. DIRECT ENERGY CONVERSION** (3-0) 3 hours credit—Direct energy conversion introduces the student to irreversible thermodynamics and transport processes with applications to direct energy conversion processes and device characteristics. Prerequisite: mechanical engineering 3302, (Heat Transfer) 3312 (Thermodynamics II) and 3313 (Fluid Mechanics).

**4307. MANUFACTURING ANALYSIS** (3-0) 3 hours credit—Manufacturing analysis will serve to give the student a quantitative understanding of material behavior and manufacturing processes and their limitations. Prerequisites: mechanical engineering 2211 (Manufacturing Processes), 3182 (Mechanical Engineering Laboratory I) 3215 (Engineering Metallurgy), and engineering mechanics 3311 (Mechanics of Materials I) and 3323 (Dynamics).

**4312. SYNTHESIS OF MECHANICAL ENGINEERING SYSTEMS** (3-0) 3 hours credit—Mechanical, hydraulic, thermal and electromechanical systems are designed or synthesized and advanced methods of analysis are used in determining and improving performance. Prerequisite: mechanical engineering 4311 (Mechanical Engineering Systems) or permission.

**4313. FLUID MECHANICS II** (3-0) 3 hours credit—This is a continuation of mechanical engineering 3313 and the application of these principles to the machines used to impart velocity and pressure to fluids. Compressible flow and topics in gas dynamics are emphasized. Prerequisite: mechanical engineering 3313.

**4314. THERMAL SYSTEMS ANALYSIS** (3-0) 3 hours credit—Thermal systems such as heat engines, power plants, heat pumps, turbomachines and nuclear plants are studied. The application of the basic engineering sciences in their analysis and design is emphasized. Prerequisite: mechanical engineering 3312 (Thermodynamics II) and 3302 (Heat Transfer).

**4316. ENGINEERING ANALYSIS** (3-0) 3 hours credit—Engineering analysis is a study of practical examples and problems taken from many fields of engineering and emphasizes physical concepts, use of assumptions, procedures in setting up equations and the physical interpretation of the mathematical results. Prerequisite: mathematics 3317 (Calculus) and 3318 (Differential Equations) and senior standing in engineering.

**4318. THERMODYNAMICS III** (3-0) 3 hours credit—This is a presentation of thermodynamics from the microscopic view. Such topics as kinetic theory, statistical thermodynamics and the thermodynamics of inherently irreversible processes are introduced. Prerequisite: mechanical engineering 3312 (Thermodynamics II).

**4320. HYDRAULIC AND PNEUMATIC SYSTEMS** (3-0) 3 hours credit—Hydraulic and pneumatic systems and components and their applications to various fields are considered. Basic principles are covered and typical systems are analyzed with the aid of computers. Prerequisite: mechanical engineering 4311 (Mechanical Engineering Systems) or permission.

**4326. NUCLEAR POWER ENGINEERING** (3-0) 3 hours credit—Nuclear power engineering is a study of nuclear and thermonuclear power reactors and their engineering application. Prerequisite: physics, 3313 (Introduction) mechanical engineering 3311 (Thermodynamics I)

**4337. PHYSICAL METALLURGY** (3-0) 3 hours credit—This course presents the scientific background to the properties of metals and alloys, with special problems in physical metallurgy. Prerequisite: mechanical engineering 3215, (Engineering Metallurgy). **\$2 lab fee.**

## AEROSPACE ENGINEERING

**3304. AERODYNAMICS II** (3-0) 3 hours credit—Aerodynamics II is a continuation of Aerodynamics I. Fundamental principles of supersonic flow are introduced with application to the prediction of lifting characteristics of wings. Viscous fluids are considered in compressible and incompressible flow. Laminar and turbulent boundary layer theory is introduced with application to prediction of viscous drag and flow separation. Prerequisite: aerospace engineering 3303 (Aerodynamics I).

**4305. DYNAMICS OF FLIGHT** (3-0) 3 hours credit—Static stability and control, general equations of unsteady motion, the stability derivatives, stability of uncontrolled longitudinal and lateral motion, and mathematical techniques are studied. Prerequisite: mathematics 3317, (Calculus) engineering mechanics 3323, (Dynamics) aerospace engineering 3304, electrical engineering 3316 (Circuits).

**4306. DYNAMICS OF FLIGHT II** (3-0) 3 hours credit—This course is a continuation of dynamics of flight 4305. It discusses methods of determining the responses of a flight vehicle to control inputs and atmospheric turbulence, methods of synthesis and analysis of flight vehicle stabilization and control systems and the dynamics of spinning vehicles. Prerequisites: aerospace engineering 4305.

**4308. VSTOL AERODYNAMICS (3-0) 3 hours credit**—This course presents the application of basic aerodynamics to predict the performance, stability, and control of VSTOL aircraft. Although rotary and highlift wing aerodynamics is the major subject of this course, direct thrust methods are also considered. Prerequisite: aerospace engineering 3304.

**4315. AERODYNAMICS III (3-0) 3 hours credit**—This course is a continuation of aerodynamics II. It considers aerodynamic problems associated with real gas effects at hypersonic velocities: aerospace engineering 3304, mechanical engineering 3302 (Heat Transfer).

**4316. APPLIED AIRFOIL THEORY (3-0) 3 hours credit**—Two-dimensional flow, complex variable theory and conformal transformations and thin airfoil theory are studied in applied airfoil theory. Prerequisite: aerospace engineering 3304 or concurrent.

**4348. FLIGHT VEHICLE OPTIMUM DESIGN (2-3) 3 hours credit**—This is a study of preliminary design techniques for optimizing design to a particular set of performance, stability, and control specifications and the influence of important design parameters on mission performance. Prerequisite: aerospace engineering 3304, 4301, (Advanced Flight Vehicle Performance) 4305, or concurrent.

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