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Texas

at

Arlington

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CAMPUS CALENDAR

FALL SEMESTER 1970

| | |
|-----------------|--|
| Aug. 26, 27, 28 | Registration for Fall Semester 8 a.m. to 5 p.m. and 6 p.m. to 9 p.m. |
| Aug. 31 | Classes begin 8 a.m. |
| Sept. 3 | Late registration closes 9 p.m. |
| Sept. 7 | Labor Day (holiday) |
| Sept. 12 | Census Date |
| Oct. 20 | Midsemester |
| Nov. 25 | Thanksgiving holidays begin 10 p.m. |
| Nov. 30 | Thanksgiving holidays end 8 a.m. |
| Dec. 15 | Final examinations begin 8 a.m. |
| Dec. 23 | End of semester |

SPRING SEMESTER 1971

| | |
|-----------------|--|
| Jan. 13, 14, 15 | Registration for Spring Semester 8 a.m. to 5 p.m. and 6 p.m. to 9 p.m. |
| Jan. 18 | Classes begin 8 a.m. |
| Jan. 21 | Late registration closes 9 p.m. |
| Jan. 30 | Census Date |
| March 9 | Midsemester |
| April 6 | Easter holidays begin 10 p.m. |
| April 14 | Easter holidays end 8 a.m. |
| May 5 | Final examinations begin 8 a.m. |
| May 17 | Commencement 8 p.m. |

SUMMER SESSIONS 1971

| | |
|-------------|--|
| May 31 | Registration for night students 6 p.m. to 9 p.m. |
| June 1 | Registration for day students 8 a.m. to 5 p.m. Registration for night students continues 6 p.m. to 9 p.m. |
| June 2 | Classes begin 7:30 a.m. |
| June 3 | Late registration closes 9 p.m. |
| June 7 | Census Date |
| July 6, 7 | Final examinations for first summer day session |
| July 12 | Registration for second summer day session 8 a.m. to 5 p.m. |
| July 13 | Classes begin for second summer day session 7:30 a.m. |
| July 14 | Late registration closes 9 p.m. |
| July 16 | Census Date |
| Aug. 9 | Final examinations begin for night sections |
| Aug. 16, 17 | Final examinations for day sections |
| Aug. 19 | End of Summer Session |



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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

An organization represented throughout the system, the Graduate School is essentially a body of professors and scholars designated as Members or Associates of the Graduate Faculty and of students duly admitted to pursue their studies beyond the baccalaureate degree.

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 (Dean of the Graduate School) 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 at The University of Texas at Arlington is divided into areas, which differ from departments in that they may be broader in scope, involving courses and research in several departments. The candidate for an advanced degree presents work done in his chosen major area, but he is also usually expected to have done supporting work of advanced level (upper-division or graduate) in one or more associated areas. There are three component parts of graduate study: course work, independent study, and independent scholarly research leading to a report, thesis, or dissertation. No one of these component parts can be neglected by the graduate student, although the proportion of independent study to course work may vary according to the previous training of the individual student and the area chosen by him. The objective of the doctoral program is to produce research scholars and scholarly teachers. The master's programs represent a stage on the road to this goal, but they also provide in themselves the possibility of a complete and useful accomplishment in advanced work.

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 the equivalent of an American degree from a foreign university, (2) satisfy the grade 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 eligibility 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, 1947 Center St., Berkeley, Calif., 94704, 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 person holding a degree from a foreign university or residing abroad 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 Dean of the Graduate School 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 con-



ditions 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 1.8 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 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 Dean, the record of any applicant will be referred for their consideration. In conformance with the recommendation of the graduate advisor and the 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.

*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.

PROCEDURE AFTER ADMISSION

Upon approval of the application for admission, the Director of Admissions will notify the applicant, the 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, the Committee on Graduate Studies and the Dean of the Graduate School.

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).

No student will be allowed to repeat a course in order to change a passing grade. A student may repeat a course only if that course is specifically designated as one that can be repeated for credit. A student who fails to receive credit (grade of D or F) may repeat a course in order to obtain credit, 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.

Course numbering system — The course listing shown below will serve as an example for the following explanation of the course numbering system, credits, and theory and practice hours at UT Arlington.

Biology 5341 . . (2-3) 3

1. "Biology" is the departmental designation for the specific course listed.
2. The first digit (5 in the above example) denotes the year in which the course is usually taken.
3. The second digit (3) denotes the semester hour credit of the course.
4. The third and fourth digits (4 and 1) distinguish the individual course; 01 through 39 indicate lecture only, 40 through 79 indicate lecture and laboratory combination, 80 through 89 indicate laboratory only, and 90 through 99 indicate individual or small group instruction and thesis.
5. The first figure in parentheses indicates the clock hours per week devoted to theory. Theory includes recitations and lectures.
6. The second figure in parentheses indicates the clock hours per week devoted to practice. Practice includes work done in the laboratory, shop, drawing room or field.
7. The final figure is the credit value of the course. The unit of credit is the "semester hour" which involves one hour of theory and/or from two to four hours of practice per week for one semester of 18 weeks.

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 Dean or his representative. When the form has been completed and approved, the applicant if currently enrolled pays a fee of \$5 per course; if not enrolled, he pays \$25 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 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 Dean of the Graduate School.



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 | \$106.00 | \$256.00 |
| 11 | 102.00 | 240.00 |
| 10 | 98.00 | 224.00 |
| 9 | 94.00 | 208.00 |
| 8 | 75.00 | 177.00 |
| 7 | 71.00 | 161.00 |
| 6 | 67.00 | 145.00 |
| 5 | 63.00 | 129.00 |
| 4 | 59.00 | 113.00 |
| 3 or less | 56.00 | 97.00 |

*Includes \$35.00 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 | \$45.50 | \$120.50 |
| 3 | 41.50 | 95.50 |
| 2 | 37.50 | 70.50 |
| 1 | 35.50 | 45.50 |

*Includes \$17.50 Building Use Fee and \$3.00 Student Service Fee.

SUMMER NIGHT SESSIONS

| Semester Hours | Texas Resident* | Out-of-state* |
|----------------|-----------------|---------------|
| 12 or more | \$91.00 | \$241.00 |
| 11 | 86.00 | 226.00 |
| 10 | 82.00 | 209.00 |
| 9 | 78.00 | 192.00 |
| 8 | 74.00 | 175.00 |
| 7 | 70.00 | 158.00 |
| 4-6 | 66.00 | 141.00 |
| 3 | 62.00 | 116.00 |
| 2 | 58.00 | 91.00 |
| 1 | 56.00 | 66.00 |

*Includes \$35.00 Building Use Fee and \$6.00 Student Service Fee.

NOTE: Students registering for first time must pay \$10.00 Property Deposit 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 1969, the following information pertains: "An individual under twenty-one (21) years of age, living away from his family, and whose family resides in another state or has not resided in Texas for the 12-month period immediately preceding the date of registration shall be classified as a non-resident student; or an individual twenty-one (21) years of age or over who resides out of the state or who has come from outside Texas and who registers in an educational institution before having resided in Texas for a 12-month period shall be classified as a non-resident student."

A non-resident student classification is presumed to be correct as long as the residence of the individual in the state is primarily for the purpose of attending an educational institution. After residing in Texas for at least twelve (12) months, it is possible that a non-resident student may be reclassified as a resident student as provided in the rules and regulations adopted by the Coordinating Board, Texas College and University System.

Two of the most common exceptions included in the state statute are as follows: (1) A non-resident who marries a resident of Texas is entitled to pay the resident tuition fee regardless of the length of time he has lived in Texas; proof of marriage must be submitted to the Registrar's Office prior to registration. (2) Usually, a member of the United States Military Forces is entitled to pay the resident tuition fee for himself or his dependents, providing that each semester he submits to the fee assessors in registration a letter from his commanding officer stating that he is currently on permanent assignment in the state.

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 any time 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. All requests for reclassification should be submitted to the Registrar's Office at least 30 days prior to the registration period in question.

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 either free or reduced admission fees 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 has paid a full Student Service Fee 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 Security Office, 302 W. Third.

In the event that a student wishes to register two motor vehicles in his own name, he must present to the Security Office proof of ownership of both 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 vehicle. The Security Office is open 24 hours a day. Complete parking regulations are available at the Security Office.

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 Census Date* of a semester will be refunded 50 per cent of fees paid. A student resigning after the Census Date 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 at the end of the lease period 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.

ASSISTANTSHIPS

Research and teaching assistantships are available. Prospective graduate students should see the appropriate head of department for further information.

*Sept. 12 in 1970 Fall Semester; Jan. 30 in 1971 Spring Semester; June 7 in 1971 Summer Semester (first day session and night session); July 16 in 1971 Summer Semester (second day session).



DOCTOR OF PHILOSOPHY DEGREE

Programs leading to the Doctor of Philosophy degree in engineering are offered with opportunities for course work and research in the following areas: aerospace engineering, civil engineering, electrical engineering, industrial engineering, materials science, mechanical engineering, interdisciplinary areas.

GENERAL REQUIREMENTS

A student's program will consist of course work, independent study, and a dissertation in fields pertinent to his areas of interest in engineering. The program for each student will be planned by the student and a committee of faculty members.

ADMISSION

A student can participate in the doctoral program after he has satisfactorily completed 30 hours of graduate work at an accredited college or university. In addition, the student's undergraduate scholastic record and his score on the Graduate Record Examinations Aptitude Test must meet the requirements for admission to Graduate School. For the Doctor of Philosophy degree in engineering, the student's previous academic background should be in the field of engineering or a related field of science.

If an applicant holds a master's or higher degree (in engineering or a related field) from an accredited institution and has not yet taken the Graduate Record Examination, the graduate advisor in his major area may recommend that he be issued a temporary permit to register in the Graduate School. This permit is valid for one semester or one summer session only. It requires that the applicant take the Graduate Record Examinations Aptitude Test during the semester or summer session for which he is issued a permit to register.

PROCEDURE

The basic format of study for a doctoral student in engineering will involve the following three examinations:

- (1) **Diagnostic Examination**—to determine background information and suggested course work for the student. The diagnostic examination will not be given until the student has completed at least 30 hours past the bachelor's degree, including at least 12 hours at UT Arlington.
- (2) **Comprehensive Qualifying Examination**—to assure that the student has a sufficient background to begin his dissertation.
- (3) **Final Oral Examination**—over the dissertation and other parts of the student's program.

FOREIGN LANGUAGE REQUIREMENT

For the Doctor of Philosophy degree in engineering a reading knowledge of one foreign language applicable to the student's field of study is required. The foreign language requirement may be satisfied by one of the following methods:

- (1) Successfully passing a locally prepared examination.
- (2) Making an acceptable score on the Graduate School Foreign Language Test provided through the Educational Testing Service, Princeton, New Jersey.
- (3) Petitioning to transfer credit for completion of the language requirement at another university.
- (4) Earning a grade of "B" or better in two semesters of a course in the language.

INQUIRIES AND APPLICATIONS

All doctoral students will be officially enrolled and advised in one of the departments of the School of Engineering. Each department has a graduate advisor who is the official delegate of the Dean of the Graduate School. A student whose area of interest logically falls within one of the areas listed earlier should address his initial inquiry to the graduate advisor or the chairman of the department containing that area. If the student is uncertain as to the department in which his interests lie, he should address his inquiry to the Associate Dean of Engineering, who will forward it to the appropriate graduate advisor(s). Graduate advisors and department chairmen to whom initial inquiries may be directed are:

| Area | Graduate Advisor | Chairman |
|-------------------------|---|-------------------|
| Aerospace Engineering | *Dr. J. E. Fairchild | Prof. C. W. Files |
| Civil Engineering | Dr. J. J. Haynes | Dr. J. J. Haynes |
| Electrical Engineering | Dr. S. F. Crumb | *Dr. F. L. Cash |
| Engineering Mechanics | Dr. N. O. Myklestad | Prof. C. W. Files |
| Industrial Engineering | Dr. F. A. Meier | Dr. F. A. Meier |
| Materials Science | *Dr. C. D. Wiseman | Prof. C. W. Files |
| Mechanical Engineering | Prof. C. W. Files | Prof. C. W. Files |
| Interdisciplinary Areas | Dr. R. L. Tucker, Associate Dean of Engineering | |

*Acting

Formal applications for admission to Graduate School must be processed through the Office of the Registrar. Application forms can be obtained from the Office of the Registrar or from the Office of the Dean of the Graduate School. Completed application forms should be submitted to the Registrar who will review and evaluate each application and forward it to the appropriate graduate advisor.

Procedures for selection of supervising professor, selection of doctoral committee, publication of dissertation and other questions related to the doctoral program should be addressed to the appropriate graduate advisor.



MASTER'S 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 Dean of the Graduate School approves acceptance of the thesis after a shorter time of preparation.

Thesis—A thesis requirement is part of the program for a master's degree. Under certain circumstances thesis substitution may be permitted, but not a non-thesis program. One method of thesis substitution is a substantial report submitted in writing as partial fulfillment of the requirements of a seminar or project course. Regular graduate level courses of the lecture-demonstration-laboratory type cannot be used for thesis substitution.

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 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 the summer sessions).
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- (3) That all work to be counted for graduate credit be approved before the end of the first two weeks of the semester or session by the graduate advisor and by the Dean.
 - (4) That the Registrar certify to the 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.

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 the spring semester.

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, filed at the same time as application for candidacy.

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 final copies of the thesis not later than 15 days before graduation day of the final semester.



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

Prerequisite—For the degree of Master of Arts one prerequisite is a bachelor's degree 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 Committee on Graduate Studies 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:

| | |
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| Biology | Government |
| Chemistry | History |
| Economics | Mathematics |
| English | Physics |
| Foreign Language | 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 Dean; the thesis is subject also to final approval by the 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 Dean.

In certain instances substitutions for the formal thesis may be recommended to the Dean by the appropriate departmental graduate studies committee. Such substitutions may include internship reports (where the internship is approved as an essen-

tial part of the graduate program by the 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, Dean of the Graduate School and the major department graduate advisor.

THE DEGREE OF MASTER OF ARTS IN URBAN AFFAIRS (M.A.)

Prerequisite—An applicant for this degree must hold a bachelor's degree from UT Arlington or the equivalent and satisfy the requirements for admission to the Graduate School. Typically, but not exclusively, applicants will have undergraduate majors in the social sciences: economics, government, sociology, history. Students with adequate preparation and interested in urban affairs may be admitted from such fields as law, architecture, planning, social psychology, engineering, and other disciplines.

Requirements—Satisfactory completion of 30 semester hours of course work and six hours for completion of a thesis or internship report will be required. These requirements will normally entail three regular semesters and one summer for full-time students. The Master's program in urban affairs is operated primarily for full-time students, but part-time students are not excluded.

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. A satisfactory score on the Graduate Record Examination or on the Admission Test for Graduate Study in Business is required.

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 PROFESSIONAL ACCOUNTING (M.P.A.)

Prerequisite—Admission to the Master of Professional Accounting degree program is based upon the general admission requirements of the Graduate School. A satisfactory score on either the Graduate Record Examination or the Advanced Test for Graduate Study in Business may qualify the applicant. In addition, the applicant must have satisfactorily completed the following minimum course requirements:

- (1) Principles of Accounting; Intermediate Accounting; Cost Accounting; Auditing; and a course in advanced accounting, accounting theory, or income tax. (This will normally involve a minimum of 21 semester hours.)
- (2) A basic course in each of business law, management, marketing, finance, and statistics.
- (3) Principles of Economics; Intermediate Macro-economic Theory; and Intermediate Micro-economic Theory. (This will normally involve a minimum of 12 semester hours.)
- (4) College Algebra, and Mathematics for Business and Economic Analysis or the equivalent. (Representative topics covered in Mathematics for Business and Economic Analysis are linear equations, inequalities, probability, vectors, differentiation, and integration.)

Students with a bachelor's degree in business administration with a major in accounting will ordinarily have fulfilled the preceding requirements. A student not holding an undergraduate accounting degree will, with the assistance of his graduate advisor, determine the existing deficiencies and select appropriate remedial course work.

Requirements—The program requires 30 semester hours of work. Not more than six may be represented by undergraduate courses, which must be approved by the student's graduate advisor. A minimum of 12 semester hours of accounting are to be selected from the courses offered. At least six semester hours in business administration and economics graduate courses are required, including an appropriate graduate course in management science. The program requirements include a six-hour thesis or an appropriate substitute.

MASTER OF SCIENCE (Geology)

The prerequisites and requirements of this degree are the same as those outlined for the Master of Arts degree.

THE DEGREE OF MASTER OF SCIENCE (Engineering)

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. A departmental 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 Dean for approval.

Fields of engineering study—The degree of Master of Science in engineering, with designation of the major branch in which it is given, is offered in the following:

- Civil Engineering
- Electrical Engineering
- Engineering Mechanics
- Industrial Engineering
- Mechanical Engineering

Candidacy requirements—A student desiring to become a candidate for the master's degree in any branch of engineering must make application to the Dean of the Graduate School 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, Dean 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. A departmental 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 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 the 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 may be required 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. All work must be completed within one six-year period, and must be completed as a full-time student.



THE LIBRARY

The Library, housed in a six-story, air-conditioned building, contains a rapidly expanding collection of more than 375,000 books including government documents and technical reports. In addition, the Library subscribes to more than 3,200 periodicals and newspapers and maintains a collection of recorded tapes, discs, microfilm, motion pictures, film strips, and slides. Books are on open shelves, making it possible for students to locate research materials easily and to browse through related books. Seating for more than 1,700 students, about 1,000 at individual carrels, is provided.

The Library also maintains an audio-visual service with listening-recording booths, listening rooms and a projection room for motion pictures. Other services include provision of equipment for photographic duplication of printed materials and microfilm at a nominal charge and typewriters for use on a rental basis.

The Texas State AFL-CIO has designated the UT Arlington Library as official depository for its records. Many local unions are also depositing records. This valuable collection of archival material in the field of labor history is housed on the sixth floor.

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| 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. |



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.

5348. AQUATIC MICROBIOLOGY (2-3) 3 hours credit — A consideration of the microorganisms occurring in aquatic environments and their activities under polluted and unpolluted conditions. Prerequisite: permission of instructor. \$2 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.

5359. ADVANCED GENETICS (2-3) 3 hours credit — In this course, linkage and crossing over, chromosome aberrations, gene mutations, extranuclear 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.

5291, 5391. INDIVIDUAL PROBLEMS IN BIOLOGY 2 or 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 6 hours credit—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.

4680. FIELD BIOLOGY 6 hours credit—Studies in the behavior, ecology, and life histories of organisms under natural conditions. Offered only in the summer session. Prerequisite: senior or graduate standing. \$8 lab fee. A special fee may be assessed.

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.

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 4461.

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.

5321. ADVANCED BIOCHEMISTRY (3-0) 3 hours credit—Prerequisite: chemistry 3442 and 4312.

5323. SELECTED TOPICS IN BIOCHEMISTRY (3-0) 3 hours credit—Prerequisite: chemistry 5321, 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) or permission of instructor, mathematics 2325 (Calculus II) or 2335 (Analysis III), eight hours of physics. \$8 lab fee.

3442. **PHYSICAL CHEMISTRY** (3-3) 4 hours credit—Chemical equilibria, chemical kinetics, electrochemistry, colloids, quantum mechanics, and nuclear chemistry. Prerequisite: chemistry 3441. \$8 lab fee.

4301. **ANALYTICAL CHEMISTRY** (3-0) 3 hours credit—This is a study of sampling and separation techniques including decomposition and dissolution and physical and chemical methods of separation. Prerequisite: chemistry 3442.

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.

4321. **PHYSICAL ORGANIC CHEMISTRY** (3-0) 3 hours credit —Acidity functions, general and specific acid and base catalysis, kinetic methods, linear free energy relationships, and solvent effects will be studied as they apply to organic reaction mechanisms. Prerequisite: chemistry 3442 and 3454 (Organic Chemistry).

4331. **PHYSICAL CHEMISTRY** (3-0) 3 hours credit—This is a study of selected topics in physical chemistry including quantum theory of atoms and molecules, statistical mechanics and absolute reaction rate theory. Numerical methods as well as theoretical consideration are emphasized. Prerequisite: chemistry 3442 or permission of the instructor.

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.

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.

4461. **INSTRUMENTAL 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.

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 economics 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.

5313. MANAGERIAL ECONOMICS (3-0) 3 hours credit—Application of economic analysis in formulating business decisions, drawing upon the theoretical foundations of the concepts of demand, cost, production, profits, and competition, with special emphasis on case studies. Prerequisite: economics 3310 or 5309.

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.

5331. URBAN ECONOMICS (3-0) 3 hours credit—An analysis of urban problems and goals with special attention given to those factors that influence the economic development of urban communities and the quality of urban life. Attention is given to policy formulation as a means for urban problem solving. Prerequisite: economics 2305 and 2306 (Principles of Economics) and consent of instructor.

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 organization 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

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 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 governmental 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 re-



lated 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.

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.

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).

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 supervising 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, Johnson).

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.

5330. THE COMPUTER AND NATURAL LANGUAGE (3-0) 3 hours credit—This course is for students of literature, linguistics, and computer science interested in using the computer as a research tool in processing natural language. The course consists of a survey of computer applications in processing natural language, an introduction to programming the computer to manipulate natural language, and exploration of appropriate programming languages and useful programming techniques. This course is also listed as Linguistics 5330 and Computer Science 5330. Credit will be granted for one of the courses only.

5331. HISTORY OF THE ENGLISH LANGUAGE (3-0) 3 hours credit — Diachronic treatment of various problems in vocabulary, pronunciation, accidence, 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.



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- 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 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 America 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).
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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.



FOREIGN LANGUAGES

OBJECTIVE

The Master of Arts degree program in foreign languages is designed to enhance the student's competence in the language and literature of his major language field. The specific objectives are to prepare the student for a career in teaching or in any area in private or public life in which the knowledge of a foreign language is essential, and to help him to develop the techniques of independent research necessary for work beyond the master's level.

Courses are available in French, German, Portuguese, Russian, Spanish, and linguistics. The program will permit Master of Arts degrees in French, Spanish, and German.

DEGREE REQUIREMENTS

A total of 30 semester hours beyond the bachelor's degree (24 hours of course work plus a six-hour thesis*) is required.

The minor may be in an area outside the Department of Foreign Languages, in linguistics, or in an appropriate language or literature area within the department.

A knowledge of a second foreign language will be required, including listening, speaking, reading, and writing skills, as demonstrated by the successful completion of two semesters of course work beyond the intermediate level or by an appropriate examination.

There shall be an examination, oral and/or written, on the thesis, course work, and general area of study.

Those wishing to major in a foreign language or literature must upon admission have a baccalaureate degree with a major in that foreign language or have a minimum of 18 advanced hours, or the equivalent in language proficiency and course content.

FRENCH

5300. HISTORY OF THE FRENCH LANGUAGE (3-0) 3 hours credit.

5304. STUDIES IN FRENCH LINGUISTICS (3-0) 3 hours credit.

5315. STRUCTURE OF THE FRENCH LANGUAGE (3-0) 3 hours credit.

5320. STUDIES IN FRENCH LITERATURE THROUGH THE RENAISSANCE (3-0) 3 hours credit.

5325. STUDIES IN FRENCH LITERATURE OF THE 17TH AND 18TH CENTURIES (3-0) 3 hours credit.

5330. STUDIES IN FRENCH LITERATURE OF THE 19TH AND 20TH CENTURIES (3-0) 3 hours credit.

5391. CONFERENCE COURSE IN FRENCH LINGUISTICS AND LITERATURE 3 hours credit.

5698. THESIS 6 hours credit.

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

*A substantial research paper and six additional graduate hours may, under certain conditions, substitute for a formal thesis.

GERMAN

5300. HISTORY OF THE GERMAN LANGUAGE (3-0) 3 hours credit.
5304. TOPICS IN GERMANIC LINGUISTICS AND PHILOLOGY (3-0) 3 hours credit.
5317. METHODS IN THE STUDY OF GERMAN LITERATURE AND LINGUISTICS (Fundamentals of Scholarship) (3-0) 3 hours credit.
5318. BACKGROUND OF GERMAN CULTURE (3-0) 3 hours credit.
5320. PERIODS OF GERMAN LITERATURE (3-0) 3 hours credit.
5391. CONFERENCE COURSE IN GERMANIC LINGUISTICS AND LITERATURE 3 hours credit.
5698. THESIS 6 hours credit.

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

SPANISH

5300. HISTORY OF THE SPANISH LANGUAGE (3-0) 3 hours credit.
5304. STUDIES IN SPANISH LINGUISTICS (3-0) 3 hours credit.
5315. STRUCTURE OF THE SPANISH LANGUAGE (3-0) 3 hours credit.
5320. STUDIES IN SPANISH LITERATURE THROUGH THE RENAISSANCE AND GOLDEN AGE (3-0) 3 hours credit.
5324. SPANISH LITERATURE SINCE 1700 (3-0) 3 hours credit.
5330. STUDIES IN SPANISH AMERICAN LITERATURE (3-0) 3 hours credit.
5391. CONFERENCE COURSE IN GERMANIC LINGUISTICS AND LITERATURE 3 hours credit.
5698. THESIS 6 hours credit.

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

LINGUISTICS

5301. PHONOLOGICAL THEORY (3-0) 3 hours credit.
5303. GRAMMATICAL THEORY (3-0) 3 hours credit.
5305. FIELD METHODS (3-0) 3 hours credit.
5306. APPLIED ANALYSIS (3-0) 3 hours credit.
5307. TOPICS IN LINGUISTICS AND LANGUAGE TEACHING (3-0) 3 hours credit.
5310. ACOUSTIC PHONETICS (3-0) 3 hours credit.
5320. HISTORICAL LINGUISTICS (3-0) 3 hours credit.
5330. THE COMPUTER AND NATURAL LANGUAGE (3-0) 3 hours credit.
5391. CONFERENCE COURSE IN LINGUISTICS 3 hours credit.

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



GOVERNMENT

OBJECTIVE

The program leading to a Master of Arts Degree in government emphasizes preparation for service in many areas of our national life, both public and private. Students interested in careers in teaching and research or in leadership roles in the public or private sectors may pursue programs adapted to their individual objectives. The Department of Government endeavors to equip students with the research techniques and subject matter background needed for academic and professional pursuits undertaken beyond the master's level. Particular attention is given newer methodologies and approaches employed by scholars in the field.

Courses are available in the fields of (1) Political Systems (developing areas, modern systems and area studies); (2) Political Processes (processes and behavior within the framework of political parties, pressure groups, legislatures, judiciaries, bureaucracies, and electoral systems); (3) Political Theory and Methodology (normative and empirical theory); and (4) Inter-Systems and Processes (international politics, law, and organization; foreign policy; and federalism).

DEGREE REQUIREMENTS

A total of 30 semester hours of credit beyond a bachelor's degree (24 hours of course work and six hours of thesis preparation) is required. Twenty-four hours in government taken as graduate work constitutes the major including a maximum of six hours in upper division undergraduate courses.

Course work for the minor may be taken in the supporting fields of history, economics, English, civil engineering, sociology, foreign languages, psychology, or others as approved by the departmental graduate advisor. A minimum of six semester hours in a single designated field shall constitute a minor. No more than three semester hours of advanced undergraduate work shall be included in the minor.

All candidates for the Degree of Master of Arts with a major in government shall pass an oral examination over the candidate's graduate course work, as determined by the Department of Government.

All candidates for the Master of Arts Degree with a major in government shall attain a grade of *B* or better in the thesis course.

5310. FEDERALISM AND INTERGOVERNMENTAL RELATIONS (3-0) 3 hours credit— This course examines the theory and practice of federal systems, with attention paid to selected contemporary problems of intergovernmental relations arising under American federalism.

5320. CONTEMPORARY JUDICIAL POLITICS AND BEHAVIOR (3-0) 3 hours credit— This course examines the process and decision-making of the American judiciary with emphasis on contemporary constitutional issues.

5330. THE ADMINISTRATIVE SYSTEM (3-0) 3 hours credit—This course examines the role and scope of administration in public organizations and in various cultural contexts. The system's characteristics as a decision-making mechanism will be analyzed, with emphasis upon processes, regulations, and responsibility.

5331. URBAN GOVERNMENT ADMINISTRATION (3-0) 3 hours credit—This course analyzes the problems of governmental administration at all levels—national, state, and local—in urban areas, with emphasis on metropolitan and regional approaches in political decision-making.

5336. THE POLITICAL SYSTEM OF THE SOVIET UNION (3-0) 3 hours credit—This course covers the development of Soviet political theory and social, political, and governmental structure from 1917 to the present.

5339. EMPIRICAL THEORY AND METHODOLOGY (3-0) 3 hours credit—This course examines selected empirical theories and research methods. Systems theory, structural-functional theory, and other empirical theories and such methodological concerns as research design, data collection, and data analysis and interpretation are studied.

5391. CONFERENCE COURSE IN POLITICAL SCIENCE 3 hours credit—Research and reading in a specialized field under the direction of a member of the graduate faculty.

5392. SELECTED TOPICS IN POLITICAL SCIENCE (3-0) 3 hours credit—Topics will vary each semester and will be drawn from the following fields of study:

1. Political Systems
2. Political Processes
3. Political Theory and Methodology
4. Inter-Systems and Processes

A seminar in each of the basic fields will be offered at least once in any four semester span. The course may be repeated for credit as the topic changes.

5698. THESIS 6 hours credit—Original research designed to augment existing studies of problems or topics related to one of the major fields of study. A written report conforming to institutional and departmental standards is required.



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.

5308. SOUTHWESTERN HISTORY (3-0) 3 hours credit—The political, economic, religious, social, intellectual and ethnic aspects of the American Southwest from prehistoric times to the present.

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.

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- 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, Islam, 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.
- 5334. AFRICAN HISTORY (3-0)** 3 hours credit—The development of Africa with special emphasis on the colonial period, the African Revolution and states of independent Africa.
- 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 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 the material contained in mathematics 4321 or 4331, and in mathematics 4334 or 4335.

Not more than 12 semester hours from mathematics 5391, 5392, 5398, 5695, and 5698 will be applicable toward a graduate mathematics program.

A graduate mathematics program must include at least two sequences chosen from the following list of sequences:

| | |
|---------------|---------------|
| 5307 and 5308 | 5322 and 5323 |
| 5309 and 5310 | 5325 and 5326 |
| 5312 and 5313 | 5327 and 5328 |
| 5317 and 5318 | 5331 and 5332 |
| 5320 and 5321 | |

Furthermore, at least one of the two required sequences must be chosen from the sequences 5317 and 5318, 5322 and 5323, 5331 and 5332.

5301. SET THEORY (3-0) 3 hours credit—This course deals with cardinal numbers, ordinal numbers, and equivalences of the Axiom of Choice. Prerequisite: mathematics 4321 or 4331, and 4335.

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 4335.

5307. POINT-SET THEORY 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 3335 (Analysis V) or 4303.

5308. POINT-SET THEORY II (3-0) 3 hours credit — A continuation of mathematics 5307. Prerequisite: mathematics 5307.

5309. THEORY OF ITERATIVE PROCESSES (3-0) 3 hours credit—This course is a study of the design and characterization of general iterative processes which will afford approximate solutions to equations. Topics considered will be of special interest to the practicing numerical analyst. Prerequisite: mathematics 3335 (Analysis V) and 4338.

5310. APPROXIMATION THEORY (3-0) 3 hours credit—This course is a study of uniform approximations, best approximations, and least square approximations. Prerequisite: mathematics 4335.

5311. 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 3335 (Analysis V) and 4311.

5312. 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 4311 or 4334 or 4335.

5313. MATHEMATICS 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 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, Stieltjes integral, and indefinite Lebesgue integral. Prerequisite: mathematics 4335.

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 4335.

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 4324 or 4334 or 4335.

5322. COMPLEX VARIABLES I (3-0) 3 hours credit—Fundamental theory of analytic functions, residues, conformal mapping and applications. Prerequisite: mathematics 4334 or 4335.

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



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- 5324. APPLIED COMPLEX VARIABLES (3-0) 3 hours credit**—This course is a study of applications of complex variables in potential theory, ordinary differential equations, transform theory, and asymptotic expansions. Prerequisite: mathematics 4322 or 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 3335 (Analysis V) 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 3335 (Analysis V) 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 4335.
- 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.
- 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 4334 or 4335.
- 5336. LOGIC (3-0) 3 hours credit**—The concept of a normal system and propositional and functional calculi are considered. Prerequisite: mathematics 3335 (Analysis V) or 3336 (Introduction to Mathematical Logic).
- 5338. NUMERICAL ANALYSIS I (3-0) 3 hours credit**—This course is a treatment of the solution of equations, interpolation and approximation, numerical differentiation and quadrature, and the solution of ordinary differential equations. Prerequisite: mathematics 3345 (Numerical Analysis and High Speed Computer Applications).
- 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 3345 (Numerical Analysis and High Speed Computer Applications).
- 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.
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5392. SELECTED TOPICS IN MATHEMATICS (3-0) 3 hours credit — The material covered may vary from semester to semester depending upon need and interest of the students. This course may be repeated for credit. Prerequisite: permission of instructor.

5695. SPECIAL PROJECT 6 hours credit—Prerequisite: permission of graduate advisor.

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 and shall not exceed six hours total credit.

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. Prerequisite: mathematics 3300 (Introduction to the Foundations of Mathematics).

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 3300 (Introduction to the Foundations of Mathematics) and 3335 (Analysis V).

4311. MATHEMATICAL PROBABILITY (3-0) 3 hours credit—Introduction to fundamental concepts of probability theory is provided with emphasis on the basic discrete and continuous distributions, characteristic functions, derived distribution theory and some limit theorems of probability theory. Prerequisite: mathematics 2326 (Calculus III) or 2336 (Analysis IV) and three hours of advanced mathematics.

4313. APPLICATIONS OF MATHEMATICAL STATISTICS (3-0) 3 hours credit—This course is a continuation of mathematics 3313. Further theory of testing of hypotheses, regression, correlation, experimental designs, nonparametric statistics, and selected topics will be studied. Prerequisite: mathematics 3313 (Introduction to Probability and Mathematical Statistics).

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) 3 hours credit—This course is 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 2326 (Calculus III) or 2336 (Analysis IV).

4323. VECTOR ANALYSIS (3-0) 3 hours credit—This course is an introduction to the algebra and calculus of vectors and includes such topics as the theorems of Green, Gauss, and Stokes with applications to differential geometry and the physical sciences, and an introduction to tensor analysis. Prerequisite: mathematics 2326 (Calculus III) or 2336 (Analysis IV) and three hours of advanced mathematics.



4324. INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS (3-0) 3 hours credit—This course treats methods of solutions of selected elliptic, parabolic, and hyperbolic partial differential equations with reference to physical applications. Prerequisite: mathematics 3318 (Differential Equations).

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 2326 (Calculus III) or 2336 (Analysis IV) 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. Prerequisite: mathematics 3300 (Introduction to the Foundations of Mathematics).

4330. MATHEMATICAL MODELS (3-0) 3 hours credit—This course will treat applications of undergraduate mathematics. The purpose of the course will be to develop the student's ability to construct useful mathematical models. Prerequisite: 12 hours of advanced mathematics.

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).

4332. LINEAR GEOMETRY (3-0) 3 hours credit—Affine and Euclidean geometry will be studied using the theory of vector spaces. Prerequisite: mathematics 3330 (Introduction to Matrix Algebra) or 4331.

4334. ADVANCED MULTIVARIABLE CALCULUS (3-0) 3 hours credit—This course treats the properties of continuous mappings from N -dimensional Euclidean space to M -dimensional Euclidean space and an introduction to differential forms and vector calculus, based upon line integrals, surface integrals, and the general Stokes' theorem. Prerequisite: mathematics 3335 (Analysis V).

4335. ANALYSIS VI (3-0) 3 hours credit—This course is a continuation of mathematics 3335. Prerequisite: mathematics 3335 (Analysis V).

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 Mathematical Logic).

4338. INTRODUCTION TO NUMERICAL ANALYSIS II (3-0) 3 hours credit—This course is a continuation of mathematics 3338. This course will present solutions of linear systems, functional approximations, and solutions of eigen-value problems. Prerequisite: mathematics 3330 (Introduction to Matrix Algebra) and 3338 (Introduction to Numerical Analysis I).

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.

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.

5307. QUANTUM MECHANICS I (3-0) 3 hours credit — Matrix formulation, theory of radiation, angular momentum, perturbation methods. Prerequisite: permission of graduate advisor.

5308. QUANTUM MECHANICS II (3-0) 3 hours credit—Approximate methods, symmetry and unitary groups, scattering theory. Prerequisite: physics 5307 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.

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

5315. SOLID STATE I (3-0) 3 hours credit—Crystal structure, lattice vibration, thermal properties, and band theory of solids. Prerequisite: permission of graduate advisor.

5316. SOLID STATE II (3-0) 3 hours credit—Electrical and magnetic properties of crystalline solids, magnetic resonance, and optical phenomena. Prerequisite: permission of graduate advisor.

5317. **RELATIVITY (3-0)** 3 hours credit — The geometry of special relativity; particles in fields; collisions of particles; experiments and applications of relativity in optics, electrical engineering, atomic and nuclear physics, and space physics; fluids; fields; introduction to general relativity and the needed differential geometry. Prerequisite: 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.

5323. **ELEMENTARY PARTICLES (3-0)** 3 hours credit—Production, detection, and classification of elementary particles. Qualitative study of strong, electromagnetic, and weak interactions, and their respective conservation laws. Semi-quantitative treatment of the SU(3) symmetry. Prerequisite: physics 5307 or permission of graduate advisor.

5325. **QUANTUM FIELD THEORY (3-0)** 3 hours credit — A study of the quantized field description of elementary particles and their interactions, developed from the principles of quantum mechanics and Lorentz invariance. Quantitative applications to electromagnetic and weak interactions. Prerequisite: physics 5308 or 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 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.

4325. **SOLID STATE PHYSICS (3-0)** 3 hours credit—Classification of crystalline solids; elastic and thermal properties; electric and magnetic properties and electronic properties of solids are covered in this course as well as an introduction to current research problems. Prerequisite: physics 4315 (Heat and Thermodynamics).

4326. **INTRODUCTION TO QUANTUM MECHANICS (3-0)** 3 hours credit—This course includes the experimental need for quantum mechanics. Schrodinger's equation and implications, the free particle, the one-electron atom, potential barrier and perturbation theory are introduced. Prerequisite: physics 4319 (Advanced Mechanics).



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.

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

Deadline for Financial Aid Applications—Students who wish to be considered for assistantships must have their application and departmental form sent to the University of Texas at Arlington by August 1 for the Fall Semester and December 1 for the Spring Semester.

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.

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.

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. Psychology 5301 (Advanced Statistics) will be required of all students.

Students will be required to take three hours in each of three of the following four core areas:

AREA I: INTERPERSONAL PROCESSES

- (1) Personality and Behavior Dynamics
 - (2) Advanced Social Psychology
 - (3) Advanced Developmental Psychology
 - (4) Psycholinguistics
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AREA II: PHYSIOLOGICAL-COGNITIVE-PERCEPTION

- (1) Perceptual Processes
- (2) Sensory Processes
- (3) Advanced Physiological Psychology
- (4) Man-Machine Systems
- (5) Cognitive Processes

AREA III: LEARNING AND MOTIVATION

- (1) Learning Theory
- (2) Animal Learning
- (3) Theories of Motivation
- (4) Animal Behavior

AREA IV: MATHEMATICAL PSYCHOLOGY

- (1) Experimental Design
- (2) Quantitative Methods
- (3) Mathematical Models in Psychology

Each time it is offered, Psychology 5389 (Contemporary Problems in Psychology) will be treated as being in one of the four areas. Psychology 5191, 5291, 5391 (Research in Psychology) may also be designated as counting in one of the four areas, subject to a responsible faculty member's discretion.

5301. ADVANCED STATISTICS (3-0) 3 hours credit—A study of parametric and nonparametric statistical techniques with emphasis on statistical inference.

5302. EXPERIMENTAL DESIGN (3-0) 3 hours credit—Area IV—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—Area IV—A survey of techniques for analyzing multivariate data; particular topics include partial and multiple correlation, factors analysis, and the linear discriminant function.

5304. MATHEMATICAL MODELS IN PSYCHOLOGY (3-0) 3 hours credit—Area IV—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 III—A survey of the basic theories of learning.

5312. ANIMAL LEARNING (3-0) 3 hours credit—Area III—A survey of contemporary problems in animal learning.

5313. COGNITIVE PROCESSES (3-0) 3 hours credit—Area II—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—Area I—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 I—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.



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5323. **ADVANCED DEVELOPMENTAL PSYCHOLOGY (3-0)** 3 hours credit—Area I—A survey of development of behavior in both humans and sub-humans.
5325. **THEORIES OF MOTIVATION (3-0)** 3 hours credit—Area III—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 II—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 II—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 II—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—Area III—A phylogenetic approach to some basic problems in behavior, with special emphasis on unlearned behavior.
5337. **MAN-MACHINE SYSTEMS (3-0)** 3 hours credit—Area II—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.
5340. **TEACHING UNDERGRADUATE PSYCHOLOGY (2-2)** 3 hours credit—A survey of the approaches to teaching general psychology, course organizations, sources of knowledge, and keeping current with contemporary developments. The definition of objectives and evaluation of teaching effectiveness are also analyzed in their application. \$2 lab fee.
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 hours credit — Prerequisite: 12 hours of advanced psychology and permission of the graduate advisor.
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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.

3318. ANALYSIS OF BEHAVIOR (3-0) 3 hours credit—Area III—A systematic formulation of the principles of individual behavior in Skinnerian terms and the extension of these principles to complex behavior including social interaction, education and psychopathology. Prerequisite: psychology 1315 (Introduction to Psychology) or 3300 (Advanced General Psychology).

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.

4330. MATHEMATICAL PSYCHOLOGY (3-0) 3 hours credit
—Area I—The application of linear algebra, probability theory, geometry and differential calculus to learning theory, psychological scaling, signal detection, concept identification and group processes. Prerequisite: psychology 2348 (Basic Statistics), psychology 4313 (may be taken concurrently) and mathematics 1326 (Calculus I).

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.

URBAN AFFAIRS

OBJECTIVES

The activities of the Institute of Urban Studies are organized into three broad, functional areas: graduate instruction and related research; applied research and services provided public and private groups and officials; and state government and regional information system development. The applied research and service activities and the information system development work are viewed as important adjuncts to the graduate instruction program. Graduate students in urban affairs may have involvement in research and service projects that are relevant and timely in relation to contemporary urban problems. Other students in need of part-time employment may find it in these areas. Much data and research materials will be assembled and can be made available to graduate students. Members of the applied research and service and information system development staff may serve as resource specialists to graduate students and members of the graduate instructional staff. The wide contacts of institute staff members with public officials and agencies and private groups outside the University and involved in urban affairs can be helpful in arranging internships and for placing graduates in positions of employment.

The Master of Arts degree in urban affairs is organized around a subject matter area, city or urban phenomena, rather than one of the traditional disciplines. Emphasis is placed on issues, problems, and public policy questions related to life in urban communities. Urban problems are viewed as complex and requiring the understanding and skills of many disciplines. Therefore, the program is multi-disciplinary or interdisciplinary in character in curriculum content, teaching staff, and enrollment of students. Students in the program will specialize in the sense that they concentrate on urban or city subject matter but will be broadly educated in that they will study cities as economic, governmental, and social entities, and as physical environments. The urban subject matter orientation does not preclude attention to development of intellectual skills and capacities for analysis and the manipulation of methodological techniques.

Broad and intensive graduate education in urban affairs can introduce graduates to a variety of rewarding and profitable careers and positions. With the increased urbanization of Texas and the nation, new career opportunities, many of them recent in origin, are becoming available.

By educating young men and women for urban affairs careers, the program seeks to help provide society with the "brain power" needed to deal with increasingly complex and urgent city problems.

DEGREE REQUIREMENTS

The Master of Arts degree in urban affairs seeks to provide students with understanding of cities in four general and inter-related areas of knowledge:



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- Cities as economic entities
 - Cities as governmental and political entities
 - Cities as social entities
 - Cities as physical environments.

Students will be expected to take seminars in each of these four areas and, to the extent possible, will be encouraged to develop a concentration in one particular area.

Satisfactory completion of 30 semester hours of courses or seminars will be required and completion of a thesis or report on internship, carrying six semester hours credit, will be necessary to receive the degree. Completion of degree requirements will normally entail 18 months of graduate work or three regular semesters and one summer in the case of full-time students. The program is organized and operated primarily for full-time students, but part-time students are not excluded.

Seminars Emphasizing Governmental and Political Aspects of Cities

5301. URBAN AND METROPOLITAN POLITICS (3-0) 3 hours credit—This course deals with politics, political parties, and pressure groups in cities and among units of local government within metropolitan areas. The relationships between national parties and political activities and cities and metropolitan areas will be studied.

5302. POLITICS OF MINORITY GROUPS (3-0) 3 hours credit—This seminar is a continuation of the course listed above, and concentrates on recent developments related to partisan activities and political involvement of minority groups in cities and metropolitan areas. Emphasis will be on roles of Negro and Mexican American groups and individuals.

5303. GOVERNMENT AND ADMINISTRATION OF METROPOLITAN AREAS (3-0) 3 hours credit—Problems and issues related to the proliferation of units of government in larger metropolitan areas and analysis of various proposals for rationalizing government in metropolitan areas will be studied. These problems and issues will be examined in the context of emerging patterns of federalism, state government-local government relationships and intergovernmental relations in general.

5304. GOVERNMENTAL POLICIES AND PROGRAMS FOR DIRECTING OR INFLUENCING URBAN DEVELOPMENT (3-0) 3 hours credit—This seminar focuses on a critical analysis of federal government and selected state and local government policies and programs designed to influence the course of change or the future development of cities and urban areas. The problem of formulating national government and state government urban development policies and goals will be studied. Difficulties of anticipating the effects of new policies and programs and measuring "improvements" or "progress" will be examined.

Seminars Emphasizing Cities and Urban Areas as Social Entities

5310. URBAN SOCIAL PATHOLOGIES (3-0) 3 hours credit—This seminar deals with the nature and extent of major types of social pathologies and deviant behavior in cities and urban areas: family disorganization, crime and delinquency, poor health, lack of education, and unemployment. Newer concepts and techniques for maintaining "social accounts" and informa-

tion systems for monitoring changes in socio-economic well-being will be studied.

5311. MINORITY GROUP RELATIONS AND SOCIAL PROBLEMS (3-0) 3 hours credit — Special problems of minority groups, primarily Negro and Mexican American groups, will be studied. The phenomenon of racial discrimination and the causes and consequences of violence and direct action or confrontation tactics will be examined, with emphasis on recent and contemporary problems and issues.

5312. COMMUNITY AND NEIGHBORHOOD ORGANIZATIONS (3-0) 3 hours credit—The role of private and semi-public groups in relation to city problems and urban trends will be studied. Private and governmental programs for neighborhood improvement, voluntary action, block organization, and the use of indigenous leaders and talent will be examined.

5313. METHODS OF SOCIAL RESEARCH AND ANALYSIS (3-0) 3 hours credit—This seminar concentrates on research methodology and statistical techniques useful in analysis of urban trends and problems. Newer concepts and procedures for use of computers in social research will be studied. Special problems and methods of evaluative research related to programs and policies for coping with urban problems will be explored.

5314. URBAN HISTORY (3-0) 3 hours credit—This seminar involves extensive reading primarily in the history of urbanization and metropolitanization of the people of the United States. The historical method as exemplified in the works of leading historians will be analyzed. Examples of the scholarship of selected historians and treatises on selected cities, regions, and urban institutions will be studied.

Seminars Emphasizing Urban Areas as Economic Entities

5320. THE DYNAMICS OF REGIONAL ECONOMIC DEVELOPMENT (3-0) 3 hours credit — This seminar examines the structure and functioning of regional economies and the relationships between regions and the national economy. Principal methods of regional economic analysis will be explored.

5321. ECONOMICS OF SELECTED URBAN PROBLEMS (3-0) 3 hours credit—This seminar will deal with different topics each semester selected from such areas as: poverty, housing, urban transportation, manpower, economic development. The seminar may be repeated for credit as the topic changes.

5322. URBAN PUBLIC FINANCE AND INTER-GOVERNMENTAL FISCAL RELATIONS (3-0) 3 hours credit—This seminar will emphasize tax, revenue, and fiscal problems of cities and local governments in metropolitan areas. Problems of matching costs and benefits in providing public services as among different local governments will be analyzed. The increasingly complex web of federal-state-local fiscal and grant-in-aid relationships will be studied.

Seminars Emphasizing Cities and Urban Areas as Physical Environments

5330. ORIENTATION TO URBAN AND REGIONAL PLANNING (3-0) 3 hours credit—This seminar deals with the nature of the planning process in cities and urban regions and with concepts and techniques used by professional planners and planning organizations. Emphasis will be on understanding the role, limitations, and political aspects of urban planning as opposed to instruction in how to practice the art of planning.



5331. ORIENTATION TO URBAN DESIGN (3-0) 3 hours credit—This seminar seeks to provide understanding and appreciation on the part of serious and systematic non-architecture students of the concepts and skills of architects and physical design specialists. The importance of design, form, and visual or aesthetic factors will be studied. The interdependence of physical design and aesthetic and governmental policies and social problems in urban areas will be explored.

5332. PROTECTION OF QUALITY OF URBAN ENVIRONMENTS (3-0) 3 hours credit—The interdependence of man and the physical environment will be studied. Trends and problems related to pollution of the environment will be studied. Problems and issues of public policy and regulatory mechanisms to cope with pollution will be examined. The approach of ecologists and other disciplines concerned with the physical environment will be explored.

5698. THESIS OR INTERNSHIP REPORT 6 hours credit—A thesis conforming to University and departmental requirements may be prepared by graduate students in urban affairs. Students will be encouraged to participate in an internship program in lieu of writing the traditional thesis. The internship program will be an integral part of the graduate offering with close faculty supervision of each student's placement and activities. Except for the requirement of original research, the report on the internship will have to comply with the same standards of scholarship and writing applied to the traditional thesis.

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 inter-individual 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.

For the Master of Business Administration program the general requirement may be a satisfactory score on the Graduate Record Examination *or* on the Admission Test for Graduate Study in Business.

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 main-



tained. 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 | (5) Economic Analysis I | (2) Economic Analysis II |
| Functional | | (3) Finance (4) Production (5) Marketing |

SECOND YEAR PROGRAM

| Areas | Semester III | Semester IV |
|-----------------------------|---|---|
| Behavioral Science | (1) Organizational Behavior | (1) Business Policy |
| Economics | (2) Business and Society | |
| Concentration and Electives | (3) Elective (4) Elective (5) Concentration Seminar | (2) Elective (3) Elective (4) Research Colloquium (5) Thesis |

Concentration may be obtained with electives in accounting, 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—An introductory study of the concepts, terminology, purposes, and methodology of financial and managerial accounting.

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

5313. ACCOUNTING THEORY (3-0) 3 hours credit—A basic theory course which treats the history and development of accounting theory, the forces which have influenced this development, different concepts of income which have been expressed over the years, and significant problem areas in asset and liability measurement and in income determination. Prerequisite: accounting 5302 or nine semester hours of undergraduate accounting.

5315. TAX PLANNING AND RESEARCH (3-0) 3 hours credit—An intensive study of the more complex provisions of the Internal Revenue Code pertaining to Individuals, Partnerships, Corporations, and Estates and Trusts. Tax planning for the business enterprise and the Gift Taxes, are emphasized throughout the course, as is student research into tax problem areas. Prerequisite: accounting 3315.

5318. STUDIES IN AUDITING (3-0) 3 hours credit—Requirements of the Securities and Exchange Commission, methods of applying statistical techniques to auditing problems, the auditing of records maintained on computers, and internal auditing problems. This course is designed to complete, insofar as possible, a student's formal education in auditing.

5321. CASES IN FINANCIAL ACCOUNTING (3-0) 3 hours credit—This course is designed to improve the student's ability to deal with complex problem areas in financial accounting and to sharpen his understanding and application of accounting concepts and principles. A variety of significant and complex accounting cases and problems are considered and analyzed in detail during this intensive study of financial accounting topics. Prerequisite: accounting 4311.

5322. ACCOUNTING FOR MANAGERIAL PLANNING AND CONTROL (3-0) 3 hours credit—An in-depth study of information and reporting needs of contemporary management for planning, control, and decision-making purposes. The viewpoint taken is that of the controller or chief financial officer. Representative topics include methods of developing and reporting useful cost information; cost-volume-profit analysis; operational, cash, and capital expenditure budgeting; and responsibility accounting. Consideration is given to both traditional and current concepts. Prerequisite: accounting 3301, or 3313, or 5302.

5324. CASES IN ADVANCED MANAGERIAL ACCOUNTING (3-0) 3 hours credit—A case-oriented course exploring the chief financial officer's responsibility in satisfying information needs, the problems encountered, and the tools available. Among the problem areas to be covered are cash flow determination, estimates of future capital requirements, PERT-Cost systems, profit maximization through control, special problems in product pricing, and intracompany pricing. Conventional methods of regression analysis, and linear programming are some of the techniques offered. Prerequisite: accounting 3314 or 5322.

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: accounting 3312.

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: six hours of accounting.

5330. INTERNATIONAL ACCOUNTING AND FINANCIAL REPORTING (3-0) 3 hours credit—Primary emphasis in this



course is on comparative and analytical study and research in the problems of obtaining, interpreting, and using financial information in international business. Consideration will also be given to reporting and controlling foreign operations, international auditing standards and practices, the role of accounting in economic development, and other dimensions of international accounting as time permits. Prerequisite: accounting 5302 or nine hours of undergraduate accounting.

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 differential equations.

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.

5330. LEGAL ENVIRONMENT OF BUSINESS (3-0) 3 hours credit—A study, in a conceptual framework, of the ideas and social and political forces that have led to changes in the business legal environment and legal institutions including current and historical developments affecting the business corporation. The legal framework for business in serving diverse interests of investors, creditors, the sovereign, the general public, and others is studied along with modern social legislation affecting business.

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. Prerequisite: accounting 5301 and economics 5309 or equivalents.

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. Prerequisite: finance 5311 or equivalent.

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. Prerequisite: finance 5311 or equivalent.

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. Prerequisite: finance 5311 or equivalent.

5325. MANAGEMENT OF FINANCIAL INSTITUTIONS (3-0) 3 hours credit—General management problems and policies of financial institutions, emphasizing the role of the major financial institutions. Use of analytical techniques through case



method of instruction as an aid to the solution of significant financial problems. Approximately one-third of the course devoted to commercial banks and two-thirds devoted to principal non-bank financial institutions such as life and casualty insurance companies, savings associations, mutual and stock investment companies, pension funds, etc. Prerequisite: finance 5311 or equivalent.

MANAGEMENT

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 personnel administration area, and to supervision-leadership, morale-motivation problems and communication.

5320. ORGANIZATIONAL BEHAVIOR (3-0) 3 hours credit—This course provides a systematic study of behavioral problems in the complex organization. The course analyzes the interaction of environmental and internal factors in their effects upon organizational behavior. The course is placed within the context of the organization process. Prerequisite: management 5311 or equivalent.

5321. ADVANCED MANAGEMENT THEORY (3-0) 3 hours credit—This course is designed to provide the foundation for an in-depth knowledge of the management process. The course will relate the empirical findings and theoretical hypotheses concerned with goal setting, planning, and control to functions of management in a profit-related organization. Prerequisite: management 5311 or equivalent.

5324. GROUP AND INTERGROUP RELATIONSHIPS (3-0) 3 hours credit—This course analyzes the operation of groups in the organization. Effects on productivity and morale of such work group attributes as cohesiveness, group norms, group pressures, and leadership are examined. The effects of the group in individual behavior is considered. Intergroup problems involving union-management relations, interdepartmental conflicts, and international relations are analyzed. 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.

5328. BUSINESS AND GOVERNMENT (3-0) 3 hours credit—This course investigates the role of government as it provides a framework for the operation of business enterprises within the United States. The impact of government upon business via federal laws will be considered from the view of management. The empirical data and theoretical information will be included.

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 or business administration 5301.

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. Prerequisite: business administration 5302 and economics 5306 or business administration 5301.

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.

5320. BEHAVIORAL SCIENCE IN MARKETING (3-0) 3

hours credit—This course employs the case method to acquaint a student with the importance of sociological and psychological applications in marketing analysis. Cases used cover a wide range of marketing problems including product decisions, promotional decisions, pricing decisions, and distribution channel decisions. The emphasis is on applications rather than technique, the students being assumed to have sufficient knowledge of behavioral science techniques from the outset. Prerequisite: marketing 5311 and management 5311 or equivalent.

5321. MANAGEMENT SCIENCE IN MARKETING (3-0) 3

hours credit—A case course designed to demonstrate applications of differential and integral calculus, matrix algebra, Bayesian statistics, Markov chains, queueing models and linear programming in marketing decision-making. The emphasis is on applications rather than technique, the students being assumed to have command of the techniques from the beginning. Prerequisite: marketing 5311 and management science 5324 or equivalent.

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. Prerequisite: marketing 5311 or equivalent.

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. Prerequisite: marketing 5311 or equivalent.

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. Prerequisite: marketing 5311 or equivalent.

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. Prerequisite: business administration 5301 and 5302 or equivalent.

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. Prerequisite: production 5311 or equivalent.

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. Prerequisite: production 5311 or equivalent.

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. Prerequisite: production 5311 or equivalent.

ACCOUNTING

OBJECTIVE

The objectives of the Master of Professional Accounting Degree program are to prepare students for careers as professional accountants, either in public, private, or government accounting, and, as a part of this larger objective, to provide them with the educational background to become Certified Public Accountants. In addition, the program is designed to provide the student with a sound understanding in selected fields such as finance, management, behavioral sciences, management sciences and economics. Thus, the program seeks to provide the student with a broad perspective, which is a requisite to success both as a professional accountant and as a top-level financial or business executive.

DEGREE REQUIREMENTS

Admission to the Master of Professional Accounting Degree program is based upon the general admission requirements of the Graduate School. However, for the Master of Professional Accounting Degree program, a satisfactory score on either the Graduate Record Examination or the Advanced Test for Graduate Study in Business may qualify the applicant. In addition, the applicant must have satisfactorily completed the following minimum course requirements.

- (1) Principles of Accounting; Intermediate Accounting; Cost Accounting; Auditing; and a course in Advanced Accounting, Accounting Theory, or Income Tax. (This will normally involve a minimum of 21 semester hours.)
- (2) A basic course in each of Business Law, Management, Marketing, Finance, and Statistics.
- (3) Principles of Economics; Intermediate Macro-economic Theory; and Intermediate Micro-economic Theory. This will normally involve a minimum of 12 semester hours.
- (4) College Algebra, and Mathematics for Business and Economic Analysis or the equivalent. (Representative topics covered in Mathematics for Business and Economic Analysis are linear equations, inequalities, probability, vectors, differentiation, and integration.)

Students holding a bachelor's degree in business administration with a major in accounting will ordinarily have fulfilled the preceding requirements. A student not holding an undergraduate accounting degree will, with the assistance of his graduate advisor, determine the existing deficiencies and select appropriate remedial course work. Provisional admission to the program may be granted while the applicant is taking course work to remove deficiencies.

The program requires 30 semester hours of work. It is characterized by flexibility so as to accommodate students having diverse undergraduate backgrounds and diverse career interests. Each student, with the assistance and consent of his graduate advisor, will develop a course of study designed to meet his edu-



cational needs in light of previous academic work and career objectives.

Of the 30 semester hours required, not more than six semester hours may be represented by undergraduate courses. Undergraduate courses submitted for graduate credit must be approved by the student's graduate advisor. A minimum of 12 semester hours of accounting are to be selected from the courses offered. If undergraduate courses in accounting are approved for graduate credit, these courses would be a part of the minimum accounting requirements. At least six semester hours in business administration and economics graduate courses are required, including an appropriate graduate course in statistics. The program requirements include a six-hour thesis or an appropriate substitute.

5313. ACCOUNTING THEORY (3-0) 3 hours credit — A basic theory course which treats the history and development of accounting theory, the forces which have influenced this development, different concepts of income which have been expressed over the years, and significant problem areas in asset and liability measurement and in income determination. Substantial use is made of Accounting Research Studies, Opinions of the Accounting Principles Board and its predecessor, pronouncements of the American Accounting Association, and readings in the literature of accounting and economics.

5315. TAX PLANNING AND RESEARCH (3-0) 3 hours credit — An intensive study of the more complex provisions of the internal revenue code pertaining to individuals, partnerships, corporations, and estates and trusts. Tax planning for the business enterprise is emphasized throughout the course, as is student research into tax problem areas. Prerequisite: accounting 3315.

5318. STUDIES IN AUDITING (3-0) 3 hours credit — Requirements of the Securities and Exchange Commission, methods of applying statistical techniques to auditing problems, the auditing of records maintained on computers, and internal auditing problems. This course is designed to complete, insofar as possible, a student's formal education in auditing.

5321. CASES IN FINANCIAL ACCOUNTING (3-0) 3 hours credit — This course is designed to improve the student's ability to deal with complex problem areas in financial accounting and to sharpen his understanding and application of accounting concepts and principles. A variety of significant and complex accounting cases and problems are considered and analyzed in detail during this intensive study of financial accounting topics. Prerequisite: accounting 4311.

5322. ACCOUNTING FOR MANAGERIAL PLANNING AND CONTROL (3-0) 3 hours credit — An in-depth study of information and reporting needs of contemporary management for planning, control, and decision-making purposes. The viewpoint taken is that of the controller or chief financial officer. Representative topics include methods of developing and reporting useful cost information; cost-volume-profit analysis; operational, cash, and capital expenditure budgeting; and responsibility accounting. Consideration is given to both traditional and current concepts. Prerequisite: accounting 3301, or 3313, or 5302.

5324. CASES IN ADVANCED MANAGERIAL ACCOUNTING (3-0) 3 hours credit — A case-oriented course exploring the chief

financial officer's responsibility in satisfying information needs, the problems encountered, and the tools available. Among the problem areas to be covered are cash flow determination, estimates of future capital requirements, PERT-Cost systems, profit maximization through control, special problems in product pricing, and intracompany pricing. Conventional methods, regression analysis, and linear programming are some of the techniques offered. Prerequisite: accounting 3314.

5327. CONTEMPORARY ISSUES IN ACCOUNTING THEORY (3-0) 3 hours credit— 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: accounting 3312.

5329. INFORMATION SYSTEM ANALYSIS (3-0) 3 hours credit— Studies in the structure, 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: six hours of accounting.

5330. INTERNATIONAL ACCOUNTING AND FINANCIAL REPORTING (3-0) 3 hours credit— Primary emphasis in this course is on comparative and analytical study and research in the problems of obtaining, interpreting, and using financial information in international business. Consideration will also be given to reporting and controlling foreign operations, international auditing standards and practices, the role of accounting in economic development, and other dimensions of international accounting as time permits. Prerequisite: accounting 5302 or nine hours of undergraduate accounting.

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. The research colloquium may with appropriate permission be used as a partial substitute for the traditional type of thesis work.

5698. THESIS 6 hours credit. Prerequisite: permission of graduate advisor.



GEOLOGY

OBJECTIVE

The graduate program in geology* is designed primarily to extend the basic foundation and to offer research experience in preparation for professional work or further graduate studies elsewhere. Secondly, the design aims to provide flexible support for several other disciplines.

DEGREE REQUIREMENTS

In addition to the general requirements for the Master of Science degree, the program in geology requires: (1) reading competence in a foreign language as demonstrated by examination or by collegiate credits at the sophomore level and (2) thesis defense as prescribed by the Departmental Committee on Graduate Studies.

5341. INTRODUCTION TO MICROPALAEONTOLOGY (2-3) 3 hours credit—A survey of selected taxa with emphasis upon the foraminifers. \$2 lab fee.

5345. PALEOECOLOGY (2-3) 3 hours credit—A study of evidences of ancient environments and applications of the evidences of geology and paleontology. \$4 lab fee.

5302. TECTONICS (3-0) 3 hours credit—A study of regional structural features and their origin and development.

5343. IGNEOUS AND METAMORPHIC PETROGRAPHY (2-3) 3 hours credit—A study of the classification and genesis of igneous and metamorphic rocks. Emphasis on metamorphic minerals and facies; origin of magmas, volcanic rocks, plutonic bodies, and relations to tectonic environment. \$2 lab fee.

5344. SEDIMENTARY PETROGRAPHY (2-3) 3 hours credit—A study of sedimentary materials from origin through lithification, with emphasis on sedimentary environments. \$2 lab fee.

5346. ADVANCED MINERALOGY (2-3) 3 hours credit—A study of the classification and associations and identification of minerals using X-ray and differential thermal analysis. \$2 lab fee.

5347. PETROLEUM GEOLOGY (2-3) 3 hours credit—A study of the origin, migration, and entrapment of hydrocarbons. \$2 lab fee.

5191, 5291. SPECIAL STUDIES IN GEOLOGY—This course will vary in credit according to the work performed. It may be repeated for credit when the topics change.

5698. THESIS—Research for and preparation of the master's thesis.

*The Coordinating Board, Texas College and University System, has granted preliminary approval for a master's degree program in geology at UT Arlington. It is anticipated that final approval for implementation of the program will be given in July 1970.

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 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 and Doctor of Philosophy degrees have been presented in other sections. 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.

5309. THIN SHELL CONCRETE STRUCTURES (3-0) 3 hours credit—This course covers the general theory of thin shells including membrane theory for domes, shells of double curvature such as hyperbolic and elliptic paraboloids, cylindrical shells and folded plates. Analysis and design are included. Prerequisite: civil engineering 5312 or equivalent.

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

5321. SUPPLY AND TREATMENT OF WATER (3-0) 3 hours credit—This course covers the pertinent physical, chemical, and biological properties of water and considers the hydrology, statistics, and planning necessary to develop water supplies. Physical and chemical water treatment methods are presented.

5322. WASTE WATER TREATMENT (3-0) 3 hours credit—This course presents the methods used in conducting municipal and industrial waste surveys, and the physical, chemical, and biological techniques used in the purification of waste waters.

5325. GROUND-WATER HYDROLOGY (3-0) 3 hours credit—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.

5330. CHARACTERISTICS OF TRAFFIC (3-0) 3 hours credit —The fundamental elements of traffic—the driver, the vehicle, and the roadway—are considered and then extended into studies of streams of traffic flow. Emphasis is placed on speed, volume, and density relationships and methods of measuring each. Capacity and levels of service are introduced along with some basic theories of traffic flow. Parking and parking terminal concepts are included as well as accident studies. Prerequisite: civil engineering 4301 (Highway Engineering).

5331. TRAFFIC ENGINEERING OPERATIONS (3-0) 3 hours credit — Methods of traffic regulation and control optimization are considered. Topics such as traffic intersection design and control are included as well as the operation of traffic signal network systems. Techniques of conducting traffic engineering studies are introduced along with a study of traffic engineering functions and administration. Analysis and design techniques involving capacity and the level of service concept are included. Prerequisite: civil engineering 4301 (Highway Engineering).

5332. HIGHWAY DESIGN (3-0) 3 hours credit—This course emphasizes geometric considerations necessary for the design of city streets, highways, and freeways such as the cross sections, vertical and horizontal alignment, sight distances as well as the design of maneuver areas, ramps, intersections, and interchanges. The design of pavements is also covered including both flexible and rigid pavement types. Prerequisite: civil engineering 4301 (Highway Engineering).

5337. URBAN TRANSPORTATION PLANNING (3-0) 3 hours credit — The theory and application of comprehensive urban transportation planning technology are included in this course. The basic studies of population, urban economics, land use, sim-

ulation models, forecasting trip generation and distribution, traffic assignment modal split, system design and evaluation, mass transit characteristics, and special problems in the operation of transportation systems, are covered.

5338. URBAN PLANNING THEORY AND STUDIES (3-0) 3 hours credit — The course covers the relationship of physical planning to the general theory and process of planning, real estate, economics and normative theory of urban organization, urban land use planning and forecasting, and urban landscape. Site engineering and transportation geography related to aesthetic values, the relationship of environmental engineering and urban ecological patterns, application of engineering processes to the social system, housing, and the total cultural milieu are also included.

5339. METROPOLITAN PLANNING AND ADMINISTRATION (3-0) 3 hours credit—The history of planning controls in the United States, organization and structure of local and regional planning administration, theory and functions of management and principles of organization, are covered in this course. The engineering systems approach related to problems in population growth, social stratification, and governmental fragmentation problems are studied. Principles of municipal public works administration and capital improvements programming, and planning and engineering techniques related to contemporary political science in urban America are also included.

5345. ADVANCED METHODS IN SANITARY ENGINEERING (2-3) 3 hours credit — This course includes the standard laboratory techniques used to characterize wastes and introduces advanced sanitary engineering theories and practices. Current research topics and methods are included.

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.

5348. SURFACE-WATER HYDROLOGY (2-3) 3 hours credit —This course encompasses the study of the hydrologic cycle, elements of hydrometeorology, infiltration and soil moisture, runoff, rainfall-runoff relationships and the effects of these factors with regard to utilization and conservation of water resources.

5350. FLEXIBLE PAVEMENT DESIGN (2-3) 3 hours credit —This course involves a study of the loads on pavements, stress analysis in flexible pavements, and design practices. Certain laboratory procedures involved in the design of flexible pavements are included.

5352. DESIGN OF WATER AND WASTE WATER TREATMENT UNITS (2-3) 3 hours credit—Problems encountered in the design of water and wastewater treatment plants are covered in this course.

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.

6301. TRANSPORTATION MODELING (3-0) 3 hours credit —The theory and application of advanced techniques in statistics, simulation, aerial photogrammetry, and data processing are



considered in connection with the solution of problems in transportation and traffic design and research. Prerequisite: computer science 3201, mathematics 3311 or equivalent.

6302. HIGHWAY CAPACITY (3-0) 3 hours credit—Rational methods for the determination of highway and street capacities are considered. Emphasis is given to street intersection capacities, ramp and weaving section capacities, and freeway capacities. The level of service concept is utilized and factors affecting the level of service as well as the capacity are considered.

6303. RIGID PAVEMENT DESIGN (3-0) 3 hours credit—The theory of rigid pavement design is covered in this course along with current design practices and methods of construction.

6304. HYDROMETEOROLOGY (3-0) 3 hours credit—Among topics to be covered are these: general meteorology and climatology, atmospheric variables, cloud and precipitation physics, techniques of precipitation analysis, probable maximum precipitation, rainfall frequency and weather modification.

6305. WATER RESOURCES PLANNING (3-0) 3 hours credit—Historical and present concepts in water development. Systems approach to development of water resources. Current problems and policies with regard to water resources allocation and administration, General principles and procedures of water resource planning within a regional, multi-purpose context with economic considerations.

6306. DESIGN OF DAMS AND APPURTENANCES (3-0) 3 hours credit—Principles used in the design of large earth and concrete dams, diversion works and appurtenances. Prerequisite: civil engineering 5347 and 6307.

6307. OPEN CHANNEL FLOW AND SEDIMENTATION (3-0) 3 hours credit—Steady flow in open channels. Basic principles, velocity formulas, backwater curves, flow through transitions, obstructions, and bends. Unsteady flow in open channels. Nature of water-borne sediment and sediment transport.

6308. FOUNDATION DESIGN PRACTICES (3-0) 3 hours credit—Subsoil investigations, sheeting and bracing, control of ground water, shallow foundations, bridge abutments, economic considerations.

6309. THEORETICAL SOIL MECHANICS (3-0) 3 hours credit—Concepts of stress, strain and stress distribution in soils, shearing properties of saturated soils, consolidation for multidirectional flow and time—dependent loading, physiochemical properties, secondary consolidation, partially saturated soils.

6310. SOIL DYNAMICS (3-0) 3 hours credit—Vibrations of simple oscillators, wave propagation in elastic media, dynamically loaded foundations, blast and earthquake resistant design of foundations.

6311. ROCK MECHANICS (3-0) 3 hours credit—Elements of elasticity, rock properties and behavior. Theories of failure for brittle, jointed and anisotropic rocks, theory of in-situ and laboratory testing.

6312. THEORY OF STRUCTURES I (3-0) 3 hours credit—This course presents a study of the classical methods of structural analysis. Topics include deflections, consistent deformations, column analogy, slope deflection, moment distribution, Castigliano's theorems and influence lines for continuous structures. The relationship between the classical methods and matrix methods is discussed. Prerequisite: civil engineering 4324.

6313. THEORY OF STRUCTURES II (3-0) 3 hours credit—A continuation of Theory of Structures I, this course presents a

study of the theory of arches, rings, rigid frames, three dimensional frames and trusses, cable supported structures, long span continuous structures and statically indeterminate continuous trusses. Classical methods and energy methods are emphasized. Prerequisite: civil engineering 6312.

6314. THEORY OF STRUCTURES III (3-0) 3 hours credit—This course presents theoretical methods for obtaining stiffness coefficients, carry-over factors and fixed end moments for continuous beam-columns and beams and frames with elastic supports. Modified moment distribution methods are utilized to obtain solutions to complex problems. Prerequisite: civil engineering 4310 or 6312.

6315. NUMERICAL METHODS FOR STRUCTURES I (3-0) 3 hours credit—This course deals primarily with non-prismatic members. Topics considered include: deflections, stiffness factors, carryover factors, fixed-end moments, elastic supports, beam columns, buckling and frequencies of vibration. Newmark's method and finite difference solutions are utilized, with the student solving problems on the IBM 1620 MODEL II-D Computer. Prerequisite: computer science 3201 and civil engineering 4310 or 5310.

6316. NUMERICAL METHODS FOR STRUCTURES II (3-0) 3 hours credit—This course deals with the finite element method for analysis of complex structures. Topics include structural stiffness, finite elements of a continuum, plane stress and strain, axi-symmetric stress analysis, application to plate and shell structures and eigenvalue problems. Prerequisite: civil engineering 4310 or 6312, and 6317.

6317. MATRIX METHODS FOR STRUCTURES (3-0) 3 hours credit—This course covers the fundamentals of matrix algebra, the solution of simultaneous linear equations and the application of matrix algebra to the stiffness and flexibility methods of structural analysis. Prerequisite: computer science 3201 and civil engineering 4310 or 6312.

6318. BEHAVIOR OF STRUCTURES UNDER DYNAMIC LOADS (3-0) 3 hours credit—This course includes the following topics: single and multiple degree of freedom systems, response of structures to wind forces, earthquakes, wave forces and blast forces; the effect of dynamic forces on material properties. Discussions will include the response of structures above ground and below ground and various design codes related thereto. Prerequisite: civil engineering 4310 or 6312, and 6317.

6319. APPLIED ELASTICITY (3-0) 3 hours credit — This course presents the theory of elasticity from the point of view of mathematical concepts as well as its application in structural design. Closed methods of solution and relaxation methods are utilized to solve problems dealing with beams, columns and other members with respect to shear, flexure and torsion. Prerequisite: civil engineering 4310 or 4324 or 6312.

6320. STABILITY OF STRUCTURES (3-0) 3 hours credit—This course considers the theory concerning elastic and inelastic stability and its application in structural design. Buckling loads are obtained for various types of structural elements having a variety of support conditions. Prerequisite: civil engineering 4310 or 4324 or 6312.

6321. PLATE STRUCTURES (3-0) 3 hours credit—This course presents a study of plates and slabs considering various materials. Methods of analysis and design are emphasized after theoretical concepts are fully developed. Flat plates and folded plates



are considered using various support conditions. Prerequisite: civil engineering 4310 or 6312.

6322. PRESTRESSED CONCRETE (3-0) 3 hours credit—This course includes discussions concerning materials and methods used in prestressing; design of sections for flexure, shear and anchorage; camber, deflections and cable layouts. Simple spans, continuous beams, prestressed piles and prestressed tanks are included in the topics discussed. Prerequisite: civil engineering 4347.

6323. PRINCIPLES OF ENVIRONMENTAL HEALTH ENGINEERING (3-0) 3 hours credit—This course is concerned with man and his environment and presents engineering methods of controlling communicable disease vectors, epidemiology, and a survey of public health engineering.

6324. INDUSTRIAL HYGIENE AND TOXICOLOGY (3-0) 3 hours credit—Industrial health hazards and methods of controlling them will be studied. The course includes a survey of health hazards in industry, the toxicity of industrial gases, vapors, and dusts, and methods of eliminating hazards.

6325. AIR POLLUTION SOURCES AND CONTROL (3-0) 3 hours credit—The types and sources of atmospheric pollutants, techniques used to predict the dispersion of pollutants, and methods used to control atmospheric emissions are included in this course.

6326. INDUSTRIAL WASTE TREATMENT (3-0) 3 hours credit—This course presents the specialized physical, chemical, and biological treatment schemes required to treat specific industrial wastes.

6327. HIGHWAY PLANNING, ECONOMICS AND FINANCE (3-0) 3 hours credit—This course is a study of the nature of highway transport, needs studies, planning surveys, classification and administration, forecasting and programming, the basis of economic analysis and feasibility studies, vehicle operating costs, apportionment formulas and other considerations of finance. The functioning of highways as a regional system will be stressed.

6328. PLANNING AND DESIGN OF AIRPORTS (3-0) 3 hours credit—This course is a study of the growth and demand of air transport, air traffic control systems, airport site selection and configuration, geometric design of runways and taxiways, terminal areas, lighting, structural design of pavements and drainage problems. The design of heliports and special short take-off facilities are also considered.

6197-6997. RESEARCH IN CIVIL ENGINEERING (variable credit as arranged)—This course may be repeated for credit.

6699. DISSERTATION (6 semester hours)—Preparation pertaining to the doctoral dissertation. Prerequisite: admission to candidacy for the doctor of philosophy degree.

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. Numer-

ical 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 multi-story 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.

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 con-



veyance systems, open and closed aqueducts, and pumpage facilities.

4360. ELEMENTS OF PHOTOGRAMMETRY (2-3) 3 hours credit—Photogrammetry optics and characteristics of aerial cameras are studied as an introduction to characteristics of aerial photographs, map projections, radial plot mosaics and mapping from oblique photographs. Ground control and interpretation of aerial photographs are also included. Emphasis will be placed on the use of stereoscopic plotting instruments and associated data processing units. Prerequisite: civil engineering 2342 (Advanced Surveying), computer science 3101 (Introduction to Computer Science) and senior standing.

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 and Doctor of Philosophy degrees have been presented in other sections. 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.

5304. FUNDAMENTALS OF POWER SYSTEM ENGINEERING (3-0) 3 hours credit—Matrix representations and characteristic values and vectors of power systems elements.

5305. ADVANCED COMPUTER METHODS IN POWER SYSTEM ANALYSIS (3-0) 3 hours credit—Advanced computer methods in short circuit and load flow studies. Prerequisite: electrical engineering 5304 or equivalent.

5306. ADVANCED COMPUTER METHODS IN POWER SYSTEM ANALYSIS (3-0) 3 hours credit—Advanced computer methods in economical load dispatching and power system stability. Prerequisite: electrical engineering 5304 or equivalent.



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- 5307. ADVANCED ELECTRICAL MACHINE THEORY (3-0)** 3 hours credit—Advanced studies of rotating machines including dynamic and steady state behavior in combination with the connected power system.
- 5310. STATISTICAL TECHNIQUES IN POWER SYSTEM ENGINEERING (3-0)** 3 hours credit—Introduction to probability theory as applied to power system analysis. Reliability study of power systems.
- 5311. STATE ESTIMATION THEORY AND COMPUTER CONTROL OF POWER SYSTEMS (3-0)** 3 hours credit—Discussion of topics in power system state estimation and computer control of power systems.
- 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 3312 (Electrical Science V) 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.
- 5315. SYSTEMS ENGINEERING (3-0)** 3 hours credit—An introductory course in the mathematical foundations of systems engineering. Both continuous and discrete data systems are considered. Prerequisite: consent of instructor.
- 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 nondeterministic. 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 (Complex Variables).
- 5319. NETWORK SYNTHESIS III (3-0)** 3 hours credit—A continuation of passive network synthesis, with emphasis on transfer function synthesis. Related topics such as predistortion, single and double terminations, and low-pass to band-pass transformations are included. Prerequisite: electrical engineering 5318 or equivalent.
- 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.
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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.

5322. RANDOM SIGNALS AND NOISE (3-0) 3 hours credit—Probability, random variables, stochastic processes in physical systems, signal detection, design of optimum filters are included.

5323. STATISTICAL DETECTION AND ESTIMATION THEORY (3-0) 3 hours credit—Statistical detection or decision theory and estimation theory as applied to modern communications systems, radar/sonar systems, stochastic control theory, and data processing systems. Prerequisite: electrical engineering 5322.

5326. ADVANCED COMMUNICATION THEORY (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. Prerequisite: electrical engineering 5322, 5323.

5327. INFORMATION THEORY AND CODING (3-0) 3 hours credit—Transmission of information over noisy channels, Shannon's coding theorems, techniques of coding and decoding for reliable transmission over noisy channels, error-detecting and error-correcting codes. Prerequisite: electrical engineering 5322.

5328. LOGIC CIRCUITS II (3-0) 3 hours credit—Systems design of digital machines, including general purpose computers, with special emphasis on control units and arithmetic units. Prerequisite: electrical engineering 5442 or equivalent.

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—Magnetofluidynamics equations, Alfvén and shock waves. Magneto-hydrodynamic channel flows: Hartman, Couvette, 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.

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



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6. Electromagnetic Theory and Practices
 7. Engineering Analysis

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

5442. LOGIC CIRCUITS I (3-3) 4 hours credit—Fundamental theory of logic circuits, including binary arithmetic, Boolean algebra, Karnaugh map, minimization and synthesis methods. Laboratory included. \$5 lab fee.

5444. ADVANCED SEMICONDUCTOR DEVICES (3-3) 4 hours credit—Theory, construction, and application of semiconductor devices with emphasis on use of such devices in monolithic integrated circuits. Laboratory included. Prerequisite: electrical engineering 5303 or equivalent. \$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.

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.

6397, 6697, 6997. RESEARCH IN ELECTRICAL ENGINEERING (3, 6 or 9 hours credit)—Individually approved research projects leading to a doctoral dissertation in the area of electrical engineering.

6699. DISSERTATION. (6 hours credit)—Preparation and submission of a doctoral dissertation in an area of electrical engineering. Prerequisite: admission to candidacy for the PhD in 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 3312 (Electrical Science V) or equivalent.

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: electrical engineering 3316 (Circuits).

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 3312 (Electrical Science V) or equivalent.

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 3312 (Electrical Science V) or equivalent.

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. Prerequisite: electrical engineering 4330 (Information Transmission) or equivalent.

4332. ELECTRONIC DEVICES (3-0) 3 hours credit — This course is a study of various important electronic devices, including controlled rectifiers, photoelectric devices, integrated circuit devices, and others. Both theory of device operation and important circuit applications are discussed. Prerequisite: electrical engineering 3304 (Electrical Circuits).

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 of power system problems. Prerequisite: senior standing.

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.

4336. DIGITAL CIRCUITS (3-0) 3 hours credit—Binary arithmetic, Boolean algebra, and Karnaugh maps are discussed at the beginning of the course. Then, various logic circuits such as AND, OR, NAND and NOR gates are studied in detail. These circuits are used in the synthesis of combinational logic circuits. Also included in the courses are studies of multivibrators, counters and shift registers. Prerequisite: electrical engineering 3303 (Electrical Science IV).

4337. COMPUTING CIRCUITS (3-0) 3 hours credit—This course is a study of the methods of applying analog computers to determine the response of dynamic systems. Programming techniques for linear, nonlinear and time-variable systems are considered. Set-up and checkout procedures are discussed. Methods are presented to determine probable solution errors, and techniques of error analysis are presented. Prerequisite: mathematics 3318 (Differential Equations).

4339. DESIGN OF ELECTRONIC CIRCUITS (3-0) 3 hours credit—Analysis techniques are applied to electronic circuits to obtain design equations. The use of parametric studies in design decision making is discussed. Design techniques, including worst-case design, are illustrated in several design projects in which the student designs a circuit to meet practical specifications. The effects of cost, reliability, and environment on design are stressed. Prerequisite: electrical engineering 3304 (Electronic Circuits).



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. The program is interdisciplinary. Applicable courses may be found in the areas of aerospace, civil, electrical, and mechanical engineering and materials science.

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—Semiformal 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: aerospace engineering 4331 (Mechanical Vibrations) or equivalent; aerospace engineering 3303 (Aerodynamics I) or equivalent, or permission of instructor.

5317. STRUCTURAL STATICS (3-0) 3 hours credit — Static response of complex structures by use of finite element methods is discussed. The matrix displacement and matrix force methods are applied to determine deflections and stresses. Analytical methods are emphasized and computer applications are undertaken. Prerequisite: engineering mechanics 5311 and consent of instructor.

5318. STRUCTURAL DYNAMICS (3-0) 3 hours credit—Free, transient, and random response of elastic structural systems are discussed. Computational aspects of these problems are studied. Prerequisite: engineering mechanics 5323 or consent 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: permission of instructor.

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 studied. Free and forced vibration of elastic systems with many degrees of freedom are considered including damping effects. Prerequisite: aerospace engineering 4331 (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: aerospace engineering 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 answers are required. All widely used methods for solving



INDUSTRIAL ENGINEERING

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.

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. \$4 lab fee.

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.

6197-6997. RESEARCH IN ENGINEERING MECHANICS (Variable credit 1 to 9 semester hours as arranged)—This course may be repeated for credit.

6699. DISSERTATION (6 semester hours)—Prerequisite: admission to candidacy for the Doctor of Philosophy.

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 and Doctor of Philosophy degrees have been presented in other sections. 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, MAINTAINABILITY, AND SAFETY (3-0) 3 hours credit—Methods of reliability, maintainability, and safety analysis, measurements, prediction, and design integration are presented. Associated human factors are considered, as well as quantitative methods for isolating, reporting, and predicting failure mechanisms induced by man and/or machine in complex systems. Consideration is also given to cost-effectiveness trade-offs, and systems operability confidence. Prerequisite: industrial engineering 3301 (Engineering Probability), industrial engineering 5317, or consent of instructor.

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.

5317. ENGINEERING PROBABILISTICS, STOCHASTICS, AND STATISTICS I (3-0) 3 hours credit—Sets and set algebra; sample spaces; combinatorics; absolute and conditional probability; discrete and continuous random variables; increment and density functions; fundamental statistical concepts; significance tests, confidence limits, binomial and normal distributions and Bayesian inference, with descriptive statistics and influence. Prerequisite: mathematics 2325 (Calculus).

5318. ENGINEERING PROBABILISTICS, STOCHASTICS, AND STATISTICS II (3-0) 3 hours credit—Laplace-Fourier transforms; law of large numbers; central limit theorems; discrete and continuous stochastic processes; efficient computational procedures; risk, power functions, operating characteristic curves; simple and multiple regression; bivariate normal distribution; analysis of variance; applications in engineering and industry. Prerequisite: industrial engineering 5317, mathematics 2326 (Calculus) or equivalent.

5320. INDUSTRIAL PLANNING AND CONTROL (3-0) 3 hours credit—Analysis of the theory and practice of the managerial function of planning and control in industrial operations. Long-range planning. Development of corporate objectives and strategies. Conversion of strategic plans into current operations. Decision-making as a step in planning.

5321. HUMAN FACTORS IN ORGANIZATION AND MANAGEMENT SYSTEMS (3-0) 3 hours credit—Traditional organization and management theory is reviewed, and the systems approach to management is presented. The managerial system is approached via decision-making processes in planning and control of organizational activities. Both computational techniques and the behavioral aspects of decision making are considered. Prerequisite: industrial engineering 5320 or 4302.

5322. SIMULATION AND OPTIMIZATION I (3-0) 3 hours credit—The course includes a survey and applications of computer languages suitable for Monte Carlo simulation of random processes. Optimization and search techniques of functions will be introduced. Prerequisite: industrial engineering 3301 or mathematics 4311 or consent of instructor.

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) 3 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.

5343. ENVIRONMENTAL BIOTECHNOLOGY (2-3) 3 hours credit—Physical, physiological, and psychological aspects of the interaction between man and thermal, atmospheric, radiant, and mechanical agents and energies in the environment. Biological and physical requirements for engineering design and control of the environment; applications to design of complex systems. Prerequisite: industrial engineering 4305 (Human Factors Engineering) or consent of instructor.

5344. HUMAN FACTORS IN SYSTEMS DEVELOPMENT (2-3) 3 hours credit—A study of human engineering, staffing, training, test and evaluation is made in relation to systems theory. The psychological, physiological, and social factors relevant to systems planning, design, analysis, and management. Methods of increasing systems effectiveness by consideration of personnel subsystems during total system development. Prerequisite: industrial engineering 4305 or equivalent.

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.

6197-6997. RESEARCH IN INDUSTRIAL ENGINEERING (Variable credit from 1 to 9 semester hours as approved)—Individually supervised research projects directed toward the dissertation. Prerequisite: graduate standing in industrial engineering and approval of advisor.

6699. DISSERTATION 6 hours credit—Prerequisite: Admission to candidacy for the Doctor of Philosophy degree.

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



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- 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 operation 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. ECONOMIC 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 3201 (Introduction) or computer science 3306 (Fundamentals) and mathematics 2325 (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 approxi-

mations 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 3201 (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 3341 or 4301 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 3201 or 3306.

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.

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. Will include the definition and writing of compilers for simple languages including some having a nonalgebraic base. Prerequisite: computer science 4306 and 4302.

4306. INFORMATION STRUCTURES (3-0) 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 inter-relationships of data structures. Prerequisite: computer science 3341.

5301. ADVANCED INFORMATION STRUCTURES (3-0) 3 hours credit—Linear lists, strings, arrays, and orthogonal lists. Representation of trees and graphs. Storage systems and structures, and storage allocation and collection. Multilinked structures. Symbol tables and searching techniques. Sorting (ordering) techniques. Formal specification of data structures. Prerequisite: computer science 4341.

5303. ADVANCED COMPUTER AND PROGRAMMING SYSTEMS (3-0) 3 hours credit—A further and more detailed study of input-output and storage systems, structures and transformations of data bases, and executive systems. Also included are the structures of program libraries, program intercommunication, batch processing executive systems, addressing techniques, system accounting and micro-programming. Prerequisite: computer science 4304.



5304. COMPILER THEORY I (3-0) 3 hours credit—Review of program language structures, translation, loading, execution, and storage allocation. Compilation of simple expressions and statements. Organization of a compiler including compile-time and run-time symbol tables, lexical scan, syntax scan, object code generation, error diagnostics, and overall design. Introduction to formal language descriptions (e.g. Backus normal form, Polish notation, etc.) Prerequisite: computer science 4305.

5305. FORMAL LANGUAGES AND SYNTACTIC ANALYSIS (3-0) 3 hours credit—Definition of formal grammars: arithmetic expressions and precedence grammars, context free and finite-state grammars. Algorithms for syntactic analysis: recognizers, backtracking, operator precedence techniques. Semantics of grammatical constructs: reductive grammars, simple syntactical compilation. Prerequisite: computer science 4305.

5306. INFORMATION ORGANIZATION AND RETRIEVAL (3-0) 3 hours credit—Structure of semiformal languages and models for the representation of structured information. Aspects of natural language processing on digital computers. The analysis of information content by statistical, syntactic, and logical methods. Search and matching techniques. Automatic retrieval systems. Evaluation of retrieval effectiveness. Production of secondary outputs. Prerequisite: computer science 4341 and computer science 4302 or concurrent.

5307. COMPUTER ORGANIZATION I (3-0) 3 hours credit—Basic digital circuits, Boolean algebra and combinational logic, data representation and transfer, and digital arithmetic. Digital storage and accessing, control functions, input-output facilities, system organization and reliability. Description and simulation techniques. Features needed for multi-programming multiprocessing and real-time systems. Prerequisite: computer science 4304.

5309. ADVANCED COMPUTATIONAL METHODS FOR ENGINEERS AND SCIENTISTS I (3-0) 3 hours credit—Selected topics from the theory and practice of using automatic digital computers for approximating arithmetic operations, approximating functions, solving systems of linear and non-linear equations, computing eigen-values and solving ordinary and partial differential equations. Prerequisite: computer science 3201 or equivalent and graduate standing in engineering or science.

5310. ADVANCED COMPUTATIONAL METHODS FOR ENGINEERS AND SCIENTISTS II (3-0) 3 hours credit—A continuation of computer science 5309. Topics in matrix operations, iterative procedures, quadrature, solution of differential equations, boundary value determination and simulation of physical processes will be studied in context of computer applications. Prerequisite: computer science 5309 or 4301 and consent of instructor.

5311. ADVANCED COMPUTER SYSTEMS I (3-0) 3 hours credit—This course goes into the structures of batch processing and time-sharing systems, their components, operating characteristics, user services and limitations. Implementation techniques for parallel processing of input-output and interrupt handling. Structure of multiprogramming systems on multiprocessor hardware configurations. Details on addressing techniques, core management, file system design and management, system accounting, and other user related services. System updating, documentation, and operation. Prerequisite: computer science 4304.

5330. THE COMPUTER AND NATURAL LANGUAGE (3-0) 3 hours credit—This course is for students of literature, linguis-

tics, and computer science interested in using the computer as a research tool in processing natural language. The course consists of a survey of computer applications in processing natural language, an introduction to programming the computer to manipulate natural language, and exploration of appropriate programming languages and useful programming techniques. This course is also listed as English 5330 and Linguistics 5330. Credit will be granted for one of the courses only.

5392. SELECTED TOPICS IN ADVANCED COMPUTER SCIENCE (3-0) 3 hours credit—May be repeated for credit when the topics vary. Prerequisite: Graduate standing and consent of instructor.



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 and Doctor of Philosophy degrees are presented in other sections. 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).

5303. CLASSICAL METHODS OF CONTROL SYSTEMS ANALYSIS AND SYNTHESIS (3-0) 3 hours credit— This course is intended to equip the student with a detailed familiarity with the historically significant tools of the control engineer. Detailed discussion of block diagram algebra, signal flow algebra, the amplitude ratio-frequency and phase shift angle-frequency plots, the Bode diagram, the Nyquist diagram, the Nichols chart and the root locus is presented.

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.

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.

5307. MODERN SYSTEMS ENGINEERING TECHNIQUES (3-0) 3 hours credit—This course introduces the tools of sampled-data theory and modern control theory and treats numerical control problems taken from local industry. Prerequisite: mechanical engineering 5331 and 5333.

- 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. INTRODUCTION TO SYSTEMS OPTIMIZATION (3-0) 3 hours credit**—The fundamental theorems of the classical calculus of variations, and of the Maximum Principle of Pontryagin are the essential content of course. Examples from the area of Mechanical Engineering Systems serve to demonstrate the applications.
- 5310. PLASMA DYNAMICS (3-0) 3 hours credit** — The elements of electromagnetic field theory, kinetic theory and statistical mechanics of gases are applied to electrical conduction in ionized gases and the derivation of MHD flow equations.
- 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 (3-0) 3 hours credit**—Magnetogasdynamics is a continuation of mechanical engineering 5310. The MHD flow equations are applied to such areas as power generation, space propulsion, boundary layer phenomena, and control of re-entry bodies.
- 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.



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- 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.
- 5327. NUMERICAL CONTROL OF MACHINE TOOLS (3-0) 3 hours credit**—The basic elements of numerical control of metal processing systems are studied; programs for point to point and contouring machines are developed; the interactions between geometry and machinability decisions are determined.
- 5328. ADVANCED MANUFACTURING ANALYSIS I (3-0) 3 hours credit**—Studies are made of the technical aspects of manufacturing, emphasizing process design and equipment. Prerequisite: mechanical engineering 4307 (Manufacturing Analysis) or equivalent.
- 5329. FORMING OF METALS (3-0) 3 hours credit**—Theoretical studies are made of various metal forming processes; elastic and plastic stress-strain relations are developed; the effects of strain hardening are considered.
- 5330. METAL CUTTING (3-0) 3 hours credit**—Metal cutting operations are studied with special emphasis on machine tool, cutting tool and work material behavior.
- 5331. ANALYTIC METHODS IN ENGINEERING (3-0) 3 hours credit**—In this course an introduction to advanced analytic methods is given. These are applied transform and matrix methods, and the elements and engineering applications of complex variables. Prerequisite: undergraduate degree in engineering, physics, or mathematics.
- 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.
- 5333. MECHANICAL ENGINEERING ANALYSIS TECHNIQUES (3-0) 3 hours credit**—The purpose of this course is to add depth to the students' capability in the use of general transform techniques. Topics which are treated include the Fourier, Laplace, Z, Henkel, LeGendre, and Mathieu transform as well as the computer-oriented Fast Fourier transforms. Prerequisite: undergraduate degree in engineering, physics, or mathematics.
- 5334. STOCHASTIC SYSTEMS (3-0) 3 hours credit**—Techniques for determining the response of systems to random inputs and random system components are developed and used. Prerequisite: mechanical engineering 5333.
- 5335. OPTIMAL LINEAR SYSTEMS (3-0) 3 hours credit**—Optimal Linear Systems is a detailed coverage of the work to date on that class of problems. Subjects are the Kalman Regulator and others in this class, optimal parameters, non-analytic criteria and gradient techniques. Prerequisite: mechanical engineering 5309.
- 5336. DESIGN AND CREATIVITY (3-0) 3 hours credit**—This course is an introduction to the philosophy of comprehensive design. The creative process and the factors that influence it are emphasized with a discussion of the attitudes and viewpoints of the designer and an investigation of techniques of analysis, synthesis, and evaluation.
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5337. DESIGN ANALYSIS I (3-0) 3 hours credit—Common machine elements and mechanisms are analyzed and limitations on analysis arising from modeling techniques are considered.

5338. DESIGN ANALYSIS II (3-0) 3 hours credit—Design concepts, life design, fatigue and failure, thermal stress and the elements of optimal design are studied.

5341. CONTROL SYSTEM COMPONENTS (2-3) 3 hours credit — Hydraulic, pneumatic, and electro-mechanical component and system characteristics are determined; component reliability is related to system reliability, and systems are simulated on analog and digital computer equipment.

5345. DESIGN PROJECT I (2-3) 3 hours credit—The student uses rational and intuitive problem-finding procedures to identify a design project, presents a project proposal, performs research, and prepares a design program. The creative aspects of design are emphasized.

5346. DESIGN PROJECT II (2-3) 3 hours credit—This course is a continuation of mechanical engineering 5341 in which a project is carried to the working prototype. Cost and production are considered.

5191, 5291, 5391. ADVANCED STUDIES IN MECHANICAL ENGINEERING (Variable credit from 1 to 3 semester hours as arranged)—May be repeated for credit as topics change.

5192, 5292, 5392. ADVANCED TOPICS IN HEAT TRANSFER (Variable credit from 1 to 3 semester hours)—Various special topics in heat transfer will be covered. May be repeated for credit as topics change.

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

6331. COMPUTER METHODS IN SYSTEMS ANALYSIS (3-0) 3 hours credit—This course provides background and experience in the use and developments of Fortran-coded digital computer programs for large-scale systems analysis and synthesis. Prerequisite: mechanical engineering 5307, 5303.

6332. ESTIMATION THEORY (3-0) 3 hours credit—Means of treating measurements to obtain a best estimate of the quantities measured are presented. The emphasis is on application to dynamic systems. Prerequisite: mechanical engineering 5303, 5307, 5331.

6333. APPLIED DIFFERENTIAL GAME THEORY (3-0) 3 hours credit—The fundamentals of differential game theory are introduced, and application in the area of system optimization in the presence of uncertainties and two player zero-sum games are discussed. Prerequisite: mechanical engineering 5309.

6334. APPLICATION OF OPTIMIZATION TECHNIQUES (3-0) 3 hours credit—Dynamic, linear, non-linear and geometric techniques are introduced. Prerequisite: mechanical engineering 5331 and 5333.

6197-6997. RESEARCH IN MECHANICAL ENGINEERING (Variable credit 1 to 9 semester hours as arranged)—This course may be repeated for credit.

6699. DISSERTATION (6 semester hours)—Prerequisite: admission to candidacy for the Doctor of Philosophy degree.



AEROSPACE OPTION

Aerospace Engineering

5301. ADVANCED AERODYNAMICS (3-0) 3 hours credit—This course may be repeated for credit as topics change. Topics include the following: hypersonic aerodynamics, transonic aerodynamics, unsteady aerodynamics and optimum aerodynamic shapes.

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.

5303. AERODYNAMICS OF WINGS AND BODIES (3-0) 3 hours credit—This course is the application of classical potential theory to the analysis of the aerodynamics of wings and bodies. A knowledge of complex variable theory is assumed.

5304. INTERNAL AERODYNAMICS (3-0) 3 hours credit —Review of one-dimensional internal aerodynamics, introduction to method of characteristics solutions, internal boundary layer flow patterns, and viscous-inviscid flow interactions. Study of interactions between internal and external flow fields, consideration of propulsion system matching problems for aerospace vehicles.

5305. BOUNDARY LAYER THEORY I (3-0) 3 hours credit—This course contains fundamental laws of motion for a viscous fluid and laminar boundary layer theory from an advanced standpoint. Some aspects of incompressible turbulent boundary layers are introduced.

5306. BOUNDARY LAYER THEORY II (3-0) 3 hours credit —This course is a continuation of 5305. It contains a study of transition phenomena and turbulent boundary layers from an advanced standpoint. The influence of compressibility on boundary layer characteristics is presented. Prerequisite: aerospace engineering 5305.

5307. APPLIED AERODYNAMICS FOR DESIGN (3-0) 3 hours credit—This course introduces non-aerospace engineering majors to sufficient fundamentals of aerodynamics theory to critically evaluate the effect of design features on aerodynamic performance, stability and control.

5308. ADVANCED V/STOL AERODYNAMICS (3-0) 3 hours credit—This course assumes an introductory knowledge of rotary wing aerodynamics. The emphasis is on the more sophisticated aspects of V/STOL aerodynamics. Included are the effects of rotor system dynamics and kinematics, more exact representation of induced velocity fields, and wing-rotor interferences.

5311. ADVANCED ASTRONAUTICS (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. ADVANCED DYNAMICS OF FLIGHT (3-0) 3 hours credit—Topics to be considered are modern course in stability and control. The course may be repeated for credit—This course assumes a comprehensive undergraduate matrix-tensor analysis of flight vehicle motion, prediction of piloted vehicle flying qualities, and V/STOL stability and control analysis.

5316. ADVANCED APPLIED AIRFOIL THEORY (3-0) 3 hours credit—This course is concerned with the application of potential flow theory and boundary layer theory to the problem of optimum design of airfoils, wings, bodies and combinations thereof.

5318. INTRODUCTION TO TURBULENCE (3-0) 3 hours credit—The phenomenological approach is taken to develop the classical methods for understanding turbulent flows; for example jet, wake, and mixing modern layer flows. A survey is made of modern approaches to predictive and correlative techniques. Emphasis is upon development of the student's intuition for treating natural turbulent flows. Prerequisite: approval of the instructor.

5319. HOMOGENEOUS TURBULENCE (3-0) 3 hours credit—The mathematics and intuitive foundations of turbulence are emphasized. Probability theory is used to describe homogeneous turbulent flow characteristics such as velocity, co-variances, and the kinetic energy spectrum. Prerequisite: approval of the instructor.

5191, 5291, 5391. ADVANCED STUDIES IN AEROSPACE ENGINEERING (Variable credit from 1 to 3 semester hours as arranged). May be repeated for credit.

6197-6997. RESEARCH IN AEROSPACE ENGINEERING (Variable credit from 1-9 hours)—This course may be repeated for credit.

6699. DISSERTATION (6 semester hours)—Prerequisite: admission to candidacy for the Doctor of Philosophy degree.

MATERIALS SCIENCE OPTION

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 tarnishing, 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. \$4 lab fee.

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. \$4 lab fee.

5191, 5291, 5391. ADVANCED STUDIES IN MATERIALS SCIENCE—(Variable credit from 1 to 3 semester hours as arranged.) Topics are selected from various branches of materials science. Prerequisite: permission of instructor or graduate advisor.

SOCIAL WORK

OBJECTIVES

The two-year program leading to the master's degree focuses on developing community leaders in the areas of direct social work practice and community social work 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 includes:

1. An understanding of social welfare policy and the social welfare institutions established to translate policy into services.
2. The behavioral, social, economic and political sciences which rationalize practice and the administrative and managerial concepts and principles needed to administer programs.
3. Causes and prevention of social dysfunctioning.
4. The methods, techniques and tools needed to identify, reduce and prevent social problems.
5. Practice under faculty supervision.

Second Year Concentration — Prior to the second year, the student chooses one of the two core areas for concentration: (1) direct practice—service to individuals, families, and small groups; (2) community practice—community organization and planning or administration.

ADMISSION REQUIREMENTS

The 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. Intellectual maturity, emotional stability, and ability and interest in working with people are among the necessary personal qualifications. Letters of reference are required and a personal interview may be required.

DEGREE REQUIREMENTS

The Master of Science in Social Work degree requires the completion of 60 semester hours of class and field instruction, including individual or group research. All work must be completed within one six-year period, and must be completed as a full-time student.

Human Behavior and the Social Environment

5301. HUMAN BEHAVIOR AND THE SOCIAL ENVIRONMENT I (3-0) 3 hours credit—This course will present an overview of the normal social functioning and behavior of the individual within the context of the family, group, community and other social systems. Special emphasis is placed on the inter-relatedness and impact of the physical, emotional, intellectual, cultural and social systems related to the stages of human development.

5202. HUMAN BEHAVIOR AND THE SOCIAL ENVIRONMENT II (2-0) 2 hours credit—A continuation of 5301 with an



expansion of the above content into the areas of psychopathology and social deviance. Prerequisite: 5301 or its equivalent.

5303. HUMAN BEHAVIOR AND THE SOCIAL ENVIRONMENT III (3-0) 3 hours credit—This course, intended for students who select the specialty of direct practice in their second year, is a study of personality theories across historical and theoretical boundaries. The intent is to provide an acquaintance with the variety of fact and opinion, out of which the student can choose that information important for his own practice.

Social Welfare Policy and Services

5211. SOCIAL WELFARE POLICY AND SERVICES I (2-0) 2 hours credit—This course examines how social goals are met by social welfare institutions. Emphasis is placed on understanding the evolution and function of the contemporary American social welfare system. Conceptual schemes are developed for analyzing the structure of social welfare institutions and services. The relationship of the socially sanctioned profession of social work to the social welfare system is also stressed. The formulation of social welfare policy involving the recognition of significant policy issues is explored.

5312. SOCIAL WELFARE POLICY AND SERVICES II (3-0) 3 hours credit — This course examines in greater detail the structure and dynamics of the American social welfare system. An analytic scheme is developed and utilized for evaluating selected social welfare sub-systems. Increased emphasis is placed on understanding the processes of social welfare policy formulation and implementation. This includes the analysis of designated social welfare programs and services. Prerequisite: 5211 or its equivalent.

5213. SOCIAL WELFARE POLICY AND SERVICES III (2-0) 2 hours credit—This course will examine significant policy issues and problems in specific substantive areas—for example, mental health and child welfare—through the development and testing of an analytic model. Among the issues to be considered are those of problem definition, client identification, manpower, and organization and delivery of services. Through analysis of these inter-related issues substantive knowledge will be developed. Prerequisite: permission of the instructor.

5214. SOCIAL WELFARE POLICY AND SERVICES IV (2-0) 2 hours credit — This integrating course focuses on issues and problems of broad concern to the profession of social work. Members of the faculty will serve as consultants and resource persons to seminar members who will be required to make analyses and presentations on issues that predict as well as apprehend the urgent concerns of the social work profession. Prerequisite: 5312 or equivalent.

Direct Practice

5221. SOCIAL WORK PRACTICE I (2-0) 2 hours credit—Required of all first year students, this course is an introduction to a model of direct practice with clients on which to organize the concepts and principles of social work practice: (1) the client interacting with his primary group, (2) the social worker/client situation, (3) the social worker/primary group—including the profession and the agency and the school. Emphasis is placed on the social worker establishing a working relationship with the

client, the use of a professional self (awareness, knowledge, skill) to help another, understanding the client and his needs in the context of the client's life situation, understanding the client in the context of the helping situation, and influencing the client to take effective and appropriate action to gain satisfactions and security in life.

5222. SOCIAL WORK PRACTICE II (2-0) 2 hours credit—Required of all first year students, this is a continuation of Social Work Practice I with the content extended to include crisis intervention, work with dyads, families and small groups. Case material from the student's on-going field experience is utilized. Prerequisite: 5221 or equivalent.

5323. SOCIAL WORK PRACTICE III (3-0) 3 hours credit—This seminar provides for an intensive study of social work practice theory stressing the development and use of the principles of diagnosis, relationship, structure, function, and process. This is done by critical analysis of selected case material involving the students' own field practice, which focuses on specifics and uniqueness of situations. Emphasis is also on self awareness and the responsible, disciplined creative use of self as a professional helper. Attention is given to form in helping the client or family partialize and focus on the problem. Depth is stressed through focus on one method (casework) and one model. Prerequisite: 5222 or equivalent.

5324. SOCIAL WORK PRACTICE IV (3-0) 3 hours credit—Emphasis is given to diversified ways of helping within the context of a firm base of practice principles. The course will be divided into two parts; the first part focuses on deepening the skill of the student by study and application of principles and concepts of casework practice. Recorded material from the student's practice is used to assess and apply these concepts. Comparative study of current casework theory and family therapy, including an examination of selected current research, will be covered through readings and class discussion. The second part is an introduction to other practice methods: supervision, consultation, and administration. Administration and educational aspects of supervision, philosophy, principles and techniques related to process are discussed. The significance of role, purpose and authority in consultation will be considered. Case material will be used from the student's present or past experiences in supervision, consultation or administration. Prerequisite: 5323 or equivalent.

5225. DIRECT METHODS WITH GROUPS (2-0) 2 hours credit—Introduction to social group work, concepts, principles and practice. Focus is on a theoretical understanding of the total group and its process; the individual, his function and the effect of group life; role of the group worker as enabler and change agent and the use of program as a dynamic element.

Community Practice

5231. COMMUNITY PRACTICE I (2-0) 2 hours credit—An introductory survey course of community organization, social planning, administration, and management, with emphasis on common areas of knowledge and practice skills. The development of analytical approaches to the understanding of community and organizational phenomena. Illustrations are given to aid in understanding theoretical concepts. Beginning development of rational analytical schemes to guide the practitioner in his choice of strategies and tactics.



5232. **COMMUNITY PRACTICE II (2-0) 2 hours credit**—Community social and related service systems and their interrelationships will be reviewed. The client systems of the administrator, community planner, and community organizer will be identified. Methodologies in problem identification and analysis will be reviewed. The respective roles of the community practitioner, related professional disciplines, and the citizen participant will be studied for their respective utility. Trends in planning will be reviewed and a general problem resolution model developed. Prerequisite: 5231.

5233. **ADMINISTRATION (2-0) 2 hours credit**—Study of the principles and processes of administration; organization and administration in social welfare organizations; role of the administrator. Theories of organizational behavior and their significance for the administrator will be studied.

5234. **COMMUNITY PROBLEM SOLVING (2-0) 2 hours credit**—This course will review a series of social planning models, analyzing their respective capabilities. A review of selected planning techniques. Prerequisite: 5231 and 5232. or their equivalent.

5235. **SUPERVISION AND CONSULTATION IN PLANNING AND ADMINISTRATION (2-0) 2 hours credit**—An examination of the role of the supervisor and consultant in programs and organizations; administrative, program, and planning consultation techniques, theories, and principles; the administrative roles and requirements in supervision. Prerequisite: 5231 or equivalent.

5236. **ADVANCED ADMINISTRATION (2-0) 2 hours credit**—A review of critical writings and research in administration with a view to identifying selected problems and methodologies in decision making, principles of organization and administration, community relations, and financing. Prerequisite: 5233 or its equivalent.

5237. **ADVANCED PLANNING (2-0) 2 hours credit**—A review of selected current and anticipated national and urban social problems analyzing current planning strategies, their efficacy and relevance. At the conclusion of the course, the student will be expected to develop his own planning practice model. Prerequisite: 5234 or equivalent.

5338. **MANAGEMENT (3-0) 3 hours credit**—Study of the principles of management as applied to social welfare organizations and programs. Social theory knowledge applicable to management will be reviewed. Principles and problems of personnel administration, supervision and leadership, motivation, and communication within an organization will be reviewed.

5136. **ADMINISTRATIVE LEADERSHIP IN SOCIAL PROGRAMS (1-0) 1 hour credit**—This seminar aims to help the student integrate in the final semester the knowledge, skills and values acquired in other courses during the preceding three semesters around the concepts of (a) administrative leadership, (b) social systems, (c) role, (d) organizational behavior, (e) multi-causation of problems, and (f) interdisciplinary approach to problem solving. To the degree possible, the student's own experience during the previous three semesters will be utilized in bringing life and substance to the above concepts as they relate to administrative processes.

Research

5205. **RESEARCH IN SOCIAL WORK SYSTEMS I (2-0) 2 hours credit**—Introduction to social research methodologies and

systems theory which enable a social worker to conceptualize and measure the variables in a practice system. Course content is concerned with the identification and analysis of system structures, communications and controls.

5206. RESEARCH IN SOCIAL WORK SYSTEMS II (2-0) 2 hours credit—This course expands the study of research in social work practice systems. Experiences in analysis of systematic components of individual and group interviews are provided to demonstrate research procedures. Prerequisite: 5205 or equivalent.

5207. EVALUATIVE RESEARCH IN SOCIAL WORK PRACTICE AND PROGRAMS (2-0) 2 hours credit—Building upon knowledge of systematic relationships obtained in the preceding research courses, this course introduces specific research methodology for evaluation of those practice or program enterprises in which the social worker may be engaged. This course completes the technical preparation necessary so the student may engage in a research project in the next semester. Prerequisite: 5206 or equivalent.

5291, 5391, 5491. DIRECTED RESEARCH (2-0, 3-0, 4-0) 2, 3, or 4 hours credit—An individual or small group research project in the student's major area of specialization, with emphasis on applying research principles and procedures through planning and carrying out a delimited study. Prerequisite: 5207 or equivalent.

Field Instruction

5481. FIELD INSTRUCTION I (0-16) 4 hours credit.

5482. FIELD INSTRUCTION II (0-16) 4 hours credit.

5483, 5683. FIELD INSTRUCTION III (0-16, 0-24) 4 or 6 hours credit.

5484, 5684. FIELD INSTRUCTION IV (0-16, 0-24) 4 or 6 hours credit.

Field Instruction is a directed educational experience in social work practice with instruction offered by agency or campus-based faculty members. Offered concurrently with classroom instruction, the field courses offer an opportunity for a student to integrate and utilize classroom content in the context of practice.

Tutorials

5190, 5290, 5390. TUTORIAL 1, 2, or 3 hours credit—Arrangements may be made for a directed and supervised tutorial in a select area of special interest to the student. May be repeated for credit with permission of graduate advisor.

Special Seminars

5192, 5292, 5392. SELECTED TOPICS IN SOCIAL WELFARE 1, 2, or 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.



GRADUATE FACULTY

- ADAMS, DUANE A., *Professor of French (1960)*. B.A., University of Nebraska, 1947; M.A., 1949; Ph.D., Louisiana State University, 1963.
- AMSLER, ROBERT W., *Professor of History (1957)*. B.A., University of Texas at Austin, 1936; M.A., 1940; Ph.D., 1950.
- ANDERSON, JAY EARL, JR., *Assistant Professor of Geology (1969)*. B.S., University of Texas at Austin, 1957; M.A., 1960; Ph.D., 1965.
- ANGUIZOLA, GUSTAVE, *Assistant Professor of History (1966)*. B.A., Evansville University, 1947; M.A., Indiana University, 1948; M.S., Michigan State University, 1953; Ph.D., Indiana University, 1954. Archeology Certificate, American School of Classics, Athens, Greece, 1965.
- ARANGIO, ANTHONY J., *Associate Professor of Social Work (1969)*. B.S., Louisiana State University, 1962; M.S.W., Tulane University, 1964.
- ARMSTRONG, ANDREW T., *Assistant Professor of Chemistry (1968)*. B.S., North Texas State University, 1958; M.S., 1959; Ph.D., Louisiana State University, 1967.
- BAERWALDT, JAMES W., *Assistant Professor of Psychology (1966)*. B.A., Wesleyan University, 1961; M.A., University of Michigan, 1965; Ph.D., 1968.
- BARKER, CALVIN L. R., *Professor of Mechanical Engineering (1960)*. B.S., University of Texas at Austin, 1953; M.S., California Institute of Technology, 1954; Ph.D., 1958. Professional Engineer.
- BARKSDALE, E. C., *Professor and Chairman of the Department of History and Philosophy (1942)*. B.A., University of Texas at Austin, 1928; M.A., 1931; Ph.D., 1941.
- BEAUDRY, HARRY R., *Assistant Professor of English (1966)*. A.B., Rice University, 1952; M.A., Boston University, 1956; Ph.D., Duke University, 1968.
- BENHAM, ANN H., *Assistant Professor of Chemistry (1960)*. B.S., University of Michigan, 1945; M.S., 1947.
- BERNSTEIN, IRA H., *Associate Professor of Psychology (1964)*. B.A., University of Michigan, 1959; M.A., Vanderbilt University, 1961; Ph.D., 1963.
- BISBEE, JAMES R., *Assistant Professor of Social Work (1968)*. B.B.A., University of Texas at Austin, 1941; M.S.W., Tulane University, 1947.
- BLACK, TRUMAN D., *Associate Professor of Physics (1965)*. B.S., University of Houston, 1959; M.A., Rice University, 1962; Ph.D., 1964.
- BLACKWELL, CHARLES C., JR., *Associate Professor of Mechanical Engineering (1966)*. B.A., Rice University, 1955; B.S., 1956; M.S., Southern Methodist University, 1960; Ph.D., University of Arizona, 1966. Professional Engineer.
- BOCK, E. C., *Assistant Professor of History (1966)*. A.B., St. Gregory's College, 1945; M.A., Oklahoma University, 1964; Ph.D., 1966.
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- BOLEN, JAMES C., Assistant Professor of Mathematics (1960). B.A., Texas A & M University, 1954; M.S., 1956; Ph.D., Texas Christian University, 1968.
- BOLEY, ROBERT B., Associate Professor of Biology (1965). B.S., Sam Houston State College, 1949; M.S., Texas A & M University, 1960; Ph.D., Ohio State University, 1963.
- *BOWEN, JAMES N., Associate Professor of Psychology (1963). B.A., Hardin-Simmons University, 1960; Ph.D., University of Texas at Austin, 1963.
- BRAGG, LOUIS H., Associate Professor of Biology (1960) (1964). B.S., North Texas State University, 1953; M.S., 1957; Ph.D., University of Texas at Austin, 1964.
- BURMAN, HAROLD G., Professor of Chemistry (1944). B.S., Dakota Wesleyan University, 1931; Ph.D., Johns Hopkins University, 1935.
- BURNS, JOHN S., Associate Professor of English (1964). B.A., New York University, 1951; M.A., Rice University, 1953; Ph.D., 1964.
- BUSCH, CAROLYN L., Assistant Professor of Spanish (1968). B.A., University of Missouri, 1951; M.A., Columbia University, 1957; Ph.D., University of Maryland, 1965.
- BUTLER, JAMES K., Associate Professor of Biology (1960). B.A., University of Texas at Austin, 1950; M.A., 1952; Ph.D., 1961.
- CAFFEY, JAMES E., Associate Professor of Civil Engineering (1959) (1965). B.S., Texas A & M University, 1965; M.S., 1956; Ph.D., Colorado State University, 1965. Professional Engineer.
- CALLICUTT, JAMES W., Associate Professor of Social Work (1968). B.S., Memphis State College, 1951; MSSW, University of Tennessee, 1958; Ph.D., Brandeis University, 1969.
- CARNEY, MARNA K., Assistant Professor of Economics (1967). B.A., Northwestern University, 1947; M.A., Southern Methodist University, 1965; Ph.D., 1968.
- CASH, FLOYD L., Professor and Acting Chairman of Electrical Engineering (1959). B.S., University of Oklahoma, 1946; M.S., University of Texas at Austin, 1951; Ph.D., 1955. Professional Engineer.
- CHEAVENS, FRANK, Professor of Psychology (1947). B.A., Baylor University, 1927; M.A., University of Texas at Austin, 1946; Ph.D., 1957.
- CHEN, MO-SHING, Professor of Electrical Engineering (1962). B.S., National Taiwan University, 1954; M.S., University of Texas at Austin, 1958; Ph.D., 1962.
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- COOKE, JAMES H., Assistant Professor of Physics (1968). B.A., North Texas State University, 1962; Ph.D., University of North Carolina, 1967.
- CRUMB, STEPHEN F., Professor of Electrical Engineering (1961). B.S., University of Texas at Austin, 1943; M.S., 1948; Ph.D., California Institute of Technology, 1955. Professional Engineer.
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- EVERARD, NOEL J., Professor of Civil Engineering (1960). B.S., Louisiana State University, 1948; M.S., 1957; Ph.D., Texas A & M University, 1962. Professional Engineer.
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- FORTENBERRY, GEORGE E., Associate Professor of English (1955). B.A., Texas Christian University, 1948; M.A., 1951; Ph.D., University of Arkansas, 1967.
- FOX, JOHN N., Assistant Professor of Industrial Engineering (1968). B.S., University of Oklahoma, 1955; M.S., 1962; Ph.D., University of California at Los Angeles, 1967.
- FRANCIS, ROBERT F., Associate Professor of Chemistry (1955). B.S., East Texas State University, 1954; M.S., 1955; Ph.D., Texas Christian University, 1967.
- GAINES, J. H., Associate Professor of Aerospace Engineering and Engineering Mechanics (1966). B.S., University of Texas at Austin, 1957; M.S., 1959; Ph.D., 1966.
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- GOLLADAY, GERTRUDE L., Associate Professor of English (1959) (1965). B.A., West Texas State College, 1946; M.A., University of Denver, 1952; Ph.D., Texas Christian University, 1967.
- GOYNE, ARLIE V., JR., Professor of English (1957). B.A., University of Texas at Austin, 1942; M.A., 1948; Ph.D., 1954.
- GREEN, GEORGE N., Assistant Professor of History (1966). B.A., University of Texas at Austin, 1961; M.A., Florida State University, 1962; Ph.D., 1966.
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- McDOWELL, ROBERT E., Assistant Professor of English (1966). B.S., Drake University, 1952; M.A., University of Minnesota, 1956; Ph.D., University of Denver, 1966.
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- McNUTT, JOHN D., Assistant Professor of Physics (1967). B.S., University of Michigan, 1960; M.S., Wayne State University, 1962; Ph.D., 1966.
- MEACHAM, WILLIAM R., Professor and Chairman of Department of Biology (1950). B.S., Texas A & M University, 1948; M.S., North Texas State University, 1950; Ph.D., University of Texas at Austin, 1958.
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- MILLER, ROBERT P., Professor of German and Linguistics (1962). B.Mus., Michigan State College, 1933; M.A., Yale University, 1948; Ph.D., 1952.
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- MOFFETT, JAMES M., Assistant Professor of English (1965). B.A., Appalachian State University, 1954; M.A., University of Arkansas, 1956; Ph.D., 1968.
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- MOORE, MARION E., Assistant Professor of Mathematics (1966). B.S., West Texas State College, 1957; M.S., Texas Technological College, 1960, Ph.D., University of New Mexico, 1968.
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- PATTERSON, JOHN D., Assistant Professor of Electrical Engineering (1968). B.S., University of Texas at Arlington, 1962; M.S., University of Texas at Austin, 1964; Ph.D., 1966.
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- PINNEY, WILLIAM, Assistant Professor of Business Administration (1969). B.S., University of Florida, 1964; M.B.A., 1965; Ph.D., 1967.
- POULTER, VIRGIL L., Assistant Professor of Spanish and Acting Chairman of Department of Foreign Languages (1961) (1968). Oklahoma State University, 1954; M.A., University of New Mexico, 1960.
- PYBURN, WILLIAM F., Professor of Biology (1956). B.A., University of Texas at Austin, 1951; M.A., 1953; Ph.D., 1956.
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- REHER, WILLIAM C., Professor of Economics (1965). B.S.C., St. Louis University, 1941; M.S.C., 1948; Ph.D., University of Michigan, 1957.
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- STEINECKE, ALAN Q., Associate Professor of French and Assistant Dean of Liberal Arts (1953). B.S., University of Vermont, 1949; M.A., 1950.
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- STUART, JOHN A., Associate Professor of French (1965). M.A., University of Montreal, 1953; Ph.D., 1959.
- TENNISON, ROBERT L., Associate Professor and Assistant Chairman of Department of Mathematics (1965). B.A., Howard Payne College, 1954; M.Ed., 1957; M.S., Oklahoma State University, 1959; Ph.D., 1964.
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- TERRELL, GLEN, Assistant Professor of Physics (1966). B.S., University of Texas at Austin, 1962; M.A., 1964; Ph.D., 1966.
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- TORGERSON, FERNANDO G., Professor of Social Work and Director of Graduate School of Social Work (1967). B.A., Minot State College, 1939; M.S., Columbia University, 1949; Ph.D., University of Minnesota, 1956.
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- WALL, BASIL M., Professor and Chairman of Department of Mathematics (1962). B.A., Sam Houston State Teachers College, 1938; M.A., 1940; Ph.D., University of Texas at Austin, 1956.
- WHALING, ANNE, Associate Professor of English (1955). B.A., Southern Methodist University, 1933; M.A., 1934; Ph.D., Yale University, 1946.
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- WHITESEL, THEODORE L., Professor of Economics and Finance (1962). B.Ed., Eastern Illinois University, 1931; B.S., University of Illinois, 1932; M.S., 1934; Ph.D., 1952.
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- WYATT, JAMES L., Professor of Spanish and Linguistics and Acting Dean of the Graduate School (1947) (1957). B.A., University of Texas at Austin, 1944; M.A., National University of Mexico, 1948; Ph.D., (Spanish) 1950; Ph.D., (Linguistics)
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*Leave of Absence

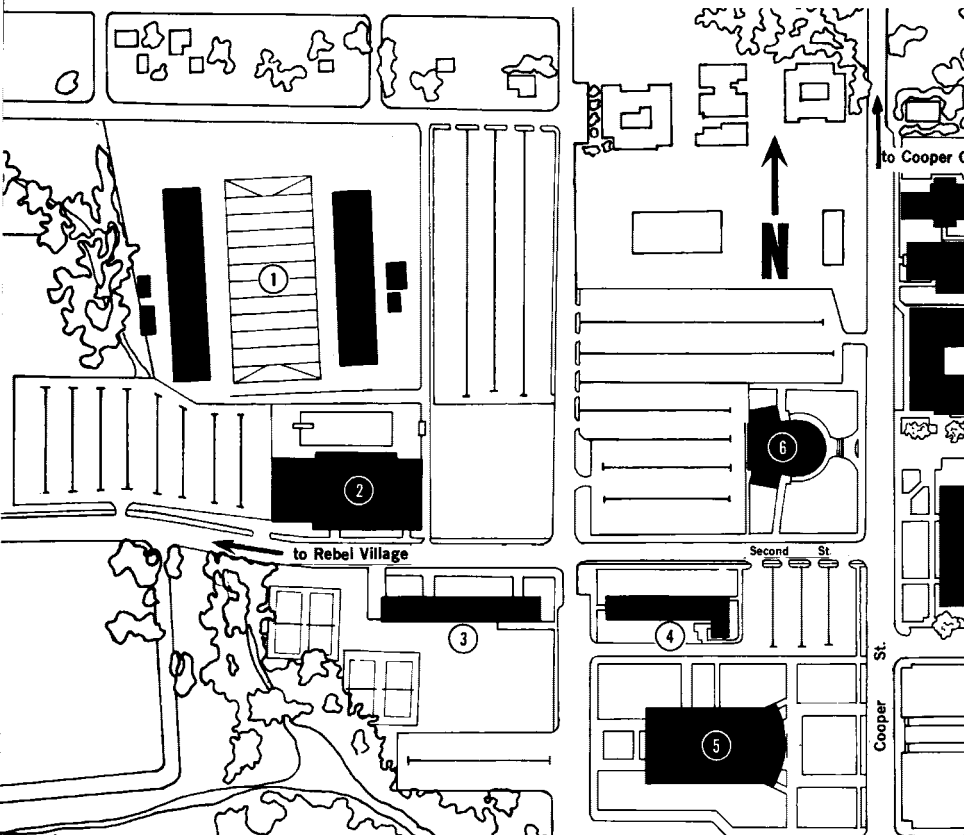


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NOTES

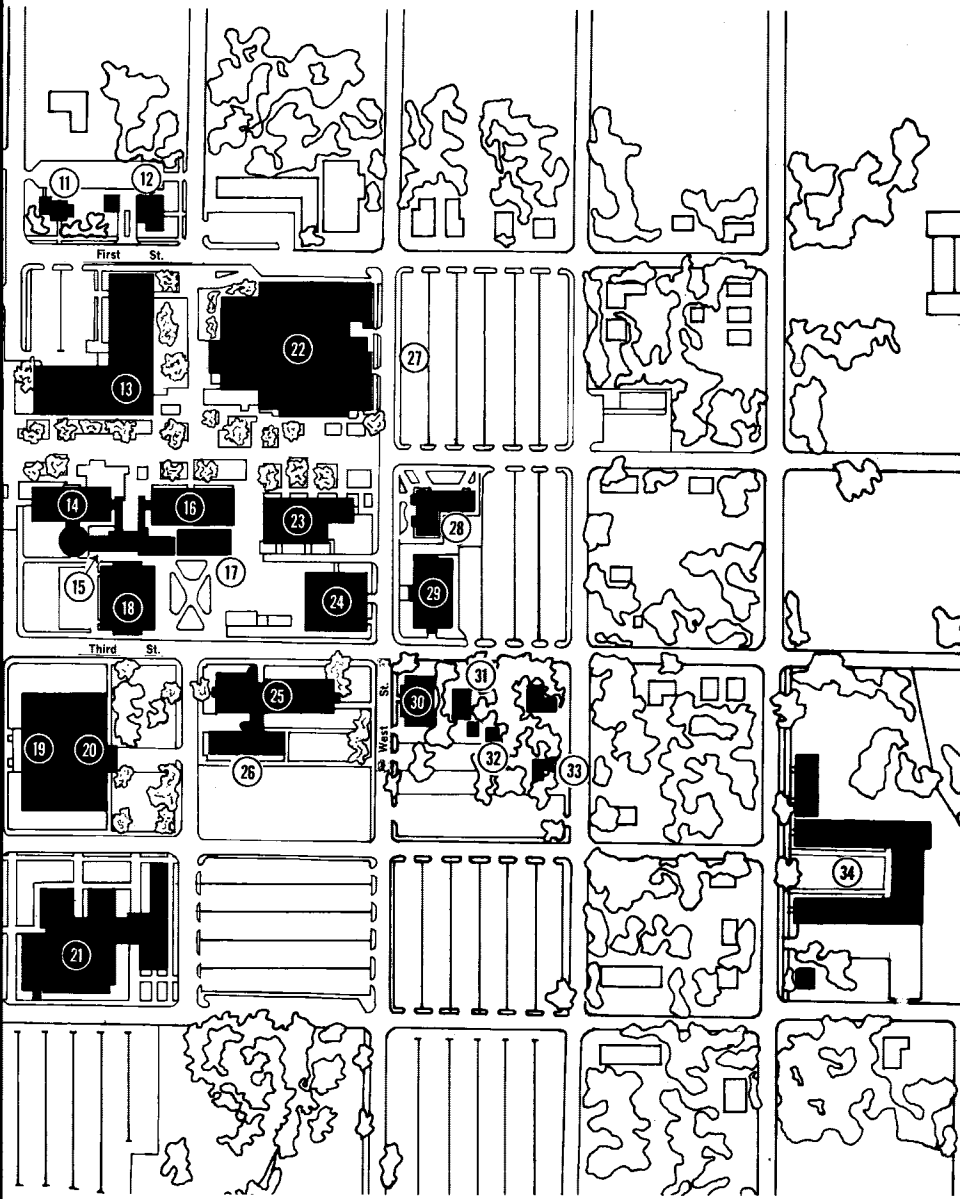




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|---------------------------|---------------------------|-----------------------------------|
| 8. Art | 19. Library | 33. Public Information |
| 28. Brazos House (men) | 34. Lipscomb Hall (women) | 16. Ransom Hall |
| 21. Business-Life Science | 1. Memorial Stadium | 20. Registrar's Office (basement) |
| 15. Carlisle Hall | 2. Men's PE | 9. Science Hall |
| 23. College Hall | 12. North House | 32. Security Office |
| 11. Education | 4. Pachi Hall (men) | 22. Student Center |
| 13. Engineering | 31. Personnel Office | 5. Texas Hall |
| 7. Engineering Technology | 24. Physical Plant | 6. Theater |
| 18. Girls' Gymnasium | 17. Placement Office | 25. Trimble Hall |
| 26. Hammond Hall | 30. President's Office | 3. Trinity House (men) |
| 29. Health Center | 14. Preston Hall | 10. University Hall |
| | | 27. Visitors' Parking |

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* Under Construction





