THE UNIVERSITY OF TEXAS AT ARLINGTON

GRADUATE CATALOG

1967-1968

1967

JANUARY	MAY	SEPTEMBER
S M T W T F S	S M T W T F S	S M T W T F S
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1968

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CAMPUS CALENDAR

Fall Semester 1967

September 13, 14, 15	Registration for Fall Semester 8 a.m. - 5 p.m. and 6 p.m. - 9 p.m.
September 18	Classes and late registration begin 8 a.m.
September 21	Late registration closes 9 p.m.
September 30	12th Class Day
November 10	Midsemester
November 22	Thanksgiving Holidays begin 10 p.m.
November 27	Thanksgiving Holidays end 8 a.m.
December 19	Christmas Holidays begin 10 p.m.
January 3	Christmas Holidays end 8 a.m.
January 10	Dead Week begins
January 16	Finals begin
January 28	Commencement, End of Semester

Spring Semester 1968

January 31 and February 1	Registration for spring semester 8 a.m. - 5 p.m. and 6 p.m. - 9 p.m.
February 2	Classes for day students and late registration begin 8 a.m.
February 5	Classes begin for night students 5:30 p.m.
February 8	Late registration closes. 9 p.m.
February 15	12th Class Day
March 29	Midsemester
April 11	Easter Holidays begin 10 p.m.
April 16	Easter Holidays end 8 a.m.
May 14	Dead Week begins
May 20	Finals begin
May 31	Commencement, End of Semester

Summer 1968

June 3	Registration for night students 6 p.m. - 9 p.m.
June 4	Registration for day students 8 a.m. - 5 p.m. Registration for night students continues 6 p.m. - 9 p.m.
June 5	Classes begin for day and night students 7 a.m.
June 6	Late registration closes 9 p.m.
July 4	Holiday
July 11, 12	Final Examinations for first Summer Day Session
July 17	Registration for second Summer Day Session 8 a.m. - 5 p.m.
July 18	Classes begin for second Summer Day Session 7 a.m.
July 19	Late registration closes for second Session 5 p.m.
August 12	Final Examinations for night students
August 22	Final Exams begin for second Summer Day students
August 26	End of Summer Session

BOARD OF REGENTS
THE UNIVERSITY OF TEXAS SYSTEM

Administration of
THE UNIVERSITY OF TEXAS AT ARLINGTON

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J. R. Woolf, Ph.D.	President, UT Arlington
S. T. Keim, Jr., Ph.D.	Vice-President for Academic Affairs
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John A. Hudson, M.A., M.S. in L.S.	University Librarian
Elwood J. Preiss, M.A.	Registrar and Director of Admissions
W. J. Karraker, Ed.D.	Director of Testing and Counseling
Bob Stephens, B.S.	Assistant to the President

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.

History

The institution now known as The University of Texas at Arlington was founded in 1895 as Arlington College, a private liberal arts institution. As a private school, it had a succession of names and ownerships until 1917, when the Texas Legislature passed legislation to make it a fully state-supported junior college and placed it under the control of the Texas A & M College board of directors. The college then bore the name Grubbs Vocational College until 1923, when the Legislature changed the name to North Texas Agricultural and Mechanical College. Legislation in 1949 changed the name to Arlington State College, and in 1959 the Legislature elevated the college to senior college rank. The Fifty-Ninth Legislature, in 1965, transferred it from the Texas A & M University system to The University of Texas. In 1967, at request of the Regents, the Legislature changed the name to The University of Texas at Arlington.

THE GRADUATE SCHOOL

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

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

THE PURPOSE AND NATURE OF GRADUATE WORK

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

GENERAL REQUIREMENTS AND PROCEDURES

Admission to the Graduate School

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

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

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

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

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

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

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

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

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

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

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

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

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

Procedure after Admission

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

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

Restriction on Admission

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

General Information

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

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

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

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

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

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

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

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

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

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

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

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

Continuation in the Graduate School

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

EXPENSES

TUITION

Regular Sessions

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

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

Summer Day Sessions

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

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

Summer Night Sessions

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

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

Non-Residence Fee

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

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

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

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

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

Student Service Fee

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

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

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

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

Property Deposit Fee

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

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

Parking Fees

Students will register their cars in a single payment for the entire school year or the balance of the school year in which they register, whichever is applicable. (School year is September 1 through August 31). The following fees will be charged 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.

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

Late Registration Fee

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

Refunds

A student who withdraws from the University on or before the 12th day of classes* of a regular semester or the equivalent of a summer term (fourth day of classes in day session and eighth day of classes in night session), will be refunded 50 per cent of fees paid. A student resigning after the 12th day of classes or its equivalent will receive no refunds. This policy applies to tuition, laboratory fees, private instruction fees, building use fees, parking

*Sept. 30 in 1967 Fall Semester; Feb. 15 in 1968 Spring Semester; June 12 in 1968 Summer Semester (first day session); June 20 in 1968 Summer Semester (night session); July 24 in 1968 Summer Semester (second day session).

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.

Bad Checks

A student who gives UT Arlington a bad check, the fault not being that of the bank, and who does not make it good within five days after official notification by the Bursar's Office, will be dropped from the University. The University will not accept a check from a student who has once given a bad check.

THE LIBRARY

(Picture on page 19)

The Library, housed in a six-story, air-conditioned building, contains a rapidly expanding collection of more than 240,000 books. In addition, the Library subscribes to more than 2,250 periodicals and newspapers and maintains a collection of recorded tapes, discs, microfilm, motion pictures, film strips, and slides. Equipment is available for photographic duplication of printed materials and microfilm.

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

Monday-Thursday	7:45 a.m. - 11 p.m.
Friday	7:45 a.m. - 6 p.m.
Saturday	10 a.m. - 4 p.m.
Sunday	2 p.m. - 5 p.m.

Schedules for holiday periods are posted.

REQUIREMENTS FOR DEGREES

General Regulations

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

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

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

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

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

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

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

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

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

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

Transfer credit—Credit will not be granted toward a master's degree for work completed in other institutions except upon the approval of the Committee on Graduate Studies. A maximum of six semester hours of transfer credit will be considered for approval.

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.

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

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

ROUTINE FOR ALL CANDIDATES FOR MASTER'S DEGREES

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

(1) A diploma name card (this must be refiled in case of postponement).

(2) An application for candidacy, if not filed in an earlier semester.

(3) A program of work if required by the department.

(4) An official transcript of all work done at The University of Texas at Arlington.

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

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

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

(General)

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

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

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

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

Economics

Mathematics

Physics

Psychology

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

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

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

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 committee on graduate studies 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 committee on graduate studies.

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

Branches of engineering in which master's degrees are offered
—The degree of Master of Science in engineering, with designation of the major branch in which it is given, is offered in electrical engineering and engineering mechanics.

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

Candidacy requirements—A student desiring to become a candidate for the master's degree in any branch of engineering must make application to the Associate Dean prior to the deadline of the semester in which he desires to receive this degree. He will be recognized as a candidate when he has satisfied the scholarship requirements given below and when his application and course of study have been approved by the graduate advisor and the Associate Dean. 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 committee on graduate studies 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 applica-

tion is approved. This examination may be either oral or written, at the discretion of the committee on graduate studies.

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 Associate Dean.

Three final copies of the thesis are required.
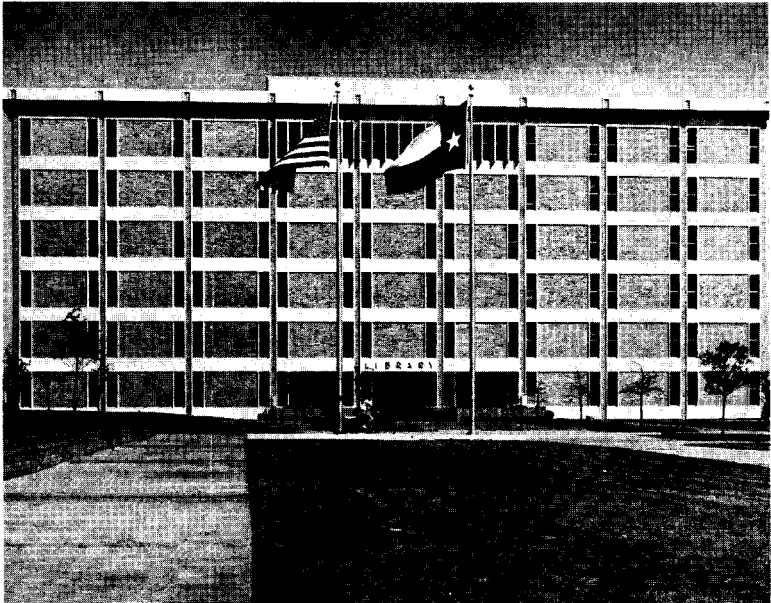
ECONOMICS

Introduction

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.

Admission

Applicants meeting admission requirements of the Graduate School and having a minimum of 12 semester hours of advanced courses in economics are automatically admitted to the program. Other applicants may be admitted, if approved by the graduate adviser in economics and the Associate Dean.

Degree Requirements

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 hours, including the thesis, shall be taken in economics, including a core of economics 5306, 5310, and 5312. The remaining 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: approval 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: approval 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 or equivalent. Prerequisite: approval 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: approval of graduate advisor in economics.

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: approval of graduate advisor in economics.

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: approval of graduate advisor in economics.

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

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

5338.   SEMINAR (3-0) 3 hours credit—Topics covered to vary from semester to semester. Prerequisite: approval 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: approval 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.

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

MANAGEMENT

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

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

ECONOMICS

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

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

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 2306 and junior standing or consent of instructor.

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 inflations, 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 2306 and junior standing or consent of instructor.

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 2306, three hours of advanced and senior standing and consent of instructor.

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 2306, three hours advanced economics and junior standing or consent of instructor.

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 governments. Prerequisite: economics 3304 and junior standing or consent of instructor.

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 2306, three hours of advanced economics and junior standing or consent of instructor.

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 2306, three hours of advanced economics and junior standing or consent of instructor.

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 and junior standing or consent of instructor.

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 2306, three hours of advanced economics and junior standing or consent of instructor.

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 2306, three hours of advanced economics and junior standing or consent of instructor.

4306. COMPARATIVE ECONOMIC SYSTEMS (3-0) 3 hours credit—This course surveys the economic institutions of capitalism, socialism, communism and facism 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 2306, three hours of advanced economics and junior standing or consent of instructor.

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 the marginal theory. The Keynesian and institutional schools are examined as major intellectual forces which are shaping contemporary economic thinking. Prerequisite: economics 2306, three hours of advanced economics and junior standing or consent of instructor.

4331. SEMINAR IN ECONOMICS (3-0) 3 hours credit—This course, made up of readings and discussion, is concerned with special topics in economics. Prerequisite: economics 2306, three hours of advanced economics and junior standing or consent of instructor.

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.

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: senior standing and consent 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. Prereuisite: accounting 3313 or 3301 and business administration 3322.

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.

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 and finance 3313.

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.

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 and business administration 3321 or consent of instructor.

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 and senior standing.

MARKETING

4311. MARKETING RESEARCH (3-0) 3 hours creait—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 and business administration 3322.

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 plus six semester hours of marketing and senior standing.

MATHEMATICS

Objective

The objective of the Mathematics Department's program at the masters 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.

Admission

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

Program

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

5303. FOUNDATIONS OF TOPOLOGY (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: Graduate standing in mathematics or consent of the instructor.

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, metrization theorems, Peano spaces, and homotopy theory. Prerequisite: mathematics 4304.

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

5312. ADVANCED MATHEMATICAL STATISTICS (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 continous distributions, mathematical expectation, moments, sampling distributions, point estimation and maximum likelihood estimations. Prerequisite: mathematics 3312 and 4317.

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 4318.

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

5320. DIFFERENTIAL EQUATIONS (3-0) 3 hours credit--This course is a study of linear and non-linear systems. The asympototic behavior of solutions and the concept of stability are investigated as well as some important existence and uniqueness theorems. Prerequisite: mathematics 4320.

5322. COMPLEX VARIABLES I (3-0) 3 hours credit--Fundamental theory of analytic functions, residues, conformal mapping and applications. Prerequisite: mathematics 4317, 4322 or mathematics 4318.

5323. COMPLEX VARIABLES II (3-0) 3 hours credit--Analytic continuation, Reimann surfaces, velocity and stream functions with applications, elliptic functions. Prerequisite: complex variables I.

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

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

5327. FUNCTIONAL ANALYSIS (3-0) 3 hours credit--This course will be concerned with properties of normed linear spaces. Prerequisite: consent of the instructor.

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: Abstract Algebra I.

5334. DIFFERENTIAL GEOMETRY (3-0) 3 hours credit--This course is an introduction to the theory of curves and surfaces in three dimensional Eucledean space. Selected topics from global differential geometry and an introduction to n-dimensional geometry will be included. Prerequisite: mathematics 4317.

5336. LOGIC (3-0) 3 hours credit--The concept of a normal system and propositional and functional calculi are considered. Prerequisite: consent of the instructor.

5338. NUMERICAL ANALYSIS I (3-0) 3 hours credit--This course is a rigorous treatment of the solution of equations, interpolation and approximation, numerical differentiation and quadrature, and the solution of ordinary differential equations. Prerequisite: mathematics 4318, 4345 or consent of instructor.

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 3330, 4318, 4353 or consent of the instructor.

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: consent of the instructor.

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: consent of the instructor.

5398 or 5698. THESIS 3 or 6 hours credit--Prerequisite: graduate standing in mathematics.

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

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: junior standing in mathematics or consent of the department.

4311. MATHEMATICAL PROBABILITY (3-0) 3 hours credit—An introduction to the fundamentals of discrete and continuous probability distributions is provided for application to operational problems. Prerequisite: mathematics 3317.

4317. ADVANCED CALCULUS (3-0) 3 hours credit—Properties of functions involved in continuity, differentiability and integration are considered. Prerequisite: mathematics 3317.

4318. ADVANCED CALCULUS (3-0) 3 hours credit—The study of the concepts presented in mathematics 4317 is continued, and the applications of integration are extended to the use of integral transforms. Prerequisite: mathematics 4317.

4320. ADVANCED DIFFERENTIAL EQUATIONS (3-0) 3 hours credit—This is a study of the existence and properties of solutions of differential equations. Prerequisite: mathematics 3318.

4321. INTRODUCTION TO ABSTRACT ALGEBRA II (3-0) 3 hours credit-This course is a continuation of mathematics 3321. Prerequisite: mathematics 3321.

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 3317

4325. OPERATIONAL MATHEMATICS (3-0) 3 hours credit—This course is a study of Laplace and Fourier Transforms, partial differential equations, Bessel Functions and Orthogonal polynomials such as Hermite and Legendre. Prerequisite: mathematics 3317 and 3318.

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: consent of the department.

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.

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.

4345. NUMERICAL METHODS (2-2) 3 hours credit—A study of methods for finding roots of polynomials with complex coefficients, eigenvalues and eigen vectors of matrices, solutions of partial differential equations, optimization problems, and Monte Carlo methods, a consideration of various types of errors arising in numerical problems. Prerequisite: mathematics 3345. **$4 lab fee**

4191, 4291, 4391. SPECIAL TOPICS IN MATHEMATICS (Variable credit from 1 to 3 semester hours as arranged)—Special topics in mathematics are assigned to individuals or small groups. Faculty members closely supervise the projects and assign library reference material. Small groups will hold seminars at suitable intervals. Prerequisite: permission of Mathematics Department. These courses may be repeated for credit.

4392. SELECTED TOPICS IN MATHEMATICS (3-0) 3 hours credit—The material covered may vary from semester to semester depending upon the interest and need of the students. This course may be repeated for credit. Prerequisite: junior standing and approval of the department.

PHYSICS

For admission to the Master of Arts program in Physics the candidate must satisfy the general admission requirements of the Graduate School and show satisfactory completion of at least 24 hours of advanced physics with supporting courses. Deficiencies must be remedied.

Thirty hours are required for the degree of which 18 hours will be in physics and six hours in mathematics. A six-hour thesis is required.

5305. QUANTUM MECHANICS II (3-0) 3 hours credit--Angular momentum and spin, theory of radiation, matrix formulation, relativistic quantum mechanics. Prerequisite: quantum mechanics I (4326) or equivalent.

5306. CLASSICAL MECHANICS (3-0) 3 hours credit--The general principles of analytical mechanics. Orbit theory and the central force problem. The kinematics of rigid bodies, treated from the standpoint of matrix transformations, canonical transformations. Hamilton-Jacobi theory. Prerequisite: graduate standing or by permission.

5309. ELECTROMAGNETIC THEORY I (3-0) 3 hours credit--The electrostatic fields. Methods of solution of potential problems. Energy relations in electrostatic fields. Current. Magnetic materials. Maxwell's equations, energy force, and momentum in the electromagnetic field. Lionard-Wiechert potential. Radiation. Prerequisite: graduate standing.

5310. STATISTICAL MECHANICS (3-0) 3 hours credit--Fundamental principle of statistical mechanics. Lionville Theorem. Entropy. Fermi-Dirac distribution, Bose-Einstein distribution and Einstein condensation. Magnetization. Density matrix and quantum statistical mechanics. Kinetic methods and transport theory. Prerequisite: graduate standing.

5313. SOLID STATE II (3-0) 3 hours credit--Free electron theory of metals. The band theory of solids. Conductors, insulators, and semiconductors. Theory of conductivity. Magnetic properties of solids. The optical properties of solids. Topics studies in this course shall be based on quantum mechanics. Prerequisite: solid state I (4325).

5314. ELECTROMAGNETIC THEORY II-ADVANCED OPTICS (3-0) 3 hours credit--Electromagnetic wave equations. Plane waves in isotropic media. Reflection, refraction, and polarization. Wave solutions in presence of metallic boundaries. Waves in anisotropic media. Theory of diffraction, radiation, scattering, and dispersion. Prerequisite: electromagnetic theory I (5309).

5317. RELATIVITY (3-0) 3 hours credit--Special theory of relativity. Invariance of electromagnetic equations. Minkowski's interpretation of relativity. Fundamental ideas of general relativity. General relativistic mechanics with application. Prerequisite: classical mechanics (5306).

5318. ADVANCED NUCLEAR PHYSICS (3-0) 3 hours credit--Nuclear radiations and their interactions with matter, nuclear structure, accelerators, nuclear reactions, and subnuclear particles. Prerequisite: graduate standing and physics 3446 and 4326 or equivalent or permission.

5320. THEORETICAL PHYSICS (3-0) 3 hours credit--Meaning of Physical Theory. Space and time in physics. The foundation of mechanics. Probability and statistics. Continua. Prerequisite: classical mechanics (5306).

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5321. MODERN PHYSICS (3-0) 3 hours credit--This course is designed for advanced undergraduate and graduate students. It will present a unified approach to the principle fields of modern physics: relativity, quantum mechanics, atomic spectroscopy, quantum statistics, solid state physics, particle, and nuclear physics. Prerequisite: graduate standing.

5698. THESIS (6-0) 6 hours credit--Prerequisite: permission of department.

A limited number of 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.

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.

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.

Programs

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.

Specific 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.

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

AREA I   (1)   Advanced Statistics

AREA II   (1)   Personality and Behavior Dynamics
                          (2)   Advanced Social Psychology
                          (3)   Advanced Developmental Psychology

AREA III   (1)   Perceptual Processes
                          (2)   Sensory Processes
                          (3)   Advanced Physiological Psychology

AREA IV   (1)   Learning Theory
                          (2)   Animal Learning
                          (3)   Cognitive Processes

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

5302. EXPERIMENTAL DESIGN (3-0) 3 hours credit--A study of the statistical aspects of complex experimental designs used in psychological research. Prerequisite: graduate standing and advanced statistics 5301.

5303. QUANTITATIVE METHODS (3-0) 3 hours credit—A survey of techniques for analyzing multivariate data; particular topics include partial and multiple correlation, factor analysis, and the linear discriminant function. Prerequisite: graduate standing.

5304. MATHEMATICAL MODELS IN PSYCHOLOGY (3-0) 3 hours credit— Elementary probability theory, matrix algebra, and theory of linear difference equations applied to theoretical problems in learning, signal detection, decision processes, and social interactions. Prerequisite: graduate standing.

5311. LEARNING THEORY (3-0) 3 hours credit--A survey of the basic theories of learning. Prerequisite: graduate standing.

5312. ANIMAL LEARNING (3-0) 3 hours credit--A survey of contemporary problems in animal learning. Prerequisite: graduate standing.

5313. COGNITIVE PROCESSES (3-0) 3 hours credit--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. Prerequisite: graduate standing.

5314. PSYCHOLINGUISTICS (3-0) 3 hours credit--An investigation of language in terms of its function, content and structure, with an emphasis on learning, perception, and generation of linguistic units. Prerequisite: graduate standing.

5321. PERSONALITY AND BEHAVIOR DYNAMICS (3-0) 3 hours credit-- Research in personality processes: particular topics include unconscious processes, anxiety, and conflict. Prerequisite: graduate standing.

5322. ADVANCED SOCIAL PSYCHOLOGY (3-0) 3 hours credit--Problems in social psychology emphasizing integration of experimental design, research findings and theoretical formulations. Prerequisite: graduate standing.

5323. ADVANCED DEVELOPMENTAL PSYCHOLOGY (3-0) 3 hours credit-- A survey of development of behavior in both humans and sub-humans. Prerequisite: graduate standing.

5325. THEORIES OF MOTIVATION (3-0) 3 hours credit--This course surveys the current literature and theory on emotion and the neural and physiological basis for motivation. Material to be covered will include both biological drives, such as hunger and thirst, and interpretations of drive less immediately related to the underlying biological processes. Prerequisite: graduate standing.

5331. PERCEPTUAL PROCESSES (3-0) 3 hours credit--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. Prerequisite: graduate standing.

5332. SENSORY PROCESSES (3-0) 3 hours credit--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. Prerequisite: graduate standing.

5333. ADVANCED PHYSIOLOGICAL PSYCHOLOGY (3-0) 3 hours credit-- 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. Prerequisite: graduate standing.

5335. ANIMAL BEHAVIOR (3-0) 3 hours credit—A phylogenetic approach to some basic problems in behavior, with special emphasis on unlearned behavior. Prerequisite: graduate standing.

5337. MAN-MACHINE SYSTEMS (3-0) 3 hours credit--The study of man-machine systems and human factors research; topics include response latency as a factor in equipment design, tracking behavior, vigilance decrement, and absolute judgment phenomena. Prerequisite: graduate standing.

5389. CONTEMPORARY PROBLEMS IN PSYCHOLOGY (3-0) 3 hours credit —Topics vary; may be repeated for credit with permission of graduate advisor. Prerequisite: graduate standing.

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. Prerequisite: graduate standing.

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. Prerequisite: graduate standing.

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. Prerequisite: graduate standing.

5698. THESIS (6-0) 6 hours credit--Prerequisite: 12 hours of advanced psychology and graduate standing.

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—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. Prerequisite: psychology 1315.

3316. TESTS AND MEASUREMENTS (3-0) 3 hours credit—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 1315 and 2328.

3317. INDIVIDUAL AND GROUP DIFFERENCES (3-0) 3 hours credit—Survey and analysis of research and major findings concerning genetic and environmental influences on behavior. Prerequisite: psychology 1315.

3326. COMPARATIVE PSYCHOLOGY (3-0) 3 hours credit—This is a survey of research and theory comparing behavior at various phyletic levels. Prerequisite: psychology 1315.

3327. PERCEPTION (3-0) 3 hours credit—A survey of theory and research in perceptual processes. Prerequisite: psychology 1315.

3329. PHYSIOLOGICAL CORRELATES OF MOTIVATION (3-0) 3 hours credit—A survey of research and theory in motivation from the standpoint of the underlying physiological processes. Prerequisite: psychology 1315.

3330. BEHAVIOR AND MOTIVATION (3-0) 3 hours credit—Theory and research involving relation of motivation to learning theory, social behavior, personality and development. Prerequisite: psychology 1315.

3331. SENSORY PROCESSES (3-0) 3 hours credit—Research and theory regarding sensory processes. Primary emphasis on vision and audition. Prerequisite: psychology 1315.

4301. ABNORMAL PSYCHOLOGY (3-0) 3 hours credit—This is a study of the causes, incidence, prophylaxis and treatment of psychopathology. Prerequisite: psychology 1315.

4302. INTRODUCTION TO CLINICAL AND COUNSELING PSYCHOLOGY (3-0) 3 hours credit—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. Prerequisite: psychology 1315.

4304. APPLIED EXPERIMENTAL PSYCHOLOGY (3-0) 3 hours credit—A survey of application of various psychological principles and techniques. Particular emphasis will be given the man-machine complex. Prerequisite: psychology 1315.

4313. PSYCHOLOGY OF LEARNING (3-0) 3 hours credit—This course is a study of the factors influencing modifications of behavior, and the underlying theoretical explanations. Prerequisite: psychology 1315.

4314. PSYCHOLOGY OF PERSONALITY (3-0) 3 hours credit—This course is a survey of all the major theories of personality. Prerequisite: psychology 1315.

4326. THE HISTORY OF PSYCHOLOGY (3-0) 3 hours credit—This course is a study of the evolution of psychology as a science, leading up to and including contemporary developments. Prerequisite: psychology 1315.

4336. THOUGHT AND COMMUNICATION PROCESSES (3-0) 3 hours credit—This is a survey of research and theory in the areas of thinking, judgment and both linguistic and non-linguistic communication. Prerequisite: psychology 1315.

4337. PHYSIOLOGICAL PSYCHOLOGY (3-0) 3 hours credit—This course is a study of the physical structures and processes underlying the behavior of the animal kingdom and of human beings. Prerequisite: psychology 1315.

ELECTRICAL ENGINEERING

Courses in a number of areas of electrical engineering are offered. The student, with the aid of a faculty adviser, 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

Specific Degree Requirements

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

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

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

5312. PROPAGATION OF ELECTROMAGNETIC WAVES (3-0) 3 hours credit--Diffraction, reflection and refraction of electromagnetic waves at plane and spherical boundaries; propagation in ionized media.

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, subharmonic oscillations, etc.

5316. STATISTICAL DESIGN OF LINEAR SERVOMECHANISMS (3-0) 3 hours credit--Analysis and synthesis techniques applicable to feedback control systems in which portions of the system and/or its input signals are non-deterministic.

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.

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.

5320. MODERN CONTROL THEORY (3-0) 3 hours credit—Linear algebra, Euclidean spaces, properties of sets, vector functions, function space and related mathematical notions. The concept of system state, finding the state representation for dynamical systems, definition of the control problem, and the concepts of controllability and observability. Conditions for optimality, the variational approach to the control problem, the maximum principle of Pontryagin, and the Hamilton-Jacobi equation. Prerequisite: electrical engineering 4314 or equivalent.

5321. MODERN CONTROL DESIGN TECHNIQUES (3-0) 3 hours credit—Minimum time problems, minimum fuel problems, minimum engergy problems and the derivation of necessary conditions. The design of time optimal and fuel optimal systems, and the design of optimal linear systems with quadratic criteria. Prerequisite: electrical engineering 5320.

5324. LOGIC CIRCUITS I (3-0) 3 hours credit--Fundamental theory of logic circuits, including binary arithmetic, Boolean algebra, Karnaugh map, minimization and synthesis methods.

5325. ADVANCED COMMUNICATION THEORY I (3-0) 3 hours credit--Basic probability and statistics, correlation functions, properties of noise sources, signal detection, design of optimum filters, etc.

5326. ADVANCED COMMUNICATION THEORY II (3-0) 3 hours credit--Continuation of study of communications problems and techniques, with emphasis shifting to specific areas such as radar detection, space communications, etc.

5331. INTRODUCTION TO PLASMA DYNAMICS (3-0) 3 hours credit—Plasma as the fourth state of matter. Particle orbits in electric and magnetic fields. Individual and collective phenomenon, collision processes, Debye shielding distance, plasma frequency, ambipolar diffusion, wave phenomena in plasmas, mirror effect (magnetic bottle), plasma confinement and stability. Prerequisite: permission of department.

5332. KINETIC THEORY OF PLASMA (3-0) 3 hours credit—Kinetic theory of ionized gases. Fluid and particle models. Equations of state, change and flux. Macroscopic motions of plasma, Boltzmann, Liouville, Langevin, Vlasov, BBGKY, Fokker, Planck equations, transport processes of plasma. Prerequisite: permission of department.

5333. MAGNETOHYDRODYNAMICS (3-0) 3 hours credit—Magnetofluid-dynamics equations, Alfven and shock waves. Magnetohydrodynamic channel flows: Hartman, Couvette. Boundary layers, MHD propulsion, MHD power generation. Faraday and Hall generator, gaseous and liquid-metal media, thermonuclear reactions, fusion power. Prerequisite: permission of department.

5335. MICROWAVE SYSTEMS ENGINEERING (3-0) 3 hours credit--Study of the relationships between system parameters and system performance in pulsed, C-W, doppler and monopulse radars.

5337. ADVANCED COMPUTER METHODS FOR POWER SYSTEM ANALYSIS (3-0) 3 hours credit—The material covered in this course includes incidence

and network matrices, algorithms for formation of network matrices, short circuit studies, load flow studies, economic load dispatching, and other current topics. May be repeated for credit with the consent of the instructor. Prerequisite: permission of department.

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

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

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

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

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.

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

5452. ELECTROMAGNETIC RADIATION (3-3) 4 hours credit--The theory of electromagnetic radiation at microwave frequencies.

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

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

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

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

4314. SERVOMECHANISMS AND CONTROLS (3-0) 3 hours credit--This course is a study of transfer functions and the analysis of closed loop systems utilizing frequency response analysis. Design analysis and synthesis techniques are developed for the study of system performance. Electrical, mechanical and hydraulic systems are considered. Prerequisite: mathematics 4322.

4317. INTRODUCTION TO NETWORK SYNTHESIS (3-0) 3 hours credit-- A major portion of this course is concerned with the realizability conditions and systematic realization procedures for 1-port and 2-port networks. Generally, the discussion is restricted to passive networks. Prerequisite: electrical engineering 3316.

4338. POWER SYSTEM ANALYSIS (3-0) 3 hours credit--This course is a study of power system parameters, fault currents, stability and relaying. Prerequisite: electrical engineering 4301.

4444. PULSE AND DIGITAL CIRCUITS (3-3) 4 hours credit--The analysis and design criteria for pulse and digital circuits will be presented. The laboratory will complement the theory by means of a series of design and design evaluation projects. Prerequisite: electrical engineering 3304. $2 lab fee.

ENGINEERING MECHANICS

Candidates for a Master of Science degree in engineering mechanics may elect programs emphasizing solid mechanics, fluid mechanics, or dynamics and vibrations. A degree program emphasizing materials science is also available.

Prior to admission as degree candidates, students 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 adviser 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.

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.

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.

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.

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.

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.

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

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.

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.

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.

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.

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.

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.

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.

5331. SIMILITUDE AND THEORY OF MODELS (3-0) 3 hours credit--Similitude, models, dimensional analysis, nomographs and graphical aids to analysis.

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.

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.

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.

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.

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: graduate standing or consent of the department.

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.

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.

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.

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

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SUPPORTING AREAS

AEROSPACE ENGINEERING

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

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

5311. ASTRONAUTICS II (3-0) 3 hours credit--This course is a continuation of aerospace engineering 4302. It considers the more sophisticated aspects of orbital mechanics, gyrodynamics, inertial navigation, and centers on the space vehicle as a spinning, variable mass body stabilized by passive means.

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

CIVIL ENGINEERING

5301. ADVANCED STUDIES IN WATER RESOURCES (3-0) 3 hours credit— Selected topics in water resources engineering pertaining to either hydraulics, hydrology or sanitary engineering. May be repeated for credit when the topics change. Prerequisite: graduate standing or permission of the department.

5302. TRANSPORTATION AND URBAN PLANNING (3-0) 3 hours credit—Selected topics pertaining to land use, zoning, and planning studies or transportation systems and traffic flow. May be repeated for credit when the topics change. Prerequisite: graduate standing or permission of the department.

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.

INDUSTRIAL ENGINEERING

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. Prerequisite: permission of department.

5302. ADVANCED HUMAN FACTORS (2-3) 3 hours credit—A study of the methods of determining limitations placed on production or other mechanical systems by human physiological and psychological limitations is made. Prerequisite: permission of department.

MECHANICAL ENGINEERING

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, 3311.

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 or equivalent.

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

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.

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

4301. MECHANICAL VIBRATIONS (3-0) 3 hours credit—This course is a study of harmonic and periodic motion including both damped and undamped free and forced vibration. Both single and multi-degree of freedom systems are treated. Methods of solution including the Holzer and Rayleigh methods are studied, as well as matrix techniques suitable for digital computer solution. Prerequisite: mathematics 3318 and engineering mechanics 3323.

4312. ANALYSIS OF INDETERMINATE STRUCTURES (3-0) 3 hours credit— This course is a study of statically indeterminate structures such as continuous trusses, continuous arches on elastic piers, non prismatic members, continuous beam columns and cable supported structures. These studies include such effects as sidesway, settlement of supports, temperature, flexibility, and dynamic response to earthquakes or blast forces. Numerical methods for solving simultaneous and differential equations, as well as iteration techniques are considered. Prerequisite: engineering mechanics 3323 and 3444.

4324. MECHANICS OF MATERIALS II (3-0) 3 hours credit—This course is a continuation of engineering mechanics 3311. The subject matter consists of the analysis of stresses in machine elements due to various loadings, stresses and strains at a point, stress-strain relationships, theories of failure, energy methods, determination of redundant loads, buckling problems, repeated loads (fatigue), and torsion. Prerequisite: engineering mechanics 3311, 3323.

4336. INTERMEDIATE DYNAMICS (3-0) 3 hours credit—This course is a study of the fundamental principles, with application to motion in resisting medium, variable mass problems, mechanical vibrations and impact. The formulation and use of the Lagrange equations of motion are included. Prerequisite: engineering mechanics 3323 and mathematics 3318.
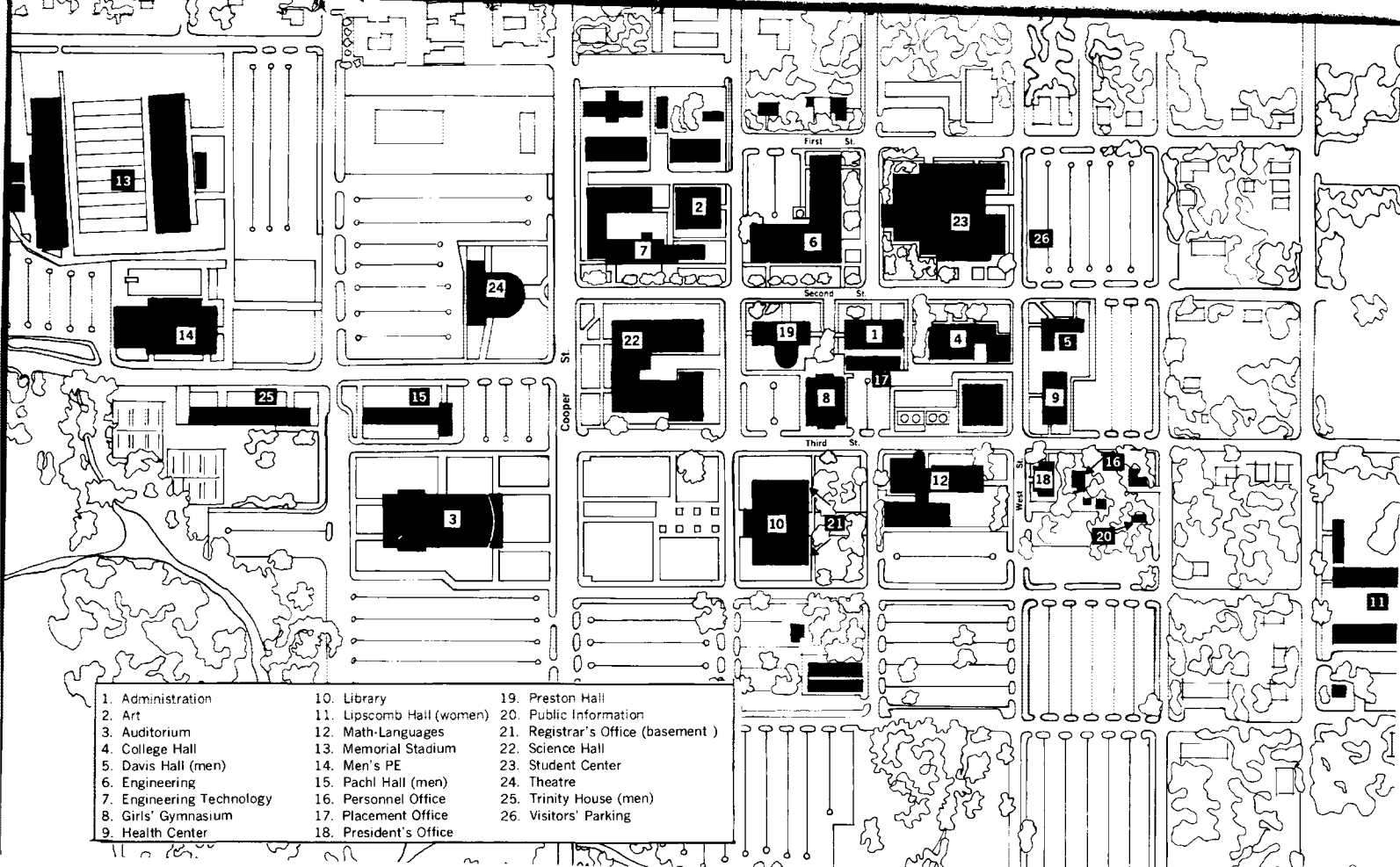
1. Administration	10. Library	19. Preston Hall
2. Art	11. Lipscomb Hall (women)	20. Public Information
3. Auditorium	12. Math-Languages	21. Registrar's Office (basement)
4. College Hall	13. Memorial Stadium	22. Science Hall
5. Davis Hall (men)	14. Men's PE	23. Student Center
6. Engineering	15. Pachl Hall (men)	24. Theatre
7. Engineering Technology	16. Personnel Office	25. Trinity House (men)
8. Girls' Gymnasium	17. Placement Office	26. Visitors' Parking
9. Health Center	18. President's Office	