Dep't. of Mathematics

Undergraduate Catalog

2004-2006

Errata

On page 428, the following requirement is added to the prescribed work for the Bachelor of Science in Astronomy:

14. Enough additional coursework to make a total of 123 semester hours.

The University of Texas at Austin

Texas 2004-6   Dep't. of Math

GRADUATION

The University holds commencement exercises at the end of the spring semester. Each college and school also holds a commencement ceremony in the spring, and many hold graduation exercises in the fall. Graduating students are encouraged to participate. Those who graduate in the summer or fall may attend Commencement the following spring. Each student should consult his or her dean early in the semester of graduation for information about commencement activities and procedures.

No degree will be conferred except on publicly announced dates.

GENERAL REQUIREMENTS

To receive an undergraduate degree from the University of Texas at Austin, a student must fulfill all requirements for the degree as set forth in a catalog under which he or she is eligible to graduate and any special requirements of the college or school and department offering the degree, as well as the following minimum general requirements:

1. The student must have a grade point average of at least 2.00 on all courses undertaken at the University (including credit by examination, correspondence, and extension) for which a grade or symbol other than *Q, W, X,* or *CR* is recorded. Additional requirements imposed by a college or school, if any, are given in the college's chapter of this catalog.

2. A student must fulfill the following requirements regarding coursework taken in residence. Residence credit includes only courses taken at the University of Texas at Austin; it does not include credit by examination, courses taken by extension or correspondence, and on-line courses that are recorded as transfer credit.

    Additional requirements imposed by a college or school, if any, are given in the college's chapter of this catalog.

    In the context of requirements 2a and 2b, coursework in approved affiliated study abroad programs (international provider programs) is treated as residence credit. However, coursework in study abroad programs may not be used to fulfill requirement 2c.

    a. The student must complete in residence at least sixty semester hours of coursework counted toward the degree.[9]

    b. Twenty-four of the last thirty semester hours counted toward the degree must be completed in residence.

    c. At least six semester hours of advanced coursework in the major must be completed in residence.

3. Coursework in American government and American history (the legislative requirement):

    a. Each student must complete six semester hours of coursework in American government, including Texas government. Because these courses are not electives, they may not be taken on the pass/fail basis at the University. Credit by examination may be counted toward the requirement.

    The six hours of coursework used to fulfill the requirement must cover both the United States and the Texas constitutions. Texas colleges and universities differ in the way they include this material in the courses they offer. As a result, some combinations of government courses taken at different institutions do not fulfill the requirement, even though they provide six hours of credit. The following combinations of coursework, some of which include transferred work, fulfill the government requirement at the University:

    1. Government 310L and 312L
    2. Government 310L and three hours of transfer credit in United States government (entered into the student's University record as "GOV 3 US")
    3. Government 310L and three hours of transfer credit in Texas government ("GOV 3 TX")
    4. Three hours of transfer credit in United States government ("GOV 3 US") and three hours of transfer credit in Texas government ("GOV 3 TX")

    A number of topics of Government 312L are offered each semester. Because some of these topics deal with state government and some deal with federal government, credit for Government 312L in combination with transfer credit in United States government ("GOV 3 US") or in Texas government ("GOV 3 TX") may fail to fulfill the legislative requirement. If a student has such a combination of credit, his or her dean's office will evaluate the coursework to determine whether both the state and the federal components of the requirement have been met.

    Students in the College of Engineering may count three hours of ROTC coursework (air force science, military science, or naval science) toward fulfillment of this requirement. Students in the College of Pharmacy may substitute three hours of ROTC coursework for Government 312L. In both colleges, ROTC coursework may be counted toward the government requirement only by students who complete the ROTC program and receive a commission.

9. This requirement is waived for students in the Accelerated Track for the Bachelor of Science in Nursing, a degree program for registered nurses who hold associate's degrees or diplomas in nursing.

b. Each student must complete six semester hours of coursework in American history. Up to three hours in Texas history may be counted toward this requirement. Because these courses are not electives, they may not be taken on the pass/fail basis at the University. Credit by examination may be counted toward the requirement.

4. A candidate for a degree must be registered at the University either in residence or in absentia the semester or summer session the degree is to be awarded and must apply to the dean for the degree no later than the date specified in the official academic calendar. To receive a degree from the Red McCombs School of Business, the College of Communication, the College of Education, or the College of Engineering, the student must be registered in that college or school.

MULTIPLE DEGREES

No second bachelor's degree will be conferred until the candidate has completed at least twenty-four semester hours in addition to those counted toward the bachelor's degree that requires the higher number of hours of credit. The Red McCombs School of Business, the Colleges of Education and Engineering, and the School of Nursing require the student to complete at least twenty-four hours in addition to those counted toward the first bachelor's degree. A student may not receive the same degree twice.

GRADUATION UNDER A PARTICULAR CATALOG

To receive a bachelor's degree, a student must fulfill all the degree requirements in a catalog under which he or she is eligible to graduate; the choices open to students in each college and school are explained below. The student must complete degree requirements within a specified time period; if he or she leaves school to enter military service during a national emergency, the time required to meet the military obligation is excluded from the time allowed for completion of the degree.

A student who transfers to the University from an accredited public Texas junior college has the same catalog choices that he or she would have had if the dates of attendance at the University had been the same as the dates of attendance at the junior college.

Since each college and school must retain the flexibility to improve its curriculum, course offerings may be changed during the student's education. If a course required under a previous catalog is no longer offered, students eligible to graduate according to that catalog should consult the dean of the college to learn whether another course may be used to fulfill the requirement.

Catalog choices. The catalog choices open to business, engineering, nursing, and pharmacy students are described below. In all other divisions, a student may graduate under the catalog covering any academic year in which he or she was enrolled at the University. Whichever catalog the student chooses, all degree requirements must be completed within six years (seven years for the Bachelor of Architecture) of the end of the two-year period covered by that catalog. For example, a student who chooses to graduate according to the requirements in the 2004–2006 catalog must do so by the end of the summer session 2012 (2013 for the Bachelor of Architecture).

Red McCombs School of Business. A business student may graduate under the catalog covering any academic year in which he or she was enrolled at the University. A business honors student who adds a second business major must graduate under the same catalog for both majors.

Whichever catalog the student chooses, all degree requirements must be completed within six years of the end of the two-year period covered by that catalog. For example, a student who chooses to graduate according to the requirements in the 2004–2006 catalog must do so by the end of the summer session 2012.

College of Engineering. An engineering student may graduate under the catalog covering any academic year in which he or she was enrolled in the college. Whichever catalog the student chooses, all degree requirements must be completed within six years of the end of the two-year period covered by that catalog. For example, a student who chooses to graduate according to the requirements in the 2004–2006 catalog must do so by the end of the summer session 2012.

Course substitutions in the degree program are permitted only with the approval of the departmental undergraduate adviser and the dean.

School of Nursing. A nursing student may graduate under the catalog covering any academic year in which he or she was enrolled in the professional nursing sequence. Whichever catalog the student chooses, all degree requirements must be completed within four years of his or her enrollment in the professional sequence. For example, a student who enters the professional sequence in the fall semester 2008–2009 must complete all degree requirements by the end of the summer session 2012 to be eligible to graduate under the 2004–2006 catalog.

College of Pharmacy. A pharmacy student may graduate under the catalog in effect immediately preceding the student's admission to the college or the catalog covering any academic year in which he or she was enrolled in the professional curriculum in the college. Whichever catalog they choose, students must complete all degree requirements within seven years of the end of the two-year period covered by that catalog. For example, a student who chooses to graduate according to the requirements in the 2004–2006 catalog must do so by the end of the summer session 2013.

11. Enough additional coursework to make a total of at least 126 semester hours.

SPECIAL REQUIREMENTS

The student must fulfill the University-wide graduation requirements given on pages 18–19 and the college requirements given on page 421. He or she must also make a grade of at least *C* in all courses used to fulfill requirements 9 and 10 of the prescribed work above.

To graduate and be recommended for certification, students must have a University grade point average of at least 2.50. They must earn a grade of at least *C* in the professional development courses listed in requirements 6, 7, and 8 and must pass the final teaching portfolio review. For information about the portfolio review and additional teacher certification requirements, consult the UTeach-Natural Sciences academic adviser.

OPTION II: SECONDARY SCHOOL TEACHING IN COMPUTER SCIENCES AND MATHEMATICS

This option is designed to fulfill the course requirements for certification as a secondary school teacher in Texas, but completion of the course requirements does not guarantee the student's certification. For information about additional certification requirements, consult the UTeach-Natural Sciences academic adviser.

7. Three semester hours in anthropology, economics, geography, linguistics, psychology, or sociology.
8. Three semester hours in architecture, art (including art history, design, studio art, visual art studies), classics (including classical civilization, Greek, Latin), fine arts, music (including music, instruments, ensemble), philosophy (excluding courses in logic), or theatre and dance.
9. The following foundation courses:
   a. Mathematics 408C, 408D, 315C, Mathematics 325K or Philosophy 313K, Mathematics 333L, 326K or 360M, 341 or 340L, 358K, and 362K.
   b. Computer Sciences 303E or 305J, 307, 310, 315, 326E or 356, 327E or 347, and 349.
   c. Six additional hours in computer sciences chosen from Computer Sciences 323E, 324E or 354, 336, 337, 345, 352, and 372.
   d. Physics 303K, 103M, 303L, and 103N; or 317K, 317L, 117M, and 117N.
   e. Management Information Systems 311F.
   f. Information Studies 312.
   g. Biology 337 (Topic: *Research Methods—UTeach*), Chemistry 368 (Topic: *Research Methods—UTeach*), or Physics 341 (Topic: *Research Methods—UTeach*).
10. Enough additional coursework to make a total of at least 126 semester hours.

SPECIAL REQUIREMENTS

The student must fulfill the University-wide graduation requirements given on pages 18–19 and college requirements given on page 421. He or she must also make a grade of at least *C* in all courses used to fulfill requirements 5, 6, and 9 of the prescribed work above.

To graduate and be recommended for certification, students must have a University grade point average of at least 2.50. They must earn a grade of at least *C* in the professional development courses listed in requirements 5 and 6 and must pass the final teaching portfolio review. For information about the portfolio review and additional teacher certification requirements, consult the UTeach-Natural Sciences academic adviser.

BACHELOR OF SCIENCE IN MATHEMATICS

As an alternative to the Bachelor of Arts degree, the Bachelor of Science in Mathematics is designed with a twofold purpose: to offer students a more extensive scientific program that may better prepare them for graduate study or employment, and to recognize students who choose to pursue a more demanding program. Students are given the opportunity to develop greater breadth and depth in their mathematical programs as well as to combine mathematics with a concentration in another scientific discipline.

To accomplish these goals, the minimum number of semester hours is increased and the maximum limit is removed. Specialization in one additional scientific area is encouraged, and the foreign language requirement is shortened by one semester.

Students seeking the Bachelor of Science in Mathematics must select one of five options: actuarial science, applied mathematics, mathematical sciences, pure mathematics, and mathematics for secondary teaching. Students who choose the option in mathematical sciences must also select a specialization in either scientific computation or statistics, probability, and data analysis.

None of the following courses may be counted toward the degree: Mathematics 301, 302, 303D, 305G.

PRESCRIBED WORK
COMMON TO ALL OPTIONS

1. Rhetoric and Composition 306 and English 316K. In addition, in taking courses to fulfill other degree requirements, the student must complete two courses certified as having a substantial writing component; one of these courses must be upper-division. If the writing requirement is not fulfilled by courses specified for the degree, the student must fulfill it either with electives or with coursework taken in addition to the number of hours required for the degree. Courses with a substantial writing component are identified in the *Course Schedule*.

2. Courses 506 and 507 (or the equivalent) in a single foreign language, and a three-semester-hour course in the same language for which 507 is a prerequisite; or as much of this coursework as required by the student's score on the appropriate language placement test. For students who enter the University with fewer than two high school units in a single foreign language, the first two semesters in a language may not be counted toward the total number of hours required for the degree.

3. Six semester hours of American history.

4. Six semester hours of American government, including Texas government.

5. Three semester hours in anthropology, economics, geography, linguistics, psychology, or sociology.

6. Eight semester hours in one of the following areas: astronomy, biology, chemistry, geological sciences, and physics.

7. Six semester hours in architecture, classics (including classical civilization, Greek, Latin), fine arts (including art history, design, ensemble, fine arts, instruments, music, studio art, theatre and dance, visual art studies), philosophy, or programs of special concentration. For students in the teaching option, three of these hours must consist of History 329U or Philosophy 329U. For students in the other options, three of these hours must be taken in architecture, classics, fine arts, or philosophy (excluding courses in logic).

8. Mathematics 408C and 408D, or Mathematics 408K, 408L, and 408M.

9. Forty-two semester hours of upper-division coursework.

10. At least six hours of upper-division coursework must be outside both mathematics and the subject areas listed in requirement 6. Philosophy courses in logic, computer sciences courses in discrete mathematics, and engineering courses may not be used to fulfill this requirement.

11. Eighteen semester hours in mathematics must be completed in residence at the University.

12. Enough additional coursework to make a total of 126 semester hours.

ADDITIONAL PRESCRIBED WORK FOR EACH OPTION

OPTION I: ACTUARIAL SCIENCE

13. Actuarial Foundations 329.

14. Economics 304K, 304L, and 420K.

15. Accounting 310F or both 311 and 312.

16. Finance 357.

17. At least thirty-two semester hours of upper-division coursework in mathematics and supporting areas, consisting of
   a. One of the following courses: Mathematics 328K, 343K, 361, 361K, 365C, 367K, 373K.
   b. Mathematics 340L or 341.
   c. Mathematics 362K and either 358K or 378K.

d. At least three courses chosen from the following: Mathematics 339J, 339U, 339V, 449P, 349T.

e. Enough additional coursework to provide a total of at least thirty-two hours. In addition to upper-division mathematics courses, the following courses in supporting areas may be counted toward this requirement: Finance 354, 367, Legal Environment of Business 320F, 323, Management Information Systems 325, Risk Management 357E, 369K, 377. Courses used to satisfy this requirement may not be counted toward requirement 10 above.

OPTION II: APPLIED MATHEMATICS

13. Computer Sciences 303E or the equivalent.

14. Thirty-two semester hours of upper-division coursework in mathematics, consisting of the following courses. The student should consult the applied mathematics adviser for information on other courses that may be counted toward this requirement.
   a. Mathematics 340L or 341.
   b. Mathematics 427K, 348, 362K, and 474M.
   c. Mathematics 361 and 365C.
   d. Mathematics 343K or 373K.
   e. Enough of the following coursework to provide a total of at least thirty-two hours: Mathematics 346, 365D, 368K, 372K, 376C.

OPTION III: MATHEMATICAL SCIENCES
Specialization in Statistics, Probability, and Data Analysis

13. Computer Sciences 303E or the equivalent.

14. At least thirty-two semester hours of upper-division coursework in mathematics and related areas, consisting of
   a. Mathematics 427K and 362K.
   b. Mathematics 340L or 341.
   c. Mathematics 361K or 365C.
   d. Mathematics 358K and 378K.
   e. Additional coursework chosen from the following: Civil Engineering 352, Computer Sciences 327E or 347, Economics 341K, 350K (Topic 4: *Advanced Econometrics*), 350K (Topic 6: *Advanced Microeconomic Theory*), 350K (Topic 7: *Applied Economic Analysis*), 354K, Electrical Engineering 366L, 379K (Topic 2: *Quality and Reliability Engineering*), 379K (Topic 15: *Information Theory*), Geography 360G, 360L, Mathematics 325K or Computer Sciences 336, Mathematics 339J, 339U, 339V, 346, 348, 449P, 365D, 368K, 374G, 474M, Mechanical Engineering 366L, 366Q, 366R, 367S, Psychology 325K, Risk Management 357E. Courses used to satisfy this requirement may not be counted toward requirement 10 above.

Most of these courses have substantial prerequisites, sometimes including courses in other departments. Some have restricted enrollment. The student is responsible for meeting prerequisites and other requirements for enrollment in the courses selected to fulfill this requirement. Courses should be chosen in consultation with the specialization adviser to form a coherent program consistent with the student's background and goals.

Specialization in Scientific Computation

Students who complete this specialization may simultaneously fulfill the requirements of the Elements of Computing Program and may apply to the director of that program for a certificate of completion. The Elements of Computing Program is described on page 415.

13. Computer Sciences 303E and 313E, or 307 and 315.
14. At least thirty-two semester hours of upper-division coursework in mathematics and related areas, consisting of
    a. Mathematics 340L or 341.
    b. Mathematics 427K, 348, 362K, and 368K.
    c. Mathematics 361K or 365C.
    d. Students who fulfill the requirements of the Elements of Computing Program may count up to six hours of upper-division coursework in that program toward this requirement. Computer Sciences 323E may not be counted toward this requirement. Courses used to satisfy this requirement may not be counted toward requirement 10 above.
    e. Additional coursework chosen from the following: Mathematics 325K or 328K (but not both), 427L, 343K or 373K (but not both), 343L, 346, 358K, 361, 365D, 372K, 474M, 376C, 378K.

OPTION IV: PURE MATHEMATICS

13. At least thirty-two semester hours of upper-division coursework in mathematics, consisting of
    a. Mathematics 340L or 341.
    b. Mathematics 427K, 361, 362K, 365C, and 373K.
    c. One of the following two-course sequences: Mathematics 427K and 372K, 358K and 378K, 362K and 339U, 362K and 339J, 348 and 368K, 365C and 365D, 367K and 367L, 373K and 373L.
    d. Additional hours of upper-division coursework in mathematics chosen with the approval of the mathematics adviser. Either Mathematics 343K or 361K may be counted toward this requirement, but not both.

OPTION V: TEACHING

This option is designed to fulfill the course requirements for certification as a middle grades or secondary school mathematics teacher in Texas; however, completion of the course requirements does not guarantee the student's certification. For information about additional certification requirements, consult the UTeach-Natural Sciences academic adviser.

Students are encouraged to become familiar with a variety of mathematical software relevant to middle grades or secondary teaching, such as computer geometry systems, spreadsheets, and statistical software. Whenever possible, the student should take courses and sections of courses that use these types of software in place of those that do not.

13. Mathematics 315C.
14. Biology 337 (Topic: *Research Methods—UTeach*), Chemistry 368 (Topic: *Research Methods—UTeach*), or Physics 341 (Topic: *Research Methods—UTeach*). The course used to fulfill this requirement may also be counted toward requirement 6 above if it is in the same field of study as the other courses counted toward requirement 6. Students are encouraged to take at least one course to fulfill requirement 6 before taking research methods.
15. At least thirty-two semester hours of upper-division coursework in mathematics, consisting of
    a. Mathematics 340L or 341.
    b. Mathematics 325K, 333L, 358K, and 362K.
    c. Mathematics 326K or 360M.
    d. Mathematics 361K or 365C.
    e. Mathematics 328K, 343K, or 373K.
    f. Mathematics 427K or 378K.
    g. Enough of the following coursework to provide a total of at least thirty-two semester hours: Mathematics 326K, 427K, 328K, 339J, 339U, 343K, 343L, 348, 360M, 361, 365C, 365D, 368K, 373K, 373L, 175 (Topic: *Seminar for Prospective Teachers*), 378K. A course used to fulfill requirements 15a through 15f may not also be counted toward requirement 15g.
16. A three-hour supporting course that uses mathematics but is in a field other than mathematics. The following courses may be used to fulfill this requirement: Architectural Engineering 323K, Astronomy 307, 352K, 352L, 358, 367M, Chemistry 301, 303, Civil Engineering 321, 341, 352, Computer Sciences 307, Economics 420K, Electrical Engineering 302, 366, 366L, Geological Sciences 346C, 354, 476K, Geography 360L, Government 341M, Human Development and Family Sciences 322, Mechanical Engineering 320, 326, 366L, 366Q, 366R, Petroleum and Geosystems Engineering 310, Physics 301, 303K, 303L, Psychology 325K, 332, 334C, 345, Sociology 369L. The supporting course may not also be counted toward requirements 2 through 7 of the prescribed work.

17. Eighteen semester hours of professional development coursework: Curriculum and Instruction 650S, UTeach-Natural Sciences 101, 110, 350, 355, 360, 170.

18. Students seeking middle grades certification must complete the following courses: Educational Psychology 363M (Topic 3: *Adolescent Development*), or Psychology 301 and 304; and Curriculum and Instruction 371 (Topic 10: *Secondary School Reading in the Content Subjects*).

SPECIAL REQUIREMENTS

The student must fulfill the University-wide graduation requirements given on pages 18–19 and the college requirements given on page 421. He or she must also make a grade of at least *C* in Mathematics 408C and 408D and in each course completed at the University and counted toward the prescribed work requirements for his or her option.

To graduate and be recommended for certification, students who follow the teaching option must have a University grade point average of at least 2.50. They must earn a grade of at least *C* in each of the professional development courses listed in requirement 17 and must pass the final teaching portfolio review; those seeking middle grades certification must also earn a grade of at least *C* in each of the courses listed in requirement 18. For information about the portfolio review and additional teacher certification requirements, consult the UTeach-Natural Sciences academic adviser.

BACHELOR OF SCIENCE IN NUTRITION

Nutrition is an integrative science with the overall objective of improving the health and well-being of individuals and groups. Nutritional inquiry encompasses not only the roles of electrons, atoms, molecules, genes, cells, organs, and complex organisms in biological life processes but also the links between life science and health, behavior, education, population, culture, and economics. The Bachelor of Science in Nutrition degree program includes four options: dietetics, nutritional sciences, nutrition and health, and teaching certification. All options combine a prescribed common core of science and nutrition courses with additional coursework in the area of specialization.

For students pursuing careers in dietetics, additional courses in behavioral and clinical nutrition and food systems management provide the academic preparation required for dietetics practice. The Didactic Program in Dietetics (DPD) meets the coursework requirements that qualify graduates to apply to a dietetic internship. The Coordinated Program in Dietetics (CPD) includes both the coursework and the supervised practice necessary to be eligible to write the examination to become a registered dietitian. The DPD is developmentally accredited and the CPD is accredited by the Commission on Accreditation of Dietetics Education of the American Dietetic Association (ADA), 120 S. Riverside Plaza, Suite 2000, Chicago IL 60606, (312) 899-0040.

The nutritional sciences option requires additional courses in science and research in order to prepare students for graduate study or professional school. Graduates may seek employment in private or publicly funded research programs or, upon completion of graduate study, may engage in college or university teaching or nutrition research. This option also allows students to fulfill requirements for postgraduate study in medicine, dentistry, and other health professions.

The nutrition and health option gives students flexibility to combine the study of nutrition with coursework in another area of interest. Additional courses in a concentration area may enhance nutrition related career opportunities; however, this option does not lead to dietetic registration. Students who select the business sequence can earn a Business Foundations Certificate and seek employment in areas such as sales and customer support in the food industry. The communication sequence provides training in public speaking and writing for the lay public along with study of the role culture plays in these areas. The computer science sequence can lead to an Elements of Computing Certificate and provide skills for future employment opportunities combining technology with nutrition. Students who are interested in the range of factors influencing health may choose the exercise and fitness sequence. The nutritional science and behavior sequence provides a scientific background for understanding eating behavior.

The teaching option allows students to meet the state certification requirements to teach science in secondary and/or middle grades. There is no certification for teaching nutrition or health in Texas public schools.

PRESCRIBED WORK
COMMON TO ALL OPTIONS

1. Rhetoric and Composition 306 and English 316K. In addition, in taking courses to fulfill other degree requirements, the student must complete two courses certified as having a substantial writing component; one of these courses must be upper-division. If the writing requirement is not fulfilled by courses specified for the degree, the student must fulfill it either with electives or with coursework taken in addition to the number of hours required for the degree. Courses with a substantial writing component are identified in the *Course Schedule*.

367K. Oceanography: Human Exploration and Exploitation of the Sea. Same as Geological Sciences 367K. Review of major oceanographic expeditions; exploration of continental shelves and deep ocean; exploration and exploitation of marine resources, including energy, hard minerals, and food. Discussion of environmental concerns, the Exclusive Economic Zone, coastal development, marine pollution, dumping at sea, cable, pipelines, and seafloor utilization. May not be counted toward a degree in geological sciences. *Prerequisite:* Nine semester hours of coursework in science, including Chemistry 302 with a grade of at least *C* and one of the following with a grade of at least *C*: Biology 211, 212, 213, 214, Geological Sciences 401, 303, 312K; and upper-division standing or consent of instructor.

170, 270, 370. Special Studies in Marine Science. Supervised individual instruction and research in marine science field and laboratory techniques. The equivalent of one, two, or three class hours a week for one semester, at the Marine Science Institute at Port Aransas. May be repeated for credit. *Prerequisite:* Six semester hours of upper-division coursework in science, a University grade point average of at least 3.00, and written consent of instructor.

DEPARTMENT OF MATHEMATICS

The Department of Mathematics offers a wide variety of courses to serve the needs of mathematics majors planning different careers and to serve the mathematical needs of students in other fields. Students majoring in mathematics should obtain a current copy of the *Handbook for Students* from the department. For help planning a program of study, students should consult an adviser in the Mathematics, Physics, and Astronomy Advising Center, Robert Lee Moore Hall 4.101.

A concentration in actuarial studies is available to students majoring in mathematics or another area. Typical programs include three hours of actuarial foundations, twenty-eight hours of mathematics, and selected coursework in the Red McCombs School of Business. Detailed information is available from the director of actuarial studies in the Department of Mathematics.

PREREQUISITES

Most entry-level courses in the Department of Mathematics have as a prerequisite a specific minimum score on the SAT II: Mathematics Level IC test; therefore, many students planning to take a course in the department must first have taken the Mathematics Level IC test. See the current *Course Schedule* or consult the Advising Center for the minimum score required.

Important advice on which entry-level mathematics course to take, based on the student's score on the Mathematics Level IC test, is available from the Measurement and Evaluation Center and the Mathematics, Physics, and Astronomy Advising Center.

In courses that have a minimum test score or course grade as a prerequisite, students will be dropped from the course if University records do not show that they have met the prerequisite. Students for whom the Mathematics Level IC test score is required must be prepared to present proof of their test score after classes have begun. Students who took the test at a College Board test center must use the official College Board score report as proof; students without the score report can obtain

alternate proof from the Measurement and Evaluation Center. Students who took the test at the University must use the test-result slip as the written proof; information about where to obtain the test-result slip is given at the time of the test.

Students who plan to use transfer credit to meet a prerequisite must submit a complete transcript to the Office of Admissions so that the credit can be added to University records. In addition to sending a transcript, students are encouraged to bring a grade report to the Advising Center as proof.

Students who wish to enroll in conference courses in the Department of Mathematics must submit consent of instructor forms to the Department of Mathematics before registering. Forms are available in the department office and the Advising Center.

Unless otherwise stated below, each course meets for three lecture hours a week for one semester.

ACTUARIAL FOUNDATIONS: ACF
Lower-Division Courses

110, 210, 310, 410. Conference Course. Supervised study of selected topics, by individual arrangement with department and instructor. May be repeated for credit when the topics vary. Some sections are offered on the pass/fail basis only; these are identified in the *Course Schedule*. *Prerequisite:* Written consent of instructor.

110T. Conference Course: Texas Department of Insurance Internship. Supervised internship at the Texas Department of Insurance. May be repeated for credit. Admission by application only. Students must apply to the director of the concentration in actuarial studies the semester before they take the course.

112M. Actuarial Laboratory on Probability and Statistics. Problems and supplementary instruction in probability and statistics, especially as required for the Society of Actuaries and Casualty Actuarial Society Exam 110. Three laboratory hours a week for one semester. *Prerequisite:* Mathematics 362K, credit or registration for Mathematics 378K, and consent of the director of the concentration in actuarial studies.

Upper-Division Course

329. Theory of Interest. Measurement of interest, present value, accumulated value, amortization of loans, sinking funds, and bonds. Covers the interest-theory portion of the syllabus for exam #2 of the Society of Actuaries and the Casualty Actuarial Society. Actuarial Foundations 309 and 329 may not both be counted. *Prerequisite:* Mathematics 408D or 408L.

MATHEMATICS: M
Lower-Division Courses

301. College Algebra. Topics include a brief review of elementary algebra; linear, quadratic, exponential, and logarithmic functions; polynomials; systems of linear equations; applications. Usually offered only in the summer session. May not be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in mathematics or toward the Bachelor of Science in Mathematics degree. In some colleges of the University, Mathematics 301 may not be counted toward the Area C requirement or toward the total number of hours required for a degree. Credit for Mathematics 301 may not be earned after a student has received credit for any calculus course with a grade of *C* or better. *Prerequisite:* A passing score on the mathematics section of the Texas Higher Education Assessment (THEA) test (or an appropriate assessment test).

302. Introduction to Mathematics. Intended primarily for general liberal arts students seeking knowledge of the nature of mathematics as well as training in mathematical thinking and problem solving. Topics include number theory and probability; additional topics are chosen by the instructor. Mathematics 302 and 303F may not both be counted. A student may not earn credit for Mathematics 302 after having received credit for any calculus course. May not be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in mathematics or toward the Bachelor of Science in Mathematics degree. May be used to fulfill the Area C requirement for the Bachelor of Arts, Plan I, degree or the mathematics requirement for the Bachelor of Arts, Plan II, degree. *Prerequisite:* Three units of high school mathematics at the level of Algebra I or higher, and a passing score on the mathematics section of the Texas Higher Education Assessment (THEA) test (or an appropriate assessment test).

303D. Applicable Mathematics. An entry-level course for the nontechnical student, dealing with some of the techniques that allow mathematics to be applied to a variety of problems. Topics include linear and quadratic equations, systems of linear equations, matrices, probability, statistics, exponential and logarithmic functions, and mathematics of finance. Mathematics 303D and 303F may not both be counted. May not be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in mathematics or toward the Bachelor of Science in Mathematics degree. A student may not earn credit for Mathematics 303D after having received credit for Mathematics 305G or any calculus course. *Prerequisite:* A score of at least 430 on the SAT II: Mathematics Level IC test, or Mathematics 301 with a grade of at least C.

403K. Calculus I for Business and Economics. Differential and integral calculus of algebraic, logarithmic, and exponential functions with applications. Three lecture hours and two discussion sessions a week for one semester. Only one of the following may be counted: Mathematics 403K, 408C, 408K (or 308K). May not be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in mathematics or toward the Bachelor of Science in Mathematics degree. *Prerequisite:* A satisfactory score on the SAT II: Mathematics Level IC test, Mathematics 301 with a grade of at least B, or Mathematics 305G with a grade of at least C.

403L. Calculus II for Business and Economics. Differential and integral calculus of functions of several variables with applications, infinite series, improper integrals; introductions to probability, differential equations, matrices, systems of linear equations, and linear programming. Three lecture hours and two discussion sessions a week for one semester. Mathematics 403L and 408L (or 308L) may not both be counted. May not be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in mathematics or toward the Bachelor of Science in Mathematics degree. *Prerequisite:* Mathematics 403K, 408C, or 308L with a grade of at least C.

305E. Analytic Geometry. Combines development of methods (including adequate treatment of theory) and acquisition of skills with applications. Mathematics 305E and 305K may not both be counted. Mathematics 305E and 305G may not both be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in Mathematics or towards the Bachelor of Science in Mathematics degree. *Prerequisite:* Mathematics 301.

305G. Elementary Functions and Coordinate Geometry. Study of elementary functions, their graphs and applications, including polynomial, rational, and algebraic functions, exponential, logarithmic, and trigonometric functions. Mathematics 305G and any college-level trigonometry course may not both be counted. Mathematics 301, 305G, and equivalent courses may not be counted toward the total number of hours required for the Bachelor of Arts, Plan I, degree with a major in mathematics or the Bachelor of Science in Mathematics degree. Credit for Mathematics 305G may not be earned after a student has received credit for any calculus course with a grade of C or better. *Prerequisite:* A score of at least 480 on the SAT II: Mathematics Level IC test, or Mathematics 301 with a grade of at least C.

408C. Differential and Integral Calculus. Introduction to the theory and applications of differential and integral calculus of functions of one variable; topics include limits, continuity, differentiation, the mean value theorem and its applications, integration, the fundamental theorem of calculus, and transcendental functions. Three lecture hours and two discussion hours a week for one semester. Only one of the following may be counted: Mathematics 403K, 408C, 408K (or 308K). *Prerequisite:* Four years of high school mathematics and a score of at least 560 on the SAT II: Mathematics Level IC test, or Mathematics 305G with a grade of at least C.

408D. Sequences, Series, and Multivariable Calculus. Certain sections of this course are designated as advanced placement or honors sections; they are restricted to students who have scored well on the AP/BC exam, are in the Engineering Honors Program, or have the consent of the mathematics adviser. Such sections and their restrictions are identified in the *Course Schedule*. Introduction to the theory and applications of sequences and infinite series, including those involving functions of one variable, and to the theory and applications of differential and integral calculus of functions of several variables; topics include parametric equations, sequences, infinite series, power series, vectors, vector calculus, functions of several variables, partial derivatives, gradients, and multiple integrals. Three lecture hours and two discussion hours a week for one semester. Only one of the following may be counted: Mathematics 403L, 408D, 408M (or 308M). *Prerequisite:* Mathematics 408C or the equivalent with a grade of at least C.

408K. Differential Calculus. Introduction to the theory and applications of differential calculus of functions of one variable; topics include limits, continuity, differentiation, and the mean value theorem and its applications. Three lecture hours and two discussion hours a week for one semester. Only one of the following may be counted: Mathematics 403K, 408C, 408K (or 308K). *Prerequisite:* Four years of high school mathematics and a score of at least 520 on the SAT II: Mathematics Level IC test, or Mathematics 305G with a grade of at least C.

308L, 408L. Integral Calculus. Introduction to the theory and applications of integral calculus of functions of one variable; topics include integration, the fundamental theorem of calculus, transcendental functions, sequences, and infinite series. For Mathematics 308L, three lecture hours a week for one semester; for 408L, three lecture hours and two discussion hours a week for one semester. Mathematics 403L and 408L (or 308L) may not both be counted. *Prerequisite:* Mathematics 408C or 408K or the equivalent with a grade of at least C.

308M, 408M. Multivariable Calculus. Each fall a section of this course is designated in the *Course Schedule* as an engineering honors section, for students who wish to investigate more thoroughly the foundations of calculus. Enrollment in this section is restricted to students in the Engineering Honors Program. Introduction to the theory and applications of differential and integral calculus of functions of several variables. Includes parametric equations, polar coordinates, vectors, vector calculus, functions of several variables, partial derivatives, gradients, and multiple integrals. For Mathematics 308M, three lecture hours a week for one semester; for 408M, three lecture hours and two discussion hours a week for one semester. Only one of the following may be counted: Mathematics 403L, 408D, 408M (or 308M). *Prerequisite:* Mathematics 408L or the equivalent with a grade of at least *C.*

110, 210, 310, 410. Conference Course. Supervised study in mathematics, with hours to be arranged. May be repeated for credit when the topics vary. Some sections are offered on the pass/fail basis only; these are identified in the *Course Schedule.* Some sections may not be counted toward any mathematics or science degree requirement; these are identified in the *Course Schedule. Prerequisite:* Written consent of instructor. Forms are available in the department office or in the Mathematics, Physics, and Astronomy Advising Center.

210E. Emerging Scholars Seminar. Restricted to students in the Emerging Scholars Program. Supplemental problem-solving laboratory for precalculus, calculus, or advanced calculus courses for students in the Emerging Scholars Program. Three two-hour laboratory sessions a week for one semester. May be repeated for credit. Offered on the pass/fail basis only.

315C. Functions and Modeling. Study in depth of topics in secondary school mathematics that are used in teaching precalculus and in the transition to calculus. Modeling with linear, exponential, and trigonometric functions; curve fitting; discrete and continuous models. Four laboratory hours a week for one semester. *Prerequisite:* Enrollment in a teaching preparation program or consent of instructor.

316. Elementary Statistical Methods. Graphical presentation, frequency functions, distribution functions, averages, standard deviation, variance, curve-fitting, and related topics. May not be counted by students with credit for Mathematics 362K. May not be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in mathematics or toward the Bachelor of Science in Mathematics degree. *Prerequisite:* A score of at least 430 on the SAT II: Mathematics Level IC test, or Mathematics 301 with a grade of at least *C.*

316K. Foundations of Arithmetic. An analysis, from an advanced perspective, of the concepts and algorithms of arithmetic, including sets; numbers; numeration systems; definitions, properties, and algorithms of arithmetic operations; and percents, ratios, and proportions. Problem solving is stressed. May not be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in mathematics or toward the Bachelor of Science in Mathematics degree. Credit for Mathematics 316K may not be earned after the student has received credit for any calculus course with a grade of *C* or better, unless the student is registered in the College of Education. *Prerequisite:* Mathematics 302, 303D, 305G, or 316 with a grade of at least *C.*

316L. Foundations of Geometry, Statistics, and Probability. An analysis, from an advanced perspective, of the basic concepts and methods of geometry, statistics, and probability, including representation and analysis of data; discrete probability, random events, and conditional probability; measurement; and geometry as approached through similarity and congruence, through coordinates, and through transformations. Problem solving is stressed. May not be counted toward the major requirement for the Bachelor of Arts, Plan I, degree with a major in mathematics or toward the Bachelor of Science in Mathematics degree. Credit for Mathematics 316L may not be earned after the student has received credit for any calculus course with a grade of *C* or better, unless the student is registered in the College of Education. *Prerequisite:* Mathematics 316K with a grade of at least *C.*

119S, 219S, 319S, 419S, 519S, 619S, 719S, 819S, 919S. Topics in Mathematics. This course is used to record credit the student earns while enrolled at another institution in a program administered by the University's Center for Global Educational Opportunities. Credit is recorded as assigned by the study abroad adviser in the Department of Mathematics. University credit is awarded for work in an exchange program; it may be counted as coursework taken in residence. Transfer credit is awarded for work in an affiliated studies program. May be repeated for credit when the topics vary.

Upper-Division Courses

325K. Discrete Mathematics. Provides a transition from the problem-solving approach of Mathematics 408C and 408D to the rigorous approach of advanced courses. Topics include logic, set theory, relations and functions, combinatorics, and graph theory and graph algorithms. *Prerequisite:* Mathematics 408D or 408L with a grade of at least *C,* or consent of instructor.

326K. Foundations of Number Systems. Restricted to students in a teacher preparation program or who have consent of instructor. Intended to provide future teachers with an understanding of certain concepts in school mathematics. Includes place value and arithmetic operations (including historical perspectives and analysis of both standard and nonstandard algorithms); prime factorization and other properties of integers; irrational and transcendental numbers; complex numbers; properties of polynomials; and connections of these topics with other areas of mathematics. Emphasis on conceptual understanding, developing both formal proofs and informal explanations, looking at concepts from multiple perspectives, and problem solving involving these topics. *Prerequisite:* Mathematics 408D or 408L or the equivalent with a grade of at least *C.*

427K. Advanced Calculus for Applications I. Ordinary and partial differential equations and Fourier series. Five class hours a week for one semester. *Prerequisite:* Mathematics 408D or 408L with a grade of at least *C.*

427L. Advanced Calculus for Applications II. Matrices, elements of vector analysis and calculus of functions of several variables, including gradient, divergence, and curl of a vector field, multiple integrals and chain rules, length and area, line and surface integrals, Green's theorems in the plane and space, and, if time permits, complex analysis. Five class hours a week for one semester. *Prerequisite:* Mathematics 408D with a grade of at least *C.*

328K. Introduction to Number Theory. Provides a transition from the problem-solving approach of Mathematics 408C and 408D to the rigorous approach of advanced courses. Properties of the integers, divisibility, linear and quadratic forms, prime numbers, congruences and residues, quadratic reciprocity, number theoretic functions. *Prerequisite:* Mathematics 341 (or 311) with a grade of at least *C*.

129S, 229S, 329S, 429S, 529S, 629S, 729S, 829S, 929S. Topics in Mathematics. This course is used to record credit the student earns while enrolled at another institution in a program administered by the University's Center for Global Educational Opportunities. Credit is recorded as assigned by the study abroad adviser in the Department of Mathematics. University credit is awarded for work in an exchange program, it may be counted as coursework taken in residence. Transfer credit is awarded for work in an affiliated studies program. May be repeated for credit when the topics vary.

329W. Cooperative Mathematics. This course covers the work period of mathematics students in the Cooperative Education program, which provides supervised work experience by arrangement with the employer and the supervising instructor. Forty laboratory hours a week for one semester. The student must repeat the course each work period and must take it twice to receive credit toward the degree; at least one of these registrations must be during a long-session semester. No more than three semester hours may be counted toward the major requirement; no more than six semester hours may be counted toward the degree. The student's first registration must be on the pass/fail basis. *Prerequisite:* Application through the College of Natural Sciences Career Services Office; Mathematics 408D or 408L; a grade of at least *C* in two of the following courses: Mathematics 325K, 427K, 341 (or 311), 362K, 378K; and consent of the undergraduate adviser.

333L. Structure of Modern Geometry. Axiom systems, transformational geometry, introduction to non-Euclidean geometries, and other topics in geometry; use of these ideas in teaching geometry. *Prerequisite:* Mathematics 408D or 408L with a grade of at least *C*, or upper-division standing and consent of instructor.

339J. Probability Models with Actuarial Applications. Introductory actuarial models for life insurance, property insurance, and annuities. With Mathematics 339U and 339V, covers the syllabus for the professional actuarial exam on models. *Prerequisite:* Mathematics 362K with a grade of at least *C*.

139S. Seminar on Actuarial Practice. Presentations by working actuaries on current issues in actuarial practice. One lecture hour a week for one semester. *Prerequisite:* Actuarial Foundations 329 and Mathematics 339J (or 439J) with a grade of at least *C* in each.

339U. Actuarial Contingent Payments I. Intermediate actuarial models for life insurance, property insurance, and annuities. With Mathematics 339J and 339V, covers the syllabus for the professional actuarial exam on models. *Prerequisite:* Mathematics 339J, and 341 or 340L with a grade of at least *C* in each; and credit with a grade of at least *C* or registration for Actuarial Foundations 329 (or credit for 309 with a grade of at least *C*).

339V. Actuarial Contingent Payments II. Advanced actuarial models for life insurance, property insurance, and annuities. With Mathematics 339J and 339U, covers the syllabus for the professional actuarial exam on models. *Prerequisite:* Mathematics 339U with a grade of at least *C*.

340L. Matrices and Matrix Calculations. Techniques of matrix calculations and applications of linear algebra. Only one of the following may be counted: Mathematics 311, 340L, 341. *Prerequisite:* One semester of calculus with a grade of at least *C* or consent of instructor.

341. Linear Algebra and Matrix Theory. Vector spaces, linear transformations, matrices, linear equations, determinants. Some emphasis on rigor and proofs. Only one of the following may be counted: Mathematics 311, 340L, 341. Mathematics majors are expected to take Mathematics 341 immediately after 408D. *Prerequisite:* Mathematics 408D with a grade of at least *C*.

343K. Introduction to Algebraic Structures. Elementary properties of groups and rings, including symmetric groups, properties of the integers, polynomial rings, elementary field theory. Students who have received a grade of *C* or better in Mathematics 373K may not take Mathematics 343K. *Prerequisite:* Consent of the undergraduate adviser, or two of the following courses with a grade of at least *C* in each: Mathematics 325K or Philosophy 313K, Mathematics 328K, Mathematics 341 (or 311).

343L. Applied Number Theory. Basic properties of integers, including properties of prime numbers, congruences, and primitive roots. Introduction to finite fields and their vector spaces with applications to encryption systems and coding theory. *Prerequisite:* Mathematics 328K or 343K with a grade of at least *C*.

343M. Error-Correcting Codes. Introduction to applications of algebra and number theory to error-correcting codes, including finite fields, error-correcting codes, vector spaces over finite fields, Hamming norm, coding, and decoding. *Prerequisite:* Mathematics 328K or 341 with a grade of at least *C*.

344K. Intermediate Symbolic Logic. Same as Philosophy 344K. A second-semester course in symbolic logic: formal syntax and semantics, basic metatheory (soundness, completeness, compactness, and Löwenheim-Skolem theorems), and further topics in logic. *Prerequisite:* Philosophy 313K or consent of instructor.

346. Applied Linear Algebra. Emphasis on diagonalization of linear operators and applications to dynamical systems and ordinary differential equations. Other subjects include inner products and orthogonality, normal mode expansions, vibrating strings and the wave equation, and Fourier series. *Prerequisite:* Mathematics 341 (or 311) or 340L with a grade of at least *C*.

348. Scientific Computation in Numerical Analysis. Introduction to mathematical properties of numerical methods and their applications in computational science and engineering. Introduction to object-oriented programming in an advanced language. Study and use of numerical methods for solutions of linear systems of equations; nonlinear least-squares data fitting; numerical integration; and solutions of multidimensional nonlinear equations and systems of initial value ordinary differential equations. *Prerequisite:* Computer Sciences 303E or the equivalent, and Mathematics 341 (or 311) or 340L with a grade of at least *C*.

449P. Actuarial Statistical Estimates. Statistical estimation procedures for random variables and related quantities in actuarial models. Covers the syllabus for the professional actuarial exam on model construction. Four lecture hours a week for one semester. *Prerequisite:* Mathematics 339J, 341 (or 311) or 340L, and 358K or 378K with a grade of at least *C* in each.

349T. Time Series and Survival-Model Estimation. Introduction to the probabilistic and statistical properties of time series; parameter estimation and hypothesis testing for survival models. Covers 30 percent of the syllabus for exam #4 of the Society of Actuaries and the Casualty Actuarial Society. *Prerequisite:* Mathematics 339U, 341 (or 311) or 340L, and 358K or 378K.

358K. Applied Statistics. Exploratory data analysis, correlation and regression, data collection, sampling distributions, confidence intervals, and hypothesis testing. *Prerequisite:* Mathematics 362K with a grade of at least *C*.

360M. Mathematics as Problem Solving. Discussion of heuristics, strategies, and methods of evaluating problem solving, and extensive practice in both group and individual problem solving. Communicating mathematics, reasoning, and connections among topics in mathematics are emphasized. *Prerequisite:* Mathematics 408D or 408L with a grade of at least *C* and written consent of instructor.

361. Theory of Functions of a Complex Variable. Elementary theory and applications of analytic functions, series, contour integration, and conformal mappings. *Prerequisite:* Mathematics 427K or 427L with a grade of at least *C* or consent of instructor.

361K. Introduction to Real Analysis. A rigorous treatment of the real number system, of real sequences, and of limits, continuity, derivatives, and integrals of real-valued functions of one real variable. Students who have received a grade of *C* or better in Mathematics 365C may not take Mathematics 361K. *Prerequisite:* Consent of the undergraduate adviser, or two of the following courses with a grade of at least *C* in each: Mathematics 325K or Philosophy 313K, Mathematics 328K, Mathematics 341 (or 311).

362K. Probability I. An introductory course in the mathematical theory of probability, fundamental to further work in probability and statistics, includes basic probability properties, conditional probability and independence, various discrete and continuous random variables, expectation and variance, central limit theorem, and joint probability distributions. *Prerequisite:* Mathematics 408D or 408L with a grade of at least *C*.

362M. Introduction to Stochastic Processes. Introduction to Markov chains, birth and death processes, and other topics. *Prerequisite:* Mathematics 362K with a grade of at least *C*.

364K. Vector and Tensor Analysis I. Invariance, vector algebra and calculus, integral theorems, general coordinates, introductory differential geometry and tensor analysis, applications. *Prerequisite:* Mathematics 427K or 427L with a grade of at least *C*.

364L. Vector and Tensor Analysis II. Continuation of Mathematics 364K, with emphasis on tensor and extensor analysis. Riemannian geometry and invariance. *Prerequisite:* Mathematics 364K with a grade of at least *C*.

365C. Real Analysis I. A rigorous treatment of the real number system, Euclidean spaces, metric spaces, continuity of functions in metric spaces, differentiation and Riemann integration of real-valued functions of one real variable, and uniform convergence of sequences and series of functions. Students who have received a grade of *C* or better in Mathematics 365C may not take Mathematics 361K. *Prerequisite:* Consent of the undergraduate adviser, or two of the following courses with a grade of at least *C* in each: Mathematics 325K or Philosophy 313K, Mathematics 328K, Mathematics 341 (or 311). Students who receive a grade of *C* in one of the prerequisite courses are advised to take Mathematics 361K before attempting 365C. Students planning to take Mathematics 365C and 373K concurrently should consult a mathematics adviser.

365D. Real Analysis II. Recommended for students planning to undertake graduate work in mathematics. A rigorous treatment of selected topics in real analysis, such as Lebesgue integration, or multivariate integration and differential forms. *Prerequisite:* Mathematics 365C with a grade of at least *C*.

367K. Topology I. An introduction to topology, including sets, functions, cardinal numbers, and the topology of metric spaces. *Prerequisite:* Mathematics 361K or 365C or consent of instructor.

367L. Topology II. Various topics in topology, primarily of a geometric nature. *Prerequisite:* Mathematics 367K with a grade of at least *C* or consent of instructor.

368K. Numerical Methods for Applications. Continuation of Mathematics 348. Topics include splines, orthogonal polynomials and smoothing of data, iterative solution of systems of linear equations, approximation of eigenvalues, two-point boundary value problems, numerical approximation of partial differential equations, signal processing, optimization, and Monte Carlo methods. Only one of the following may be counted: Computer Sciences 367, Mathematics 368K, Physics 329. *Prerequisite:* Mathematics 348 with a grade of at least *C*.

372. Fourier Series and Boundary Value Problems. Discussion of differential equations of mathematical physics and representation of solutions by Green's functions and eigenfunction expansions. *Prerequisite:* Mathematics 427K with a grade of at least *C*.

372K. Partial Differential Equations and Applications. Partial differential equations as basic models of flows, diffusion, dispersion, and vibrations. Topics include first- and second-order partial differential equations and classification (particularly the wave, diffusion, and potential equations), and their origins in applications and properties of solutions. Includes the study of characteristics, maximum principles, Green's functions, eigenvalue problems, and Fourier expansion methods. *Prerequisite:* Mathematics 427K with a grade of at least *C*.

373K. Algebraic Structures I. A study of groups, rings, and fields, including structure theory of finite groups, isomorphism theorems, polynomial rings, and principal ideal domains. Students who have received a grade of *C* or better in Mathematics 373K may not take Mathematics 343K. *Prerequisite:* Consent of the undergraduate adviser, or two of the following courses with a grade of at least *C* in each: Mathematics 325K or Philosophy 313K, Mathematics 328K, Mathematics 341 (or 311). Students who receive a grade of *C* in one of the prerequisite courses are advised to take Mathematics 343K before attempting 373K. Students planning to take Mathematics 365C and 373K concurrently should consult a mathematics adviser.

373L. Algebraic Structures II. Recommended for students planning to undertake graduate work in mathematics. Topics from vector spaces and modules, including direct sum decompositions, dual spaces, canonical forms, and multilinear algebra. *Prerequisite:* Mathematics 373K with a grade of at least *C*.

374. Fourier and Laplace Transforms. Operational properties and application of Laplace transforms; some properties of Fourier transforms. *Prerequisite:* Mathematics 427K with a grade of at least *C*.

374G. Linear Regression Analysis. Fitting of linear models to data by the method of least squares, choosing best subsets of predictors, and related materials. *Prerequisite:* Mathematics 358K or 378K with grade of at least *C*, Mathematics 341 or 340L, and consent of instructor.

374K. Fourier and Laplace Transforms. Continuation of Mathematics 374. Introduction to other integral transforms, such as Hankel, Laguerre, Mellin, Z. *Prerequisite:* Mathematics 374 with a grade of at least *C*.

474M. Introduction to Mathematical Modeling and Industrial Mathematics. Some of the problems encountered in current industry, and how mathematics can help solve them. Basic material in theory and computation of ordinary and partial differential equations, integral equations, calculus of variations and control theory. Specific industrial applications. Three lecture hours and two laboratory hours a week for one semester. *Prerequisite:* Mathematics 427K, and 341 (or 311) or 340L, with a grade of at least *C* in each.

175, 275, 375, 475. Conference Course. Supervised study in mathematics, with hours to be arranged. May be repeated for credit when the topics vary. *Prerequisite:* Varies with the topic and is given in the *Course Schedule.*

375C. Conference Course (Computer-Assisted). Supervised study in mathematics on material requiring use of computing resources, with hours to be arranged. May be repeated for credit when the topics vary. *Prerequisite:* Varies with the topic and is given in the *Course Schedule.*

375G. Methods of Applied Mathematics. Variational methods and related concepts from classical and modern applied mathematics. Models of conduction and vibration that lead to systems of linear equations and ordinary differential equations, eigenvalue problems, initial and boundary value problems for partial differential equations. Topics may include a selection from diagonalization of matrices, eigenfunctions and minimization, asymptotics of eigenvalues, separation of variables, generalized solutions, and approximation methods. May be repeated for credit when the topics vary. *Prerequisite:* Computer Sciences 303E or the equivalent, Mathematics 427K, and Mathematics 341 (or 311) or 340L with a grade of at least *C* in each.

378K. Introduction to Mathematical Statistics. Sampling distributions of statistics, estimation of parameters (confidence intervals, method of moments, maximum likelihood, comparison of estimators using mean square error and efficiency, sufficient statistics), hypothesis tests (p-values, power, likelihood ratio tests), and other topics. Mathematics 358K, 362K, and 378K form the core sequence for students in statistics. *Prerequisite:* Mathematics 362K with a grade of at least *C*.

379H. Honors Tutorial Course. Directed reading, research, and/or projects, under the supervision of a faculty member, leading to an honors thesis. Conference course. *Prerequisite:* Admission to the Mathematics Honors Program, a grade point average of at least 3.50 in Mathematics 365C and 373K, and approval of the honors adviser.

NATURAL SCIENCES COURSES

See page 457.

NUTRITION

See Department of Human Ecology, page 482.

PHYSICAL SCIENCE

See Department of Physics, below.

DEPARTMENT OF PHYSICS

Unless otherwise stated below, each course meets for three lecture hours a week for one semester.

PHYSICAL SCIENCE: P S

Lower-Division Courses

303. Introductory Physical Science I: Mechanics and Heat. Designed for students with minimum prior preparation in mathematics and physics. Especially appropriate for prospective elementary school teachers. Inquiry laboratory approach to basic concepts of measurement, forces, motion, energy, temperature, and heat. Four hours of integrated laboratory and lecture a week for one semester.

304. Introductory Physical Science II: Electricity, Light, and Optics. Inquiry laboratory approach to electricity, magnetism, waves, light, and optical instruments. Four hours of integrated laboratory and lecture a week for one semester. *Prerequisite:* Physical Science 303.

Upper-Division Courses

350. Physical Science for Elementary and Middle School Teachers. Designed for kindergarten through sixth grade teachers with minimal preparation in mathematics (college algebra) and no preparation in physics. An inquiry laboratory in the basic concepts of light, electricity, and magnetism. Three hours of integrated laboratory and lecture a day for three weeks.

367M. Physical Science: Methods of Astronomy. Same as Astronomy 367M. An introductory, self-paced course in the methods of astronomy that emphasizes learning astronomical principles through observations. Six laboratory hours a week for one semester. May not be counted toward the Bachelor of Arts, Plan I, degree with a major in astronomy. *Prerequisite:* Upper-division standing and nine semester hours of coursework in mathematics and/or science, including one of the following: Physical Science 303, 304, Astronomy 301, 302, 303. Equivalent preparation in mathematics, physics, chemistry, or earth sciences may be substituted with written approval of the instructor.

375. Individual Study in Physical Science. Intended primarily for preservice and in-service teachers. Guided inquiry reading or laboratory research in physical science. Meets three times a week for one semester, for one hour each meeting. May be repeated for credit when the topics vary. *Prerequisite:* Upper-division standing and written consent of instructor.