

CATALOGUE

The following bulletins comprise the Catalogue of The University of Texas at Austin:

- PART II *College of Pharmacy*
- PART III *College of Business Administration*
- PART IV *College of Engineering*
- PART V *General Information*
- PART VII *Graduate School*
- PART VIII *School of Law*
- PART IX *College of Humanities*
- PART X *College of Fine Arts*
- PART XI *School of Communication*
- PART XII *College of Natural Sciences*
- PART XIII *College of Education*
- PART XIV *College of Social and Behavioral Sciences*
- PART XV *School of Architecture*
- PART XVI *Division of General and Comparative Studies*

GENERAL PURPOSE OF THE CATALOGUE

The Catalogue Parts of The University of Texas at Austin are intended to give general information, to record the work of the biennium about to close (except Part V), and to make announcements for the ensuing period specified in each case.

As to the courses to be offered the following Long Sessions, the Catalogue contains only a preliminary announcement and is superseded by the *Course Schedule*, printed each semester.

The Catalogue contains the official regulations. Except as to degree requirements, these regulations are not valid beyond the period specified on the cover page.

Statement on Equal Educational Opportunity

With respect to the admission and education of students, with respect to the availability of student loans, grants, scholarships, and job opportunities, with respect to the employment and promotion of teaching and nonteaching personnel, with respect to the 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, The University of Texas at Austin shall not discriminate either in favor of or against any person on account of his or her race, creed, color, or national origin.

CATALOGUE NUMBER: PART XII

College of NATURAL SCIENCES

1973-1974 and 1974-1975

WITH ANNOUNCEMENTS FOR
1975-1976 and 1976-1977



THE UNIVERSITY OF TEXAS AT AUSTIN
AUSTIN, TEXAS

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needs. Except for those limits imposed by specific requirements in the Plan I degree program, there is no restriction on the number of courses a student can take in other colleges and schools within The University of Texas at Austin.

Students in the Bachelor of Arts program, Plan I, are permitted, with the approval of the deans of the colleges or schools involved, to major in departments in other colleges and schools within The University of Texas at Austin.

DEGREE REQUIREMENTS, GENERAL

A total of 120 semester hours is required for the B.A. degree, Plan I. This may include credits received by examination and a maximum of sixteen hours of classroom work on a Pass-Fail basis. All students graduated in Plan I must complete the requirements for a departmental major and must complete at least thirty semester hours in residence in the classroom at The University of Texas at Austin. These thirty hours must include at least eighteen hours in the major. A completed degree program must include at least thirty-six semester hours in upper division courses, of which eighteen semester hours must be in residence.

DEGREE REQUIREMENTS, SPECIFIC

Specific requirements for the B.A. degree, Plan I, are divided into four areas, A, B, C, and D. With the Dean's approval, interdepartmental courses, courses offered by other schools and colleges at The University of Texas at Austin, University Courses, and credit by examination may be used to meet these requirements. Such courses may not be used to meet the requirements of special programs or departmental majors without the approval of the program director or the departmental chairman. A course taken to meet the requirements of one area cannot also be used to satisfy the requirements of another area. No courses to satisfy area requirements may be taken on a Pass-Fail basis.

A. Prescribed Work

AREA A

English: (a) English 306, 307, and either 310, 312L, 312M, 314K, 317, or 318M;
or

(b) English 306, 308, and either 312L, 312M, or 314K.

Foreign Language: Students continuing a study of the language for which they present two high-school admission units must satisfy the equivalent of three semesters beyond the beginning course in that language. Students electing a language different from the one used for admission must pass four semesters in the new language, including the beginning course. Students who had no foreign language in high school must take the beginning course in a language without degree credit to remove their language deficiency, then satisfy the equivalent of three semesters beyond that course in the same language to fulfill their foreign language requirement.

The foreign language requirement is the attainment of a certain proficiency rather than the completion of a specified number of hours; any or all of these required semesters may be fulfilled by credit by examination. Students

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may accelerate their progress at any point in the sequence by means of credit by examination.

A student may not receive degree credit for two entrance units in a foreign language and Course 406 in that same language. A single foreign language unit presented under Group G of the entrance requirement is not affected by this restriction.

A student who has received credit for prior work in Latin, either in high school or college, should consult the Chairman of the Department of Classics, who will designate the Latin course for which he should enroll.

In order to achieve proficiency in a foreign language as rapidly as possible, qualified students are urged to take advantage of the intensive foreign language study program. Detailed information about this program may be obtained from the co-ordinator of the appropriate language department. Courses used toward fulfillment of the foreign language requirement must be "language" courses; e.g., literature in translation courses will not count.

AREA B

Eighteen semester hours, distributed among at least four of the subareas listed below. For meeting the legislative degree requirement of six semester hours each in American government and American history, only three semester hours of credit by examination in each subject may be used. None of these courses, including those to satisfy the government and history requirement, can be taken on a Pass-Fail basis.

(1) Legislative requirement (six hours each):

- (1) American government
- (2) American history

(2) Three hours each from any two of the subareas listed below:

- (3) Anthropology¹
- (4) Economics
- (5) Geography¹
- (6) Linguistics
- (7) Psychology¹
- (8) Sociology

AREA C

Fifteen semester hours, with no more than nine in any one department, from the subareas as listed below.

Algebra courses at the level of Mathematics 301, 301E or their equivalent, cannot be counted toward the Area C requirement or toward the total hours required for the degree if taken September, 1972, or later.

No more than nine semester hours of mathematics and computer sciences combined may be used to fulfill requirements under Area C.

A maximum of three semester hours in courses in history of science and philosophy of science may be used to fulfill Area C requirements. Such courses shall have a minimum prerequisite of six hours of biological or physical sciences.

A course listed in two or more departments may be used as a course in only one department in fulfilling requirements under Area C.

- (1) Astronomy
- (2) Biology
- (3) Botany
- (4) Chemistry

¹Courses taken to satisfy Area B requirements cannot also be used to satisfy requirements in other areas.

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| (5) Computer sciences | (11) Physical geography ² |
| (6) Experimental psychology ² | (12) Physical science |
| (7) Geology | (13) Physics |
| (8) Mathematics | (14) Zoology |
| (9) Microbiology | (15) History of science and
philosophy of science |
| (10) Physical anthropology ² | |

Students, counselors, and advisers are urged to make careful selection of Area C courses in order to develop a meaningful pattern and a coherent sequence. Students should confer with their departmental advisers or with counselors in the Student Office about what courses can be used for items (6), (10), (11), (12), and (15).

AREA D

Six semester hours from the subareas listed below.

A student who uses Greek or Latin to meet the foreign language requirements may offer only upper-division courses if he wishes to use the same language to meet the Area D Classics requirement.

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| (1) Architecture | programs of special concentration cutting across specific departments, schools, or colleges. |
| (2) Classics: Classical civilization, Greek, Latin | Questions concerning courses which qualify should be addressed to the student's academic dean. |
| (3) Fine Arts: Art, drama, and music | |
| (4) Philosophy | |
| (5) Interdisciplinary courses including, but not restricted to, those in | |

B. Special Requirements

ELECTIVE REQUIREMENTS AND LIMITATIONS

Elective courses will be taken to complete the 120 hours required for the B.A. degree. No more than twelve hours of Bible, nine hours of ROTC courses, fifteen hours of University Courses, sixteen hours of work taken on a Pass-Fail basis, or thirty-six hours in any one subject may be counted toward the 120-hour requirement.

MINIMUM SCHOLASTIC REQUIREMENTS

The student must (a) make a grade-point average of at least 2.0 on the courses taken at The University of Texas at Austin which are required and counted toward the degree; in addition, he must (b) make a grade-point average of at least 2.0 on courses taken at The University of Texas at Austin and counted as the major requirement. A grade of A counts 4 points per semester hour; a B, 3 points; a C, 2 points; a D, 1 point; and an F, 0.

Students should refer to the description of their major program (see "D. Majors," below), as a specific major may set higher minimum scholastic requirements.

² Courses taken to satisfy Area C requirements cannot be used to satisfy requirements in other areas.

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REQUIREMENTS IN ORDER OF WORK

Each student is required to register for the beginning course in English in his first long-session semester at the University, unless he has received credit by transfer or credit by examination. If he does not pass the course, he should repeat it in each succeeding long-session semester of his residence until a satisfactory grade is received.

In general, it is desirable that a student register for a foreign language course in his first long-session semester and continue the foreign language sequence until the requirement is complete. A freshman may not begin two first-semester language courses; neither may a freshman register for more than eight semester hours in one department per semester.

Each regularly enrolled student shall have completed fifteen semester hours of required courses by the end of his first long session (or two long-session semesters in residence), thirty semester hours by the end of the second, and forty-five semester hours by the end of the third, counting credits and exemptions earned by credit by examination. If this number of hours is not successfully passed at the end of the specified periods, the student must register for a minimum of nine semester hours of required courses in each long-session semester in residence until the deficiency is removed.

If there is a conflict between these requirements and orderly progress in the student's major course program or preprofessional program, exceptions may be authorized by the Dean upon recommendation of the departmental chairman or special program supervisor in the student's major field. Major course program is understood to mean all work, in any department, necessary to the program.

C. Special Concentrations

Within the general requirements for the degree of Bachelor of Arts and the requirements of the student's major department or subject, a student may also accomplish a concentration in one of several special programs (see the catalogue of the Division of General and Comparative Studies). These programs are provided by the Division of General and Comparative Studies, under the direction of the Dean.

D. Majors

Major Requirement: The B.A. Plan I degree requires the completion of all requirements for one major, as specified in the catalogues of the College of Humanities, the College of Natural Sciences, the College of Social and Behavioral Sciences, and the Division of General and Comparative Studies.

These majors are:

College of Humanities: Classics, Czech, English, French, German, Greek, Humanities, Italian, Latin, Oriental and African Languages and Literatures, Philosophy, Portuguese, Russian, Scandinavian, and Spanish.

College of Natural Sciences: Astronomy, Biochemistry, Biology, Botany, Chemistry, Computer Sciences, Geological Sciences, Home Economics, Mathematics, Microbiology, Physics, and Zoology.

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BIOLOGY

The biology degree program is offered by the Division of Biological Sciences. Students electing this degree program shall have completed at least five semester hours from Biology 302, 303, 304, 205 and 206 (or their equivalents). Two courses in biological sciences with laboratory, one of which must be upper-division, are required and all programs of this major must be approved by the student's advisor.

Major: Twenty-four additional semester hours of biology (Botany, Microbiology, and Zoology) with the following requirements: (a) At least twelve semester hours must be in upper-division courses; (b) at least one course must be taken in each department; (c) of the twenty-four semester hours offered for the major, one course from an approved list must be selected from each of the following areas: (1) Cellular or molecular biology, (2) genetics or evolution, (3) organismal or environmental biology, (4) physiological or developmental biology. Each course taken at The University of Texas at Austin and counted as satisfying the major requirement must be passed with a grade of at least C.

Minor: General chemistry and organic chemistry (Chemistry 610 and 110K and 110L [or 810], or 618 and 118K and 118L [or 818] or their equivalents); or at least six semester hours of mathematics, or six semester hours of computer sciences, or six semester hours of physics (Physics 302K, 302L, 102M, 102N, or 827 or their equivalents).

BOTANY

Major: Botany 420, 421, 428, 374 or 478, 419 or 462, Zoology 325 and two additional courses in botany only one of which may be Botany 377.

Minor: Twelve semester hours of chemistry including Chemistry 610a and 110K (or 810a).

Additional electives from anthropology, chemistry, geography, geology, marine studies, mathematics, microbiology, physics, or zoology are recommended.

CHEMISTRY

Not less than eight semester hours of mathematics, including not less than six semester hours of differential and integral calculus, and Physics 401 and 411 are required of all students majoring in chemistry.

Major: Chemistry 301, 302, 204, 610 and 110K and 110L (or 810), or 618 or 118K and 118L (or 818), 353, 153K, 354 (or 354L), 154K, 455, 376K.

Minor: Twelve semester hours of botany and/or zoology, geology, mathematics, microbiology, or physics; or, with written consent of the departmental chairman and approval of the Dean, twelve semester hours in a subject offered outside the College of Natural Sciences.

COMPUTER SCIENCES

Major: Mathematics 808 and 311, and eighteen semester hours of upper-division computer sciences courses, including Computer Sciences 327 and two semester hours of numerical mathematics (normally Computer Sciences 340, but the more advanced 368K or 368L are also acceptable). A grade of C or better is required in each upper-division course offered for the major requirement. The one Computer Sciences 370 course may be counted toward the major requirement.

GEOLOGICAL SCIENCES

Majors in geology must make a grade of at least C in each semester of each course presented in fulfillment of the requirements for the degree.

Major: Geology 401 or 303, 404, 416K, 416L, 416M, 320K, 321, 422K, 428, 436K, or equivalent courses to make a total of thirty-three semester hours.

Minor: Twelve semester hours, of which six must be upper-division, in any one of the following disciplines: Anthropology, astronomy, any biological science, business administration, computer sciences, chemistry, education, engineering, geography, mathematics, physics. Other disciplines may be chosen with written approval of the Chairman of the Department of Geological Sciences.

HOME ECONOMICS

Major: Thirty semester hours of home economics, of which at least fifteen must be upper-division. No more than fifteen hours of lower-division courses may be counted toward the degree.

MATHEMATICS

Major: A minimum of thirty-two semester hours of mathematics, including Mathematics 808 or the equivalent, 311, 665a, 373K, and at least nine additional semester hours of upper-division courses. The courses 808a, 808b, 311, 665a, and 373K must each be passed with a minimum grade of C. Each student should consult his adviser for help in choosing courses consistent with his educational plan.

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MICROBIOLOGY

Eight semester hours of organic chemistry, at least six semester hours of mathematics, and eight semester hours of physics are required for all students majoring in microbiology.

Major: Three semester hours of biology and twenty-four semester hours of microbiology, including Microbiology 362. At least sixteen hours of microbiology must be in upper-division courses.

PHYSICS

Students majoring in physics must take Chemistry 301, 302, and 204.

Major: Fifteen semester hours of upper-division physics.

First Minor: Twelve semester hours of mathematics of which six must be upper-division and include three semester hours of differential equations.

Second Minor: Six semester hours, of which three must be upper-division, in any one of the following: Botany, chemistry, geology, microbiology, philosophy, psychology, zoology, or in courses offered in the Colleges of Education and Engineering.

ZOOLOGY

Six hours of organic chemistry (excluding 305, 310, 410, 311, 411, 313N, 113P) and six hours of mathematics beyond Mathematics 305G (may be Pass-Fail) are required of all students majoring in zoology.

2. Curriculum and Instruction 332S, 667S, 370S, 371; Educational Psychology 332S.

3. Forty-eight semester hours in home economics including 202K, 102L, 103L, 304, 205, 105L, 407, 207L, 311 or 342, 116, 216L, 221, 121L, 322 or 323, 126, 226L, 333, 352, 355 (Introduction to Home Economics Education) and two semester hours of upper-division child development. With approval of the advisor, Home Economics 152 or 252 may be taken in lieu of Home Economics 352.

4. In order to meet the minimum general education requirements for undergraduate degrees, the student who enters the University with an admission deficiency of two units in foreign language must choose three semester hours elective from the area of the basic courses: Accounting, drawing, foreign language, logic, mathematics, statistics, music theory.

Option VI: Interior Design

1. Art 305 and three semester hours of upper-division European art or architectural history. (See "Course Numbers" in the General Information bulletin.)

2. Six semester hours of chemistry or physics; six semester hours of biology or Zoology 311K and 316K.

3. Drawing 208 and three semester hours from Architecture 348 or Art 362M, 362N.

4. Choice of Art 301K, 302K, 302L; or Architecture 411D, 417D.

5. Speech 319 and three semester hours from advertising, business law, or marketing.

6. Six semester hours of economics, psychology, and/or sociology.

7. Home Economics 202K, 102L, 203, 103L, 205, 105L, 313, 214K, 214L, 314, 446, 446L, 268K, 168L, 269K, 169L, 675 and three semester hours from an area in home economics not already represented.

8. In order to meet the minimum general education requirements for undergraduate degrees, the student who enters the University with an admission deficiency of two units in foreign language must choose one semester hour of the elective from the area of the basic courses: Accounting, drawing, foreign language, logic, mathematics, statistics, music theory, unless Architecture 411D is taken.

Option VII: Child Development⁷

1. Eighteen semester hours in education, including Curriculum and Instruction 667K and Educational Psychology 371; and nine semester hours from Curriculum and Instruction 632E, 371, Educational Psychology 332E, Special Education 371.

2. Six semester hours of chemistry or physics; six semester hours of biology or Zoology 311K and 316K.

3. Three semester hours of sociology or cultural anthropology; six semester hours of psychology with at least three being upper-division.

4. Home Economics 202K, 102L, 304, 311, 322, 333, 133L, 348 (topic 1), 348 (topic 2), 366, 372K, 378K.

5. Three semester hours of mathematics or computer sciences.

⁷ Prerequisite for Curriculum and Instruction 667K: A grade-point average of at least 2.35 in all courses undertaken at The University of Texas at Austin.

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6. In order to meet the minimum general education requirements for undergraduate degrees the student who enters the University with an admission deficiency of two units in foreign language must choose three semester hours of the elective from the area of the basic courses: Accounting, drawing, foreign language, logic, mathematics, statistics, music theory, unless mathematics is taken.

BACHELOR OF SCIENCE IN MATHEMATICS

A. Prescribed Work

1. English 306 and either (a) English 307 and three hours chosen from English 310, 312L, 312M, 314K, 317, 318M, or (b) English 308 and three hours from English 312L, 312M, and 314K.

2. Courses 406, 407, and three additional semester hours of French, German, or Russian (or such portion thereof as may be required by the score on the language test). Beginning foreign language 406 will not count toward the 126 hours if it indicates the language used for the entrance requirement or if the student has a foreign language entrance deficiency.

3. Six semester hours of American history.

4. Six semester hours of American government.

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

6. Eight semester hours chosen from one of the following sciences or science combinations: Astronomy, biology, botany, chemistry, geology, microbiology and biology, physics, zoology and biology.

7. Six semester hours chosen from the following: Architecture, classics, fine arts, philosophy, or programs of special concentration.

8. Not less than forty-one but no more than forty-five semester hours of mathematics, including Mathematics 808 or the equivalent, 311, 665a, 373K, and at least fifteen additional semester hours of upper-division courses in mathematics. All courses in mathematics must be passed with a minimum grade of C.

9. Forty-two semester hours of upper-division courses. At least six upper-division hours must be taken in courses not listed above in item 6.

10. Eighteen semester hours of mathematics must be completed in residence at The University of Texas at Austin.

11. Enough additional work to make a total of 126 semester hours.

B. Special Requirements

The student must (a) make a grade-point average of at least 2.0 on the courses taken at The University of Texas at Austin which are required and counted toward the degree; in addition, he must (b) make a grade of at least C in each semester of each course in mathematics taken at The University of Texas at Austin and counted toward the major.

C. Order and Choice of Work

The following work is recommended as a typical program under the assumption that the student has the prerequisites for Mathematics 808a. Certain

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approved courses offered in the College of Business Administration may be substituted for economics. The science requirement may be fulfilled by approved courses in the College of Engineering. Additional courses that may be of interest to mathematics majors are offered by various departments in these colleges.

First Year: Mathematics 808; six semester hours of English; Courses 406 and 407 in a foreign language; three semester hours from requirement 5 above; three semester hours from requirement 7 above; three semester hours of elective.

Second Year: Mathematics 311 and six additional semester hours of mathematics; six semester hours of English; third semester of foreign language; six semester hours of American history; ten semester hours of electives. (Computer Sciences 404G is recommended.)

Third Year: Mathematics 665a and nine additional semester hours of upper-division mathematics (probability is recommended); eight semester hours of science from requirement 6 above; six semester hours of American government; six semester hours of upper-division electives.

Fourth Year: Mathematics 373K and nine additional semester hours of upper-division mathematics; three semester hours from requirement 7 above; six semester hours of nonscience upper-division electives; six semester hours of additional upper-division electives; five semester hours of additional electives.

BACHELOR OF SCIENCE IN MEDICAL TECHNOLOGY

This degree is designed to enable the student preparing for medical technology simultaneously to earn the Bachelor of Science degree within the usual four-year period and to complete the technical training required for certification by the Registry of Medical Technologists. The purpose of this degree is to meet the increasing demands of the medical sciences for technologists with a higher level of science background and a greater degree of technical competence than that which can be attained by satisfying the minimum Registry requirements.

A. Prescribed Work

1. Nine semester hours of English including English 306.
2. Courses 406 and 407 in a foreign language (or such portion thereof as may be required by the score on the language test). Beginning foreign language 406 will not count toward the 100 hours if it duplicates the language used for the entrance requirement or if the student has a foreign language entrance deficiency.
3. Six semester hours of American government.
4. Six semester hours of American history.
5. Three semester hours chosen from the following: Psychology 301 (recommended), Anthropology 302, classical civilization (except literature in transition), economics, or sociology.
6. Three semester hours chosen from the following: Technical writing, creative writing, English literature (one of these three is recommended), architecture, art, drama, linguistics, a literature course in a foreign language, music, or speech.
7. One course chosen from the following: Computer Sciences 404G, Mathematics 305G, 808a, Statistics 310, or Zoology 350. (Computer Sciences 404G or Zoology 350 or Statistics 310 is recommended.)
8. Biology 302 and 303 or the equivalent.

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Degrees, Programs, and Requirements in the College 35

9. Chemistry 301; 302; 204; 610 and 110K and 110L (or 618 and 118K and 118L); 412K; and 339.
10. Microbiology 429 (or 319 and 119K or 419), 360, 160K, 261, 261K, and one course chosen from 330, 340, or 371.
11. Eight semester hours of physics chosen from one of the following sequences: Physics 827; or 302K, 302L, 102M, and 102N; or 401 and 416; or 403K and 403L.
12. At least twelve additional semester hours of upper-division biological science courses including Zoology 325, 365L, 365N. (Zoology 330 is recommended as the optional course.)
13. Such additional hours of electives as shall be required for a minimum total of one hundred semester hours of academic work prior to the fourth-year training program.
14. The satisfactory completion of twelve months of training in a school of medical technology accredited by the Board of Schools of the American Medical Association and the American Society for Clinical Pathology. A transcript of grades in all courses in the school of medical technology should be sent to the Office of the Dean, College of Natural Sciences, The University of Texas at Austin, Austin, Texas 78712, for approval, upon the recommendation of the faculty adviser of the Department of Microbiology. None of the work prescribed for the fourth year of this curriculum can be used to satisfy the minimum residence requirement.

B. Special Requirements

The student must make a grade-point average of at least 2.0 on the courses taken at The University of Texas at Austin which are required and counted toward the degree.

C. Order and Choice of Work

The student should consult with the faculty adviser each semester regarding order and choice of work. Students should complete the requirements both for general chemistry (Chemistry 301, 302, and 204) and for biology (Biology 302 and 303) during the first year, since these courses are prerequisite for courses required in the second year. Organic chemistry (Chemistry 610 and 110K and 110L [or 810] or 618 and 118K and 118L [or 818] should be completed as soon thereafter as possible, since it is prerequisite for Microbiology 429 and Chemistry 301.

None of the work prescribed for the fourth year of this curriculum can be used to satisfy the minimum residence requirement.

BACHELOR OF SCIENCE IN PHYSICS

A. Prescribed Work

1. Nine semester hours of English including English 306 (or the equivalent).
2. Twenty-four semester hours of mathematics.
3. Eight semester hours of chemistry approved by the Department of Physics.
4. Five semester hours of biological or geological science, including laboratory work or a laboratory course.

354M. *Structure and Function of Marine Animals*.—May count as zoology. Only one of the following may be counted: Marine Studies 354M, 352.7, 382.7, 384M. Comparative physiology of selected marine animals (fishes and invertebrates); adaptive mechanisms and relationships to environments. Prerequisite: Upper-division standing in zoology and consent of instructor. Laboratory fee, \$5. (Prior to 1975–1976, given as Marine Studies 352.7.)

354N. *Physical Oceanography*.—Same as Meteorology 376. Only one of the following may be counted: Marine Studies 354N, 352.10, 382.10, 384N. An introduction to the physical properties of sea water and physical processes in the ocean, including energy exchanges, wave and tidal motions, and the general circulation. Prerequisite: Calculus and a course in physics. Laboratory fee, \$5. (Prior to 1975–1976, given as Marine Studies 352.10.)

354P. *Marine Meteorology*.—Only one of the following may be counted: Marine Studies 354P, 352.11, 382.11, 384P. An introduction to the properties and structure of the marine atmosphere, air-sea interaction and meso- and macro-scale components of the general circulation. Prerequisite: Calculus and a course in meteorology. (Prior to 1975–1976, given as Marine Studies 352.11.)

Graduate Courses

- 680. *Research in Marine Studies.*
- 382. *Principles of Marine Studies.*
- 383. *Topics in Marine Studies.*
- 384. *Marine Invertebrates.*
- 384E. *Marine Microbial Ecology.*
- 384F. *Marine Geology.*
- 384G. *Biology of the Microalgae.*
- 384K. *Ecology of Fishes.*
- 384L. *Marine Chemistry.*
- 384M. *Structure and Function of Marine Animals.*
- 384N. *Physical Oceanography.*
- 384P. *Marine Meteorology.*
- 188, 288, 388. *Marine Research Training Cruise.*
- 690. *General Marine Studies.*
- 191. *Seminar in Marine Studies.*

DEPARTMENT OF MATHEMATICS

PROFESSOR Bledsoe, Chairman

PROFESSORS EMERITUS Craig, Ettlinger, Lubben, Moore, Nance, Prouse; PROFESSORS Berberian, Bledsoe, Cannon, Charnes, Cheney, Edmondson, Gardner, Gibb, Gillman, Greenwood, Gregory, Guy, John, Lacey, Lorentz, Olum, Osborn, Schumaker, Young; VISITING PROFESSORS Bing, Rota, Schroeder, Shisha; ASSOCIATE PROFESSOR EMERITUS Weaver; ASSOCIATE PROFESSORS Armendariz, Berens, Bernau, Bichteler, Cain, Carry, Daniel, Dollard, Durbin, Eaton, Gilbert, Greenleaf, Seever, Showalter, Thomas, Vick, Walston; VISITING ASSOCIATE PROFESSORS Beiglböck, Braess, Rallis; ASSISTANT PROFESSORS Alexander, James, Beeson, Chao, Chester, Dietrich, Fisher, Friedman, Gerth, Hall, Hamrick, Hurt, Iarrobino, Joshi, Kwon, Leih, McAdam, Pixley, Pledger, Pond, Richter, Russell, Smith, Soucek, Speiser, Starbird, White, Wojtaszyk, Wolf.¹⁰

Lower-Division Courses

All students should consult an adviser before registering for Mathematics 808. The adviser will determine on the basis of the student's background and CEEB Mathematics Level I Achievement Test results whether the student should precede the course by Mathematics 305G. Students may take an examination for credit in Mathematics 305G.

307. *Introduction to Mathematics*.—May not be included in the major requirement for the Bachelor of Arts or Bachelor of Science degrees with a major in mathematics. May be repeated for credit when the topics vary. May be used to satisfy the Area C requirements for the Bachelor of Arts degree under Plan I or the mathematics requirement for the Bachelor of Arts degree under Plan II. Intended primarily for general liberal arts students. Designed to enable students to study the nature and techniques of mathematics. Topics include history and development of mathematical sciences, axiomatic mathematics, models and mathematics.

603. *Mathematics for Business and Economics*.—Only one of the following may be counted: Mathematics 603b, 808, 608E, 808E, 613, 613E. May not be included in the major requirement for the Bachelor of Arts or Bachelor of Science degrees with a major in mathematics. First semester: Logic, sets, permutations, combinations, probability, relations, functions, inequalities, introduction to linear programming. Second semester: Linear programming, functions, analytic geometry and calculus of elementary functions. Either half may be taken for independent credit. Prerequisite: For Mathematics 603b, 603a or consent of instructor. Three hours a week for two semesters.

33P. *Mathematics of Investment*.—May not be included in the major requirement for the Bachelor of Arts or Bachelor of Science degrees with a major in mathematics. Simple and compound interest, equivalent rates, equivalent values, annuities, amortization, sinking funds, bonds, depreciation.

¹⁰This list, for the sessions of 1973–1974 and 1974–1975, includes all staff members of professional rank.

305G. *Elementary Functions and Co-ordinate Geometry.*—May not be counted by students with credit for Mathematics 304 or 304E. Only one of the following may be included in the major requirement for the Bachelor of Arts or Bachelor of Science degree with a major in mathematics: Mathematics 305G, 304, 304E, 305, 305E. Study of elementary functions, their graphs and applications including polynomial, rational, and algebraic functions, exponential, logarithmic, and trigonometric functions.

308. *Calculus I and II.*—Only one of the following may be counted: Mathematics, 808, 603b, 608E, 808E, 613, 613E. Introduction to the theory and applications of differential and integral calculus, including functions of several variables. Topics will include the real numbers, functions, analytic geometry, limits, integrals, derivatives, mean value theorems, fundamental theorem of calculus, and derivative techniques, areas, volumes, moments, arc length, problems involving maxima and minima, functions of several variables, series, trapezoidal and Simpson's rules. Certain sections are designated as intended primarily for well-prepared students of mathematics and mathematically oriented sciences who wish to investigate more carefully the foundations of calculus. Either half may be taken for independent credit. Prerequisite: For 808a, four years of high-school mathematics and satisfactory score on the CEEB Mathematics Level I Achievement Test, or Mathematics 305G; for 808b, Mathematics 808a with a grade of at least C, or consent of instructor. Three lectures and two discussion sessions a week for two semesters.

311. *Linear Algebra and Matrix Theory.*—Linear equations and matrices, linear mapping, determinants, quadratic forms. Prerequisite: Mathematics 808 or consent of instructor.

315K. *Elementary Set Theory and Logic.*—Naive set theory, relations and functions, equivalent sets, cardinal arithmetic, induction, introduction to symbolic logic, and other related topics. Prerequisite: Mathematics 808.

316. *Elementary Statistical Methods.*—May not be included in the major requirement for the Bachelor of Arts or Bachelor of Science degrees with a major in mathematics. Graphical presentation, frequency functions, distribution functions, averages, standard deviation, variance, curve-fitting, and related topics.

316K. *Modern Topics in Elementary Mathematics I.*—Mathematics 316K and 360M may not both be counted. May count as an upper-division course toward the degree of Bachelor of Science in Elementary Education. Selected topics in mathematical analysis, with emphasis on the development of basic concepts in mathematical thinking needed for elementary teachers. Prerequisite: Consent of elementary education adviser or mathematics education adviser.

316L. *Modern Topics in Elementary Mathematics II.*—Mathematics 316L and 360N may not both be counted. May count as an upper-division course toward the degree of Bachelor of Science in Elementary Education. Selected topics in mathematics, with emphasis on the development of basic concepts in mathematical thinking needed for elementary teachers. Prerequisite: Mathematics 316K.

Upper-Division Courses

47K. *Advanced Calculus for Applications I.*—Only one of the following may be counted: Mathematics 427K, 318L, 319E, 326. Infinite series, ordinary and partial differential equations. Prerequisite: Mathematics 808. Four lectures a week for one semester.

47L. *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, complex analysis. Prerequisite: Mathematics 808 or the equivalent. Four lectures a week for one semester.

328K. *First Course in the Theory of Numbers.*—Properties of the integers, divisibility, linear and quadratic forms, prime numbers, congruences and residues, quadratic reciprocity, number theoretic functions. Prerequisite: Eleven hours of mathematics and upper-division standing or consent of instructor.

333L. *Structure of Modern Geometry.*—Basic ideas of plane and solid geometry; ruler and compass constructions; representation of space objects by plane projections; use of these ideas in teaching plane and solid geometry. Prerequisite: Mathematics 343K, or upper-division standing and consent of instructor.

340L. *Matrices and Matrix Calculations.*—Techniques of matrix calculation. Prerequisite: Mathematics 808 or the equivalent.

343K. *Introduction to Algebraic Structures.*—Elementary properties of groups and rings, including symmetric groups, properties of the integers, polynomial rings, elementary field theory. Prerequisite: Mathematics 311 or consent of instructor.

348. *A Survey of Numerical Techniques.*—Mathematics 348 and Computer Sciences 348 may not both be counted. Meets with Computer Sciences 348. May not be counted in fulfilling the major requirements for a master's degree in mathematics. Emphasizes the derivations and applications of numerical techniques most frequently used by scientists and engineers; interpolation; approximation; numerical differentiation and integration; differential equations; zeros of functions; solution of linear systems; material supplemented by problems to be solved on a high-speed digital computer. Prerequisite: Mathematics 808 or consent of instructor, and Computer Sciences 404G (or 304G). Laboratory fee, \$3.

360K. *Topics in Modern Mathematics I.*—May be repeated for credit when the topics vary. Designed especially for high-school mathematics teachers. May not be counted in fulfilling the major requirements for a bachelor's or master's degree in mathematics. Prerequisite: Six hours of college mathematics; or a valid teacher's certificate in science, two years of teaching experience, and consent of instructor.

360L. *Topics in Modern Mathematics II.*—May be repeated for credit. Designed especially for high-school mathematics teachers. May not be counted in fulfilling the major requirements for a bachelor's or master's degree in mathematics. Prerequisite: Mathematics 360K.

360R. *Topics in Mathematics for Advanced Business Administration and Economics.*—May be repeated for credit when the topics vary. May not be counted as fulfilling the major requirements for a bachelor's or master's degree in mathematics. Prerequisite: Six hours of college mathematics, upper-division standing, and 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 665a, or upper-division standing and consent of instructor.

362K. *Probability I.*—An introductory course in the mathematical theory of probability; this course is fundamental to further work in probability and statistics. Prerequisite: Mathematics 808.

362L. *Probability II.*—Continuation of Mathematics 362K. Prerequisite: Mathematics 362K.

362M. *Introduction to Stochastic Processes.*—Introduction to Markov chains, birth and death processes, and other topics. Prerequisite: Mathematics 362K. (Not yet given.)

364K. *Vector and Tensor Analysis I.*—Invariance, vector algebra and calculus, integral theorems, general co-ordinates, introductory differential geometry and tensor analysis, applications. Prerequisite: Mathematics 427K or 427L.

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

665. *Introduction to Analysis.*—An introduction to basic concepts and techniques in analysis. The first semester bridges the gap between elementary calculus (808) and more advanced courses in analysis, primarily by putting the elementary calculus of functions of one real variable on a rigorous foundation. Topics include axioms for the real numbers, elementary topology of the line, limits, continuity and differentiability, the intermediate value theorem and the mean value theorem, the Riemann integral, and the fundamental theorem of calculus for a continuous function on a closed interval. The second semester, which is a continuation of the first, includes topics in functions of several variables. Either half may be taken for independent credit. Prerequisite: For 665a, Mathematics 808 or 311, or consent of instructor; for 665b, Mathematics 665a. Three lectures a week for two semesters.

367K. *Topology I.*—An introduction to topology, including sets, functions, cardinal numbers, and the topology of metric spaces. Prerequisite: Mathematics 311 or consent of instructor.

367L. *Topology II.*—Various topics in topology, primarily of a geometric nature. Prerequisite: Mathematics 367K or consent of instructor. (Not yet given.)

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368K. *Introduction to Numerical Analysis.*—Mathematics 368K and Computer Sciences 368K may not both be counted. Meets with Computer Sciences 368K. A thorough mathematical treatment of basic numerical techniques; interpolation and approximation; numerical differentiation and integration; solution of ordinary differential equations; zeros of functions; material supplemented by problems to be solved on a high-speed digital computer. Prerequisite: Mathematics 427K, and Computer Sciences 404G or consent of instructor. Laboratory 368K.

368L. *Introduction to Numerical Linear Algebra.*—Mathematics 368L and Computer Sciences 368L may not both be counted. Meets with Computer Sciences 368L. A survey of computational methods in linear algebra; direct solution of linear systems; norms and condition numbers; the linear least squares problem; singular values and eigenvectors; material supplemented by problems to be solved on a high-speed digital computer. Prerequisite: Mathematics 340L and Computer Sciences 404G or consent of instructor. Mathematics 311 is also recommended.

369. *Mathematical Analysis for Advanced Physical Chemistry.*—Either half may be taken for independent credit. The mathematics of thermodynamics, quantum mechanics, and statistical mechanics. Topics include ordinary differential equations and special functions, partial differential equations, matrix algebra, and numerical calculations. Prerequisite: Mathematics 427K and 427L. Three lectures a week for two semesters.

370K. *Differential Equations I.*—Discussion of existence, uniqueness, and qualitative properties of solutions; methods for representation of solutions. Prerequisite: Mathematics 427K or 665a or consent of instructor.

370L. *Differential Equations II.*—Topics in differential equations. Prerequisite: Mathematics 370K or consent of instructor.

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 or 370K.

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. Prerequisite: Mathematics 311.

373L. *Algebraic Structures II.*—Topics from vector spaces and modules, including direct sum decompositions, dual spaces, canonical forms, and multilinear algebra. Prerequisite: Mathematics 373K.

374. *Fourier and Laplace Transforms.*—Operational properties and application of Laplace transforms, some properties of Fourier transforms. Prerequisite: Mathematics 427K.

374K. *Fourier and Laplace Transforms.*—Continuation of Mathematics 374. Introduction to other integral transforms such as Hankel, Laguerre, Mellin, Z-transform. Prerequisite: Mathematics 374.

375. *Conference Course*.—May be repeated for credit. Prerequisite: Upper-division standing in mathematics and consent of instructor.

676. *Methods of Applied Mathematics*.—May be repeated for credit when the topics vary. A unified treatment of various methods of applied mathematics with discussion of linear spaces, spectral theory of operators, Green's functions, and elementary theory of distributions; the precise contents will depend on the interest of the instructor. Prerequisite: Mathematics 427K and 427L, or 665a. Three lectures a week for two semesters.

378K. *Introduction to Mathematical Statistics*.—Mathematics 378K and 676 may not both be counted. Estimation of parameters and testing of hypothesis. Mathematics 378K and 362K form the core sequence for students in statistics. Prerequisite: Mathematics 362K.

378L. *Introduction to Decision Theory*.—Topics in estimation and hypothesis testing, and an introduction to game theory from the decision theoretic viewpoint. Prerequisite: Mathematics 362K. (Not yet given.)

378M. *Statistical Methods*.—Analysis of variance, factorial experiments, and regression analysis; emphasis on applications. Prerequisite: Upper-division standing, an introductory statistics course, and consent of instructor. (Given for the first time in 1974-1975.)

379K. *Functions of Several Variables*.—Line integrals, differentiable functions on Euclidean spaces, calculus of alternating forms, Stokes' theorem, Gauss' theorem. Prerequisite: Mathematics 665a.

379L. *Introduction to Differential Geometry*.—Differential geometry of curves and surfaces, tensor analysis, smooth manifolds. Prerequisite: Mathematics 379K. (Given for the first time in 1973-1974.)

Graduate Courses

680C. *Algebra*.

681C. *Real and Abstract Analysis*.

381D. *Complex Analysis*.

682C. *General Topology*.

682D. *Algebraic Topology*.

382E. *Differential Geometry*.

383C. *Numerical Treatment of Problems of Algebra*.

383D. *Numerical Treatment of Differential Equations*.

684C. *Theory of Probability*.

684D. *Mathematical Statistics*.

684E. *Analysis of Variance and Design of Experiments*.

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390C. *Topics in Algebra*.

391C. *Topics in Analysis*.

392C. *Topics in Geometry and Topology*.

393C. *Topics in Applied Mathematics*.

393D. *Topics in Numerical Analysis*.

394C. *Topics in Probability and Statistics*.

395C. *Topics in Logic and Foundations*.

396C. *Topics in Mathematics*.

397S. *Seminar in Mathematics*.

698. *Thesis*.

398T. *Supervised Teaching for Graduate Students in Mathematics*.

399R, 699R, 999R, 399W, 699W, 999W. *Dissertation*.

MICROBIOLOGY

See Division of Biological Sciences.

NATURAL SCIENCE

The term "natural science" refers to courses in the biological sciences (e.g., biology, botany, microbiology, zoology), the physical sciences (e.g., astronomy, chemistry, physics), those which include both the biological and the physical sciences (e.g., geology and marine studies), and computer sciences and mathematics.

PHYSICAL SCIENCE

Lower-Division Courses

303. *Introductory Physical Science I: Mechanics and Temperature*.—Only one of the following may be counted without prior approval of the department: Physical Science 303, Physics 401, 302K, 403K, 609a, 827a. Inquiry laboratory approach to basic concepts of motion and of objects. Designed for students with minimum prior preparation in mathematics and physics. Four hours of integrated laboratory and lecture a week for one semester. Laboratory fee, \$2.

304. *Introductory Physical Science II: Substances, Heat, Electricity*.—Only one of the following may be counted without prior approval of the department: Physical Science 304, 302L, 403L, 609b, 827b. Inquiry laboratory approach to heat, classification of substances by chemical and physical means, current and static electricity. Mathematics 305 or the equivalent recommended in parallel. Prerequisite: Physical Science 303. Four hours of integrated laboratory plus lecture a week for one semester. Laboratory fee, \$2.