1994-1995 Graduation Requirements: Williams

ıe nineteenth century, the College was not ɔn principle in the twentieth. By first being iams has been able, over the years, and with- ɛgotiate the crucial balance between breadth ining an appropriately liberal distribution of ılum with some measure of control over the d. Among us, the presence of traditionally ılly interposed some obstacles, has not in the interdepartmental programs. We have simi- ɐvelopment to establish, alongside the more m, an honored place for the creative and per- lio art. Our rural location, from the earliest spiritual refreshment and of recent years the condemned us to isolation or provincialism. rkshires, we are a truly national college and gagements, commitments, and connections. ions among trustees, administrators, and fac- the one hand, the Board of Trustees has been olicy and financial stewardship, and to avoid governance and administrative decision. On nued to be willing, not only to play a determi- : also to accept the burden of service in nearly Hopkins Hall, the location of most of our cen- :lassroom building symbolizes, we believe, l about the ideals that have helped sustain it e change.

ons outlined above emerges a certain profile ıally at odds with the profile of Williams once sumed. At the time of our centennial in 1893, ırned professions. As we approach our bicen- of our alumni occupy leadership positions in ɛ world of arts and of arts administration is ng careers in public or private education, and, h. D. degrees, we fall, along with the group of percent of the institutions of higher education ıtes of a college of high intellectual purpose, pires to be a genuine community of learning. ıarter of a century ago, the trauma of ridding nate its social life and to blunt its intellectual :o coeducate without hesitation or regret, and and students alike, in terms of race, religion, members of such a community we work hard ıts, backgrounds, and talents. We do so in the luals by relationships with students and col- share a desire for self-development and learn- ıs, integrity, mutual respect, and humane intel- community and the sustenance of such an at- lents, and resources.

ɛe *Self-Study for Reaccreditation, August 1987,* the a comprehensive review of the College's values and rancis Oakley, as the committee's chair, wrote the

THE CURRICULUM

Williams College offers a course of study leading to the degree of Bachelor of Arts. The course requirements prescribe both the number of courses to be completed and the minimum grade level to be achieved; the curriculum also requires that each student explore several fields of knowledge and concentrate in one. The full requirements for the degree include meeting the minimum academic standards stated below, residence at the College, fulfillment of the distribution requirement, completion of a major, and completion of the physical education requirement.

The academic year is divided into two regular semesters and a Winter Study Program. The student takes four courses in each semester and during January pursues a single program of study on a pass-fail basis.

The Winter Study Program, which began in 1967, is intended to provide students and faculty with a dramatically different educational experience in the January term. The differences are in the nature of the courses, the nature of the learning experience, and the change of educational pace and format from the fall and spring semesters. These differences apply to the faculty and students in several ways: faculty can try out courses with new subjects and techniques that might, if successful, be used later in the regular terms; they can explore subjects not amenable to inclusion in regular courses; and they can investigate fields outside their usual areas of expertise. In their academic work, which is graded Honors, Pass, Perfunctory Pass, or Fail, students can explore new fields at low risk, concentrate on one subject that requires a great deal of time, develop individual research projects, or work in a different milieu (as interns, for example, or on trips outside Williamstown). In addition, Winter Study offers students an opportunity for more independence and initiative in a less formal setting, more opportunity to participate in cultural events, and an occasion to get to know one another better.

REQUIREMENTS FOR THE BACHELOR OF ARTS DEGREE

Academic Requirement

To be eligible for the Bachelor of Arts degree a student must pass 32 regularly graded semester courses and receive grades of C *minus* or higher in at least 19 of those semester courses, pass four Winter Study Projects, fulfill the distribution requirement, attain an average of C *minus* or higher in the major field, and complete the physical education requirement.

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Residence Requirement

Students who begin college at Williams must spend a minimum of six semesters in residence at Williams. Students transferring to Williams from other institutions must spend a minimum of four semesters in residence at Williams, and those entering as sophomores are expected to spend six semesters in residence. Students are considered to be in residence if they are taking a program of study under the direction of the Williams College Faculty. Students must be in residence for both semesters of the final year.

The degree requirements must be completed within eight semesters, including any semesters for which a student receives credit while not in residence at Williams. Thus, semesters spent away on exchange programs with other colleges or on junior year abroad are included in the eight semesters. Similarly, if a student requests, and the Committee on Academic Standing grants, degree credit based on Advanced Placement scores, then these semesters are also included in the limit of eight.

Major Requirement

The Major Requirement is designed to assure that all Williams undergraduates will have the experience of disciplined and cumulative study, carried on over an extended period of time, in some important field of intellectual inquiry. Juniors are required to declare a major field of concentration; the actual selection of a major is normally made at the time of registration in the spring of the sophomore year.

Major Fields

Majors are offered in the following fields:

American Studies
Anthropology
Art
Asian Studies
Astronomy
Astrophysics
Biology
Chemistry
Classics (Greek, Latin)
Computer Science
Economics
English
French
Geology
German
History
Literary Studies
Mathematics
Music
Philosophy
Physics
Political Economy
Political Science
Psychology
Religion
Russian
Sociology
Spanish
Theatre

General Structure of Majors

1) A student ordinarily must elect at least nine semester courses in his or her major field. A particular major may also require an additional course and/or one Winter Study Project during the junior or senior year.

A student may also fulfill the minimum requirements for a major by taking eight semester courses in the major field and two semester courses, approved by a major advisor, in associated fields. In interdepartmental majors, such as Political Economy, a larger number of courses may be required.

2) A prescribed sequence of courses, supplemented by parallel courses, and including a major seminar, is required in some major fields. Other majors ask the student to plan a sequence of elective courses, including advanced work building on elementary courses in the field, and ending in a one- or two- semester faculty-organized course or project in the senior year. All majors provide a system of counseling to help students plan programs reflecting individual interests as well as disciplined and cumulative patterns of inquiry.

Courses in many major programs require prerequisite courses in related areas. A full description of the detailed structure of each major is found under the heading of that major in the section, "Courses of Instruction."

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Contract Major

Students who wish to undertake the coherent study of an interdisciplinary subject not covered by a regularly offered major may propose to be contract majors. Procedures for arranging a contract major and for honors work in such a major are described in the section, "Courses of Instruction." Students interested in this option should begin consulting with the Dean's Office and with potential faculty advisors early in the sophomore year. A student completing a contract major may not do so in conjunction with a second major. For further details, see p. 142.

Double Major

A student may complete two majors with the permission of each major department and the Committee on Academic Standing. Although a student may be granted permission to use a course from one major to fulfill a particular requirement in the other, the student nevertheless must take the minimum number of courses in each field without counting any course twice. A student may be a candidate for Honors in either or both of the majors, but a course for Honors in one major may not be used for an Honors course in the other.

Co-ordinate Programs

In addition to majoring in a field, a student may choose to concentrate elective courses on a single topic or area, such as African and Middle Eastern Studies; Afro-American Studies; Biochemistry and Molecular Biology; Environmental Studies; Neuroscience; Science and Technology Studies; or Women's Studies. Descriptions of such possible co-ordinate programs appear under the appropriate heading in "Courses of Instruction." If the co-ordinate program courses are directly related to the major, a student may be allowed to reduce the number of courses required to complete the major.

Physical Education Requirement

The Physical Education requirement provides students the opportunity of establishing and maintaining a general level of fitness and well-being; of developing abilities in carry-over activities; of discovering and extending their own physical capabilities; and of developing skills in activities with survival implications, such as swimming, life saving, and water safety.

A swim test is required of all first-year students at the start of the academic year. Students who fail to complete the test must pass a basic swim course given in the Physical Education program during the first quarter of the year.

Students must complete eight quarters of physical education by the end of the sophomore year unless excused by the Dean of the College and the Director of Health. Extensions can be granted by the Dean in consultation with the Physical Education Department to postpone completion until junior year.

Students must enroll in at least three different activities in fulfilling the requirement and at least two quarters must be devoted to one carry-over sport, as defined by the Physical Education Department.

historical will be discussed. Since memory is a sign of and a surrogate for something that is absent or that has been lost, we will focus our attention on the memorializing aspects of memory in Renaissance theories concerning "the art of memory," in the development of mnemonic techniques, in the valorizing of certain rituals or protocols of remembrance, in the construction of monuments of commemoration, and in the private and public celebration of birthdays, anniversaries, bicentennials, and similar events. Other areas of concern will be: the role of gender in the reconstruction of the past, the formation of identity through personal and historical recollection, and the way images of the past determine perceptions of the present and the future. Readings from different centuries and by writers of different nationalities will be selected from among the following: Baudelaire, Freud, Kafka, Proust, Perec, Borges, Marshall, Woolf, Nabokov, Kundera, Bishop, Calvino, des Forets, and writers of the Holocaust. Critical and theoretical readings will include texts by Bergson, Halbwachs, Yates, Benjamin, Jankelevitch, Nora, Blanchot, Barthes, Foucault, Derrida, Sacks, and White.
Requirements: three 5- to 7-page papers; one hour exam.

STAMELMAN

LIT 332 The Literary Feast ***(Not offered 1995-96)***
Ezra Pound maintained that "the function of literature...is precisely that it does incite humanity to continue living; that it eases the mind of strain, and feeds it, I mean definitely as *nutrition of impulse*." Using Pound's metaphor as food for thought, this course will examine some of the world's greatest fiction from a gastronomic perspective. Food is fundamental not only to the structure of many literary works, but also to the writer's cultural self-definition. We will examine food imagery as a literary device used to define the behavior of characters in the works of such authors as Petronius, Austen, Gogol, Dickens, Zola, Chekhov, Maupassant, Marinetti, Esquivel, and Rushdie. This literary approach will also enable us to gain an understanding of cultural norms as we examine the ways various authors use food as a cultural code to influence readers' responses. Film adaptations of literary works such as "Babette's Feast" and "Like Water for Chocolate" will supplement the required readings.
Requirements: active class participation, an oral report, and two or three papers.
Open to junior and senior Literary Studies majors. Open to other only with permission of the instructor.

GOLDSTEIN

LIT 345(F) Space, Place, and Fiction (Same as English 387)
(See under English for full description.)
Prerequisite: English 101, Literary Studies 111, or any 200-level Literary Studies course.

LIT 352 Authenticity and Audience: "The Ethnic" in the Literary Marketplace (Same as English 352) ***(Not offered 1995-96; to be offered 1996-97)****
(See under English for full description.)
Prerequisite: English 101, Literary Studies 111, or any 200-level Literary Studies course.

LIT 356(S) Theorizing Whiteness (Same as English 355)*
This course looks into the question of "white" American identity as a cultural location. Among the questions we will ask: How does whiteness mark itself? What are the borders, visible and invisible, against which whiteness takes up its position? Do these borders ever shift? What does whiteness look like, sound like, and feel like, from the perspective of the racial "other"? What happens when we consider whiteness as a racial or ethnic category? And in what ways does a consideration of gender complicate the above questions? Readings will include critical/theoretical essays by Richard Rodriguez, Renato Rosaldo, bell hooks, Cherríe Moraga, Ruth Frankenberg, Edward Said, María Lugones, Trinh T. Minh-ha, James Baldwin, and Homi Bhabha, and primary texts by authors such as Charlotte Perkins Gilman, James Weldon Johnson, Kate Chopin, William Faulkner, Nathaniel West, Don DeLillo, Alice Walker, and Dorothy Allison.
Requirements: participation in listserver class "journal," one short paper, and a longer final paper.
Prerequisite: English 101, Literary Studies 111, or any 200-level Literary Studies course. *Enrollment limited to 25.*
Hour: 11:20-12:35 TR

CARTER-SANBORN

LIT 374(S) Theory and Criticism in Modernist Fiction (Same as English 374)
This course is meant primarily for students who have already studied British and/or European modernist fiction, and who wish to carry this interest to a theoretical level. Our readings will be roughly divided between theoretical and critical essays concerning modernism, and comparatively short, in some cases lesser-known works of modernist fiction by authors who may be

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familiar to students from other courses. (Please note, however, that the fiction will be read and discussed more rapidly and summarily than is usual: our concern is not with interpreting these texts in the fullness of their own terms, but rather with using them as case-studies to test and extend theoretical ideas.) We will explore such issues as: radical experiments with narrative point of view; the formal implications of new ways of representing sexuality, and the possible gender-affinities of certain aesthetic forms and myths, and more generally, the relation of modernism to the past; the social and political implications of modernism's often aggressively difficult or formalistic aesthetics, and the relation of such aesthetics to specific political movements such as anarchism and fascism, and to historical phenomena such as imperialism and war; affinities between modernist literary techniques and psychoanalytic paradigms, and the corresponding tendency to treat the text or the representational world as if it were a psyche. A wide range of theoretical readings from throughout the twentieth century will be assigned; novels may include James's *What Maisie Knew,* Conrad's *The Secret Agent,* Ford's *The Good Soldier,* and Woolf's *The Waves*, as well as short works or excerpts from European fiction such as Kafka's *The Metamorphosis,* the "Overture" to Proust's *Swann's Way,* Bely's *Petersburg,* and Mann's *Doctor Faustus.* Reading assignments will be heavy at times. Students who have taken a course in critical theory, such as English 373 or 375, will find this background helpful.
Requirements: several short written exercises, a 15-page final paper, and regular, active participation in seminar discussions.
Prerequisite: English 101. Preference to students who have taken or are taking a course in which Joyce's *Ulysses* was studied, and/or Literary Studies 203.
Major seminar. *Enrollment limited to 15.* Permission of English department chair required.
Hour: 1:10-2:25 TF

TIFFT

LIT 402(S) Issues in Literary Theory: The Art of Love
Jean Baudrillard has observed that seduction has everything to do with artifice and planning, and nothing to do with nature and spontaneity. Using Baudrillard's concept as a point of departure, in this course we will examine the many ways in which literary texts—most of which are taken from the ancient and medieval periods—have attempted to teach the art of seduction to both male and female characters, as well as to their supposed "readership." Some of these texts take the form of manuals, where careful advice is imparted in systematic ways to the reader; others create a fiction within which the character(s) learn the lessons of love from various figures who clearly possess much authority in the field of seduction. Having analyzed Ovid's *Art of Love,* we will move on to the Middle Ages, when both Europe and the Islamic Empire saw a flourishing of ideas on the protocol and methodologies of seduction. Readings include segments from Arthurian romances, Chaucer's *Canterbury Tales,* Juan Ruiz's *The Book of Good Love,* selected stories from *1001 Nights,* and translations from Near-Eastern erotological and scientific manuals, all of which deal in particular ways with the "art of love." The final stages of the course will center upon the study of some of the literary manifestations of the figure of don Juan. In addition to the main texts, the course will include films, and readings from the works of relevant contemporary theorists and scholars.
Requirements: active class participation, two written assignments (8-10 pages and 15-20 pages, respectively).
Open to junior and senior Literary Studies majors. Open to others with permission of the instructor.
Hour: 1:10-2:25 MR

ROUHI

LIT 397(F), 398(S) Independent Study

LIT 493(F)-W031, W031-494(S) Senior Thesis

MATHEMATICS (Div. III)

Chair, Professor OLGA R. BEAVER

Professors: ADAMS, O. BEAVER, V. HILL, LENHART, MORGAN. Associate Professors: BERGSTRAND*, GARRITY, SILVA**. Assistant Professors: BURGER, DE VEAUX, S. JOHNSON, MIZNER. Visiting Professor: MAINI§.

MAJOR

The major in Mathematics is designed to meet two goals: to introduce some of the central ideas in a variety of areas of mathematics, and to develop problem-solving ability by teaching students to combine creative thinking with rigorous reasoning.

Students are urged to consult with the department faculty on choosing courses appropriate to an individualized program of study.

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REQUIREMENTS *(nine courses plus colloquium)*

Calculus (two courses)
104 Calculus II
105 Multivariable Calculus

Applied/Discrete Mathematics (one course)
151 Discrete Mathematics *or*
210 Differential Equations and Vector Calculus *or*
243 Statistics and Data Analysis *or*
a more advanced elective in discrete or applied mathematics, with prior departmental approval: Math 305, 306, 315, 317, 330, 346, 348, 351, 361, 431, 433, 452, 454, or an appropriate course from another department as listed in the notes below.
Note: Math 151 is required in Computer Science, and Math 210 is required in Physics and recommended in other sciences, but double majors should understand that no course may count toward both majors; Math 243 is recommended for students interested in statistics or actuarial science.

Core Courses (three courses)
211 Linear Algebra
301 Real Analysis *or* 305 Applied Real Analysis
312 Abstract Algebra *or* 315 Groups and Characters *or*
317 Applied Algebra

Completion (three courses plus colloquium)
Senior Major Course *(any 400-level course taken in the senior year)*
One elective from courses numbered Mathematics 210 or above *and*
one elective from courses numbered 300 or above.
Weekly participation as a senior in the Mathematics Colloquium, in which all senior majors present talks on mathematical topics of their choice.

NOTES

A student who has taken Math 148 (*Probability*) may use it as an alternative to the Math 151/210/243 requirement in Math 211 or 313.

An appropriate course from another department (Chemistry 301, Computer Science 256, Economics 255, Physics 201, Physics 202) may with prior permission be substituted for one of the electives. In any case, at least seven courses must be taken in Mathematics at Williams. Students with transfer credit should contact the department about special arrangements.

APPLIED MATHEMATICS OR OTHER SCIENCES

Students interested in applied mathematics or other sciences, including economics, should consider Mathematics 210, 243, 244, 305, 306, 315, 317, 330, 346, 348, 351, 361, 431, 433, 452, 454 and additional appropriate courses from outside Mathematics, including possibilities such as Chemistry 301, Computer Science 256, Computer Science 361, Economics 255, Physics 201, Physics 202 or more advanced physics courses.

BUSINESS AND FINANCE

Students interested in careers in business or finance should consider Mathematics 102 or 202, as well as courses in statistics and related areas such as Mathematics 140, 243, 244, 346, and 348. Since these courses address different needs, students should consult with the instructors to determine which seem to be most appropriate for individuals.

ENGINEERING

Students interested in engineering should consider the courses for applied mathematics immediately above, with Mathematics 210 and 305 especially recommended. Williams has exchange and joint programs with good engineering schools. Interested students should consult the section on engineering near the beginning of the Bulletin and the Williams pre-engineering advisor for further information.

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GRADUATE SCHOOL IN MATHEMATICS

Students interested in continuing their study of mathematics in graduate school should take Mathematics 301 and 312. Mathematics 302 and 324 are strongly recommended. Many of the 400-level courses would be useful, particularly ones that involve algebra and analysis. Honors theses are encouraged. Reading knowledge of a foreign language (French, German, or Russian) is helpful.

STATISTICS AND ACTUARIAL SCIENCE

Students interested in statistics or actuarial science should consider Mathematics 243, 244, 346, 348, Economics 255. Additionally, students should consider taking some number of the actuarial exams given by the Society of Actuaries, which can constitute part of a Honors program in actuarial studies (see section on Honors below).

TEACHING

Students interested in teaching mathematics at the elementary or secondary school level should consider Mathematics 243, 285, 313, 325, 381, and practice as a tutor or teaching assistant. Winter Study courses that provide a teaching practicum are also highly recommended.

THE DEGREE WITH HONORS IN MATHEMATICS

The degree with Honors in Mathematics is awarded to the student who has demonstrated outstanding intellectual achievement in a program of study which extends beyond the requirements of the major. The principal considerations for recommending a student for the degree with Honors will be: Mastery of core material and skills, breadth and, particularly, depth of knowledge beyond the core material, ability to pursue independent study of mathematics, originality in methods of investigation, and, where appropriate, creativity in research.

Prospective Honors students are urged to consult with their departmental adviser at the time of registration in the spring of the sophomore or at the beginning of the junior year to arrange a program of study that could lead to the degree with Honors. By the time of registration during spring of the junior year, the student must have requested a faculty member to be Honors adviser and must have obtained the Department's approval of formal admission to the Honors program. Such approval depends on both the record and the promise of the applicant. It is conditional on continuing progress.

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An Honors program normally consists of two semesters and a WSP (031) of independent research, culminating in a typed thesis and a presentation. Under certain circumstances, the honors work can consist of coordinated study involving a regular course and one semester plus a WSP (030) of independent study, culminating in a typed "minithesis" and a presentation. At least one semester should be in addition to the major requirements.

An Honors program in actuarial studies requires significant achievement on four appropriate examinations of the Society of Actuaries and giving a second colloquium talk. Written work is a possible component.

The recommendation for Honors is usually announced at the end of the spring term. The decision is based not only on successful completion of the Honors Program but also on the merit of the student's overall record in Mathematics. If the student completes the program during the fall or Winter Study, the decision may be announced at the beginning of the spring term, conditional on continuing merit.

Highest Honors will be reserved for the rare student who has displayed exceptional ability, achievement or originality. Such a student usually will have written a thesis, or pursued actuarial Honors and written a minithesis. An outstanding student who writes a minithesis, or pursues actuarial Honors and writes a paper, might also be considered.

ADVANCED PLACEMENT

The Mathematics Department attempts to place each student who elects a mathematics course in that course best suited to the student's preparation and goals. The suggested placement in an appropriate mathematics course is determined by the results of the Advanced Placement Examination (AB or BC) if the student took one, and any additional available information. A student who receives a 3, 4, or 5 on the BC examination or a 4 or 5 on the AB examination is ordinarily placed in Mathematics 105. A student who receives a 1 or 2 on the BC examination or a 2 or 3 on the AB examination is ordinarily placed in Mathematics 104. Students who have had calculus in high school, whether or not they took the Advanced Placement Examination, are urged to register for either Mathematics 104 or Mathematics 105. In any event, students registering for mathematics courses are urged to consult with

members of the department concerning appropriate courses and placement. In general, students are encouraged to enroll in the most advanced course for which they are qualified: it is much easier to drop back than to jump forward. The department reserves the right to refuse registration in any course for which the student is determined to be *over*-prepared.

GENERAL REMARKS

Divisional Requirements

All courses may be used to satisfy this requirement.

Alternate year courses

Courses numbered 306, 325, 348, 351, 360, 381, 452, and 454 are each normally offered once every two years. Other 400-level courses are each normally offered once every three or four years. All other courses are normally offered every year. Any course may be canceled if the enrollment is insufficient.

Course Admission

Courses are normally open to all students meeting the prerequisites. Students with questions about the level at which courses are conducted are invited to consult members of the department.

Course Descriptions

Descriptions of the courses in Computer Science are under that heading. More detailed information on all of the offerings in the Department is available in the *Informal Guide to Mathematics Courses at Williams* that can be obtained at the departmental office.

Courses open on a pass/fail basis

Students taking a mathematics course on a pass/fail basis must meet all the requirements set for students taking the course on a graded basis.

With the permission of the department, any course offered by the department may be taken on a pass/fail basis. Permission will not be given to mathematics majors to meet any of the requirements of the major or honors degree on this basis. However, with the permission of the department, courses taken in the department beyond those requirements may be taken on a pass/fail basis.

Graduate School Requirements

An increasing number of graduate and professional schools require mathematics as a prerequisite to admission or to attaining their degree. Students interested in graduate or professional training in business, medicine, economics, or psychology are advised to find out the requirements in those fields early in their college careers.

QUST 100(F) Quantitative Studies

This course is intended for all students—first-year students and upperclassmen—who want to strengthen their basic arithmetic and algebraic skills, and to understand the central concepts of elementary mathematics. Topics will include: signed numbers, fractions, decimals, percentages, exponents, logarithms, scientific notation, polynomials, algebraic fractions, linear and quadratic equations, and graphing. Concepts will be stressed in classroom lectures and discussions; techniques will be developed through daily assignments.
Evaluation will be based primarily on performance on quizzes and exams.
Prerequisite: permission of the instructor. *Satisfies one semester of Division III requirement.*
Depending on his or her performance on the diagnostic test administered at the beginning of the academic year, a student may be required to take QUST 100 or QUST 101 as a prerequisite for Biology 101, Chemistry 101, 102, Computer Science 134, 135, Mathematics 102, 103, 140, or Physics 131. However, a student need not be planning to take one of these additional courses in order to take QUST 100 or 101.
Hour: 12:00-12:50 MWF MIZNER

QUST 101(F) Pre-Calculus

The elementary functions—algebraic, logarithmic, and trigonometric—from both a graphical and analytic point of view.
Evaluation will be based primarily on performance on quizzes and exams.
Prerequisite: permission of the instructor. *Satisfies one semester of Division III requirement.*
Hour: 10:00-10:50 MWF, 11:00-11:50 MWF MIZNER

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MATH 102 Mathematics of Finance ***(Not offered 1995-96; to be offered Spring 1997)***

The mathematics underlying various problems that arise in personal and business finance. Applications will include various kinds of taxes, business and personal insurance, simple and compound interest (and Banker's Rule), periodic loans (such as home mortgages and auto loans), present value, future value, amortization, sinking funds, bonds and money market funds, tax-exempt and tax-deferred investments, life annuities, perpetual annuities, and some basic mathematical principles of accounting. Students will be required to carry out some assigned problems on either the IBM (Lotus) or Macintosh (Excel) system; instruction on the use of these systems will be given as needed. Graphical and basic algebraic solution of linear programming problems may also be included.
Evaluation will be based primarily on performance in class quizzes, computer software exercises, and exams.
Prerequisite: Quantitative Studies 100 (or demonstrated proficiency on a diagnostic test—see QUST 100).
Not open to first-year students. Not open to students who have completed Mathematics 104, 151, or equivalent, except by prior written permission of the instructor. Such students should register for Mathematics 202 instead. *Credit will not be given for both Mathematics 102 and Mathematics 202.*
Enrollment may be limited.

MATH 103(F,S) Calculus I

Calculus permits the computation of velocities and other instantaneous rates of change by a limiting process called differentiation. The same process also solves "max-min" problems: how to maximize profit or minimize pollution. A second limiting process, called integration, permits the computation of areas and accumulations of income or medicines. The Fundamental Theorem of Calculus provides a useful and surprising link between the two processes. Subtopics include trigonometry, exponential growth, and logarithms. This is an introductory course for students who have not seen calculus before.
Evaluation will be based primarily on homework, quizzes, and/or exams.
Prerequisite: Quantitative Studies 101 (or demonstrated proficiency on a diagnostic test; see QUST 101).
Hour: 11:00-11:50 MWF Conferences: 8:30-9:45 R, 9:55-11:10 R, 11:20-12:35 R, 1:10-2:25 R
First Semester: MORGAN
11:00-11:50 MWF Second Semester: S. JOHNSON

MATH 104(F,S) Calculus II

Mastery of calculus requires understanding how integration computes areas and business profit and acquiring a stock of techniques. Further methods solve equations involving derivatives ("differential equations") for population growth or pollution levels. Exponential and logarithmic functions and trigonometric and inverse functions play an important role. This course is the right starting point for students who have seen derivatives, but not necessarily integrals, before.
Evaluation will be based primarily on homework, quizzes, and/or exams.
Prerequisite: Mathematics 103 *or* equivalent.
Hour: 8:00-8:50 MWF, 9:00-9:50 MWF, 10:00-10:50 MWF First Semester: O. BEAVER, S. JOHNSON
11:00-11:50 MWF, 12:00-12:50 MWF Second Semester: MIZNER

MATH 105(F,S) Multivariable Calculus

Applications of calculus in mathematics, science, economics, psychology, the social sciences, involve several variables. This course extends calculus to several variables: vectors, partial derivatives, multiple integrals. There is also a unit on infinite series, sometimes with applications to differential equations. This course is the right starting point for students who have seen differentiation and integration before.
Evaluation will be based primarily on homework, quizzes, and/or exams. Prerequisite: Mathematics 104 *or* equivalent, such as satisfactory performance on an Advanced Placement Examination.
Hour: 9:00-9:50 MWF, 10:00-10:50 MWF, 11:00-11:50 MWF, 12:00-12:50 MWF
First Semester: ADAMS, BURGER
9:00-9:50 MWF, 10:00-10:50 MWF Second Semester: BURGER

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MATH 143(F) Elementary Statistics and Data Analysis
It is nearly impossible to live in the world today without being inundated with data. Even the most popular newspapers feature statistics to catch the eye of the passerby, and sports broadcasters overwhelm the listener with arcane statistics. How do we learn to recognize dishonest or even unintentionally distorted representations of quantitative information? How are we to reconcile two medical studies with seemingly contradictory conclusions? How many observations do we need in order to make a decision? It is the purpose of this course to develop an appreciation for and an understanding of the interpretation of data. We will become familiar with the standard tools of statistical inference including the t-test, the analysis of variance, and regression, as well as exploratory data techniques. Applications will come from the real world that we all live in.
Evaluation will be based primarily on performances on quizzes and exams.
Prerequisites: Quantitative Studies 100 (or demonstrated proficiency on a diagnostic test; see QUST 100). Students who have had calculus, and potential Mathematics majors should consider taking Mathematics 243 instead.
Not open for major credit to junior or senior mathematics majors.
Hour: 11:00-11:50 MWF — DE VEAUX

MATH 151(F,S) Discrete Mathematics
As a complement to calculus, which is the study of continuous processes, this course focuses on the discrete, including finite sets and structures, their properties and applications. Topics will include basic set theory, graph theory, logic, counting, recursion, and functions. The course serves as an introduction not only to these and other topics but also to the methods and styles of mathematical proof.
Evaluation will be based primarily on performance on homework and exams.
Prerequisite: Mathematics 103 *or* one year of high school calculus.
Hour: 10:00-10:50 MWF — First Semester: LENHART
8:30-9:45 TR — Second Semester: GARRITY

MATH 202(F,S) Mathematics of Finance (Advanced Section)
This course includes all of the material in Mathematics 102, but is intended for students who have approximately the background of Mathematics 104. Topics will include simple and compound interest (and Banker's Rule), periodic loans (such as home mortgages and auto loans), present value, future value, amortization, sinking funds, bonds and money market funds, tax-exempt and tax-deferred investments, life annuities, perpetual annuities, the mechanics of life insurance, and some basic accounting. Students will be required to carry out some assigned problems on either the IBM (Lotus) or Macintosh (Excel) system; instruction on the use of these systems will be given as needed. Recursion and probability will be used as widely as possible. Additional topics may include advanced linear programming, probability theory, finite differences, and selected topics from actuarial mathematics. The course, however, does not prepare students for the examinations of the Society of Actuaries.
Evaluation will be based primarily on performance in class quizzes, computer software exercises, and exams.
Prerequisite: Mathematics 103 or equivalent. *(Students with less background should register for Mathematics 102 instead.)*
Credit will not be given for both Mathematics 102 and Mathematics 202.
Not open to first-year students.
Not open to junior or senior Mathematics majors except by permission of the instructor.
Enrollment limited to 40. Preference for seniors in the fall. Preference to juniors in the spring.
Hour: 9:00-9:50 MWF — First Semester: V. HILL
10:00-10:50 MWF — Second Semester: V. HILL

MATH 210(F,S) Differential Equations and Vector Calculus
Historically, much beautiful mathematics has arisen from attempts to explain heat flow, chemical reactions, biological processes, or magnetic fields. A few ingenious techniques solve a surprisingly large fraction of the associated ordinary and partial differential equations. The mystical Pythagorean fascination with ratios and harmonics is vindicated and applied in Fourier series and integrals. Integrating vectorfields over surfaces applies equally to blood flow, gravity, and differential geometry.
Lectures and discussion, three hours a week; problem sets.
Evaluation will be based on problem sets, hour tests, and a final exam.
Prerequisite: Mathematics 105.
Hour: 12:00-12:50 MWF — First Semester: S. JOHNSON
9:00-9:50 MWF — Second Semester: S. JOHNSON

MATH 211(F,S) Linear Algebra
Many social, political, economic, biological, and physical phenomena can be described, at least approximately, by linear relations. In the study of systems of linear equations one may ask: When does a solution exist? When is it unique? How does one find it? How can one interpret it geometrically? This course develops the theoretical structure underlying answers to these and other questions and includes the study of matrices, vector spaces, linear independence and bases, linear transformations, determinants and inner products. Course work is balanced between theoretical and computational, with attention to improving mathematical style and sophistication.
Evaluation will be based primarily on homework and exams.
Prerequisite: Mathematics 105 *or* 151 *or* 210 *or* 243.
Hour: 9:55-11:10 TR — First Semester: GARRITY
9:55-11:10 TR — Second Semester: O. BEAVER

MATH 232 The Mathematics of Biology and Medicine *(Not offered 1995-96)*
This course will look at various mathematical topics in biology and medicine. Topics may include the modeling of disease spread, the determination of appropriate drug dosages, models of heart function, probabilities in genetics, mathematically modeling muscle contraction, the fluid mechanics of blood, the mathematics of DNA, models of nerve-impulse transmission, models of pupil contraction under illumination, thyroid-pituitary interaction, predator-prey models, and bacterial birth and death models, to name just a few possibilities.
Evaluation will be based primarily on homework, exams, and a final project.
Prerequisite: Math 104 or a year of high-school calculus or equivalent.
ADAMS

MATH 243(F) Statistics and Data Analysis
Statistics can be viewed as the art (science?) of turning data into information. Real world decision making, whether in business or science is often based on data and the perceived information it contains. Sherlock Holmes, when prematurely asked the merits of a case by Dr. Watson, snapped back, "Data, data, data! I can't make bricks without clay". In this course we will study the basic methods by which statisticians attempt to extract information from data. These will include many of the standard tools of statistical inference such as the t-test, analysis of variance and linear regression as well as exploratory and graphical data analysis techniques.
Evaluation will be based primarily on performance on quizzes and exams.
Prerequisite: Mathematics 104 or equivalent. Students without any calculus background should consider Mathematics 143 instead.
Hour: 9:00-9:50 MWF — DE VEAUX

MATH 244(S) Statistical Design of Experiments
What does statistics have to do with designing and carrying out experiments? The answer is, surprisingly perhaps, a great deal. In this course we will study how to design an experiment in order to obtain the most information from it in the fewest number of observations. The efficient design of experiments is important not only in the sciences: it has been credited for helping Japanese industry achieve its success. The examples from this course will be primarily from the physical sciences and industry, but will apply to the biological and to some extent the social sciences as well. The culmination of the course will be a project where each student designs, carries out, analyzes, and presents an experiment of interest to him or her.
Evaluation will be based primarily on performance on the project, homework, and exams.
Prerequisites: Mathematics 140 *or* 143 *or* 241 *or* 243 *or* permission of instructor.
Hour: 9:00-9:50 MWF — DE VEAUX

MATH 285(F) Teaching Mathematics
Under faculty supervision, student-teachers will prepare and conduct scheduled weekly extra sessions for calculus, for smaller, assigned groups of students. For these sessions they will prepare presentations (on topics initially assigned by the instructor and later chosen by them), assign and grade homework, and answer questions on the course material and on the homework. They will be available to their students outside of class, attend and assist at calculus lectures (3 hours a week), and visit and evaluate each other's sessions.

At the core of this activity is a seminar, meeting an hour or two a week, focusing on a deeper study of the calculus and on teaching methods and experience. There will be assigned readings, instruction, discussion, and weekly homework or papers. The student-teachers will participate in the design and review of exams, weighing the importance and difficulty of questions, and observing the kinds of mistakes the students make. Responsibility for the exams and grading will of course rest with the instructor.
Evaluation will be based on the overall teaching activity, participation in the seminar and other meetings, homework, and papers.
Prerequisite: permission of instructor, early in previous spring.
Very limited enrollment.
Hour: 11:00-11:50 MWF Conference: 1:10-2:25 T MORGAN

MATH 301(F) Real Analysis
The real and complex number systems. Elementary topology of the real line and plane. Functions of a single variable: limits, continuity, differentiability, the Riemann and Riemann-Stieltjes integrals. Sequences, series and uniform convergence. Elementary topology of metric spaces and functions on metric spaces with emphasis on R.
Evaluation will be based primarily on performance on problem assignments, projects, and exams.
Prerequisites: Mathematics 211 *or* permission of instructor.
Hour: 9:00-9:50 MWF BURGER

MATH 302(S) Complex Analysis
Analytic functions: Cauchy-Riemann equations, Cauchy's integral theorem and its consequences, Taylor series, and Laurent series. Applications, including some of the following: calculus of residues, conformal mapping, harmonic functions, and boundary value problems.
Evaluation will be based primarily on performance on problem assignments, projects, and exams.
Prerequisite: Mathematics 301 *or* 305.
Hour: 11:00-11:50 MWF SILVA

MATH 305(S) Applied Real Analysis
A deeper understanding of the derivative and limits leads to important applications in physical and social sciences as well as more advanced mathematics. Phase plane analysis extracts information from "insoluble" systems of nonlinear differential equations about the counterintuitive ecological balance between sharks and their prey or the peculiar motion of a box tossed in the air. The calculus of variations ("infinite-dimensional calculus") underlies inventory control in economics, Lagrange's equations in physics, Riemannian "noneuclidean" geometry, and general relativity.
Evaluation will be based on performance on homework and exams.
Prerequisites: Mathematics 105 *and* 211, *or* 210 and permission of instructor.
Hour: 9:55-11:10 TR GARRITY

MATH 306(S) Dynamics and Fractals
This course is an introduction to dynamical systems, chaos and fractal geometry. The topics will include bifurcations, the quadratic family, symbolic dynamics, chaos, iterative function systems, fractal sets, dynamics of linear systems, and some complex dynamics.
Evaluation will be based on performance on homework, exams, and a final project.
Prerequisite: Mathematics 210 *and* 211.
Hour: 9:00-9:50 MWF SILVA

MATH 312(S) Abstract Algebra
Algebra gives us the tools to solve equations. Sets such as the integers or real numbers have special properties which make algebra work or not work according to the circumstances. In this course we generalize algebraic processes and the sets upon which they operate in order to better understand, theoretically, when equations can and cannot be solved. We define and study the abstract algebraic structures called groups, rings and fields, as well as the concepts of factor group, quotient ring, homomorphism, isomorphism, and various types of field extensions.
Evaluation will be based primarily on problem sets and exams.
Prerequisites: Mathematics 211 and 148 or 151 or 210 or 243, or permission of instructor.
Hour: 10:00-10:50 MWF ADAMS

Williams 1995

MATH 313(S) Elementary Number Theory
Divisibility properties of the integers; prime and composite numbers. Congruence modulo n; solutions of linear and quadratic congruences and of some Diophantine equations. The distribution of primes. Problems in additive arithmetic and discussion of some famous unsolved problems.
Evaluation will be based primarily on performance on problem assignments, projects, and exams.
Prerequisite: Mathematics 211 *or* 151.
Hour: 12:00-12:50 MWF BURGER

MATH 315(F) Groups and Characters
An introduction to group theory with emphasis on topics having applications in the physical sciences; greater attention is paid to examples and to the application of theorems than to the more difficult proofs. Topics include symmetry groups, group structure (especially properties related to order), representations and characters over the real and complex fields, space groups (chemistry), matrix groups (physics).
Evaluation will be based primarily on performance on problem assignments and a final exam.
Prerequisite: Mathematics 211.
Hour: 10:00-10:50 MWF V. HILL

MATH 317 Applied Algebra *(Not offered 1995-96)*
This course introduces the techniques and applications of modern algebra, including the theory of vector spaces, fields, groups, Boolean algebras, and polynomials. Vector spaces (over finite fields) are used in the error-handling methods of CD players and other communication systems. Group theory is used in the study of symmetric structures, such as crystals, and to reveal underlying patterns in sets of data. Boolean algebras and polynomials are used to design and analyze the switching circuits of computers.
Evaluation will be based primarily on problem sets and projects, including some group work.
Prerequisites: Mathematics 211, and 148 or 151 *or* 210 or 243 *or* permission of instructor.

MATH 321 Knot Theory *(Not offered 1995-96)*
Take a piece of string, tie a knot in it, and glue the ends together. The result is a knotted circle, known as a knot. For the last 100 years, mathematicians have studied knots, asking such questions as, "Given a nasty tangled knot, how do you tell if it can be untangled without cutting it open?" Some of the most interesting advances in knot theory have occurred in the last ten years. This course is an introduction to the theory of knots. Among other topics, we will cover methods of knot tabulation, surfaces applied to knots, polynomials associated to knots, and relationships between knot theory and chemistry and physics. In addition to learning the theory, we will look at open problems in the field.
Evaluation will be based on problem sets, midterms, and a final exam.
Prerequisite: Mathematics 211 *or* permission of instructor.

MATH 324(S) Topology
Topology is the study of when one geometric object can be bent and twisted, but not ripped, into another object. Determining when two objects are topologically the same is incredibly difficult and is still the subject of a tremendous amount of research. The first part of the course involves establishing a precise definition for topological equivalence (point-set topology). Then we develop methods to determine when objects are the same. We will define homotopy and homology and, if time permits, examine the topological classifications of surfaces, which will show that you cannot twist a basketball into a doughnut.
Evaluation will be based on exams and homework.
Prerequisite: Mathematics 301, or permission of the instructor and Mathematics 305 or 312.
Hour: 2:35-3:50 MR MORGAN

MATH 325 Topics in Geometry *(Not offered 1995-96)*
Selected topics from differential geometry, geometric algebra, non-Euclidean geometry, projective geometry, Hilbert's axiomatic development of Euclidean geometry.
Evaluation will be based primarily on performance on problem assignments, projects, and exams.
Prerequisite: Mathematics 211 *or* permission of the instructor.

MATH 330 Numerical Methods *(Not offered 1995-96)*
Many real-world problems can be stated precisely in mathematical terms, but not solved. Significant insight into these problems can be gained by computationally approximating the

tions. This course will cover popular numerical techniques with an emphasis on implementation, error control, and applications.
Evaluation will be based primarily on homework, projects, and exams.
Prerequisite: Mathematics 105 or equivalent and some basic programming skill.

MATH 341(F) Probability
The historical roots of probability lie in the study of games of chance. Modern probability, however, is a mathematical discipline that has wide applications in a myriad of other mathematical and physical sciences. Drawing on classical gaming examples for motivation, this course will present axiomatic and mathematical aspects of probability. Included will be discussions of random variables (both discrete and continuous), distribution and expectation, independence, laws of large numbers, and the well-known Central Limit Theorem. Many interesting and important applications will also be presented, including some from classical Poisson processes, random walks and Markov Chains.
Evaluation will be based primarily on class participation, performance on homework sets and exams.
Prerequisites: Mathematics 211 *or* permission of the instructor.
Hour: 11:00-11:50 MWF
O. BEAVER

MATH 346(S) Regression and Forecasting
This course focuses on the building of empirical models through data in order to predict, explain, and interpret scientific phenomena. The main focus will be on multiple regression as a technique for doing this. Through no fault of its own, regression analysis has perhaps the most used of all data analysis methods. We will study both the mathematics of regression analysis and its applications, including a discussion of the limits to such analyses. The applications will range from predicting the quality of a vintage of Bordeaux wine from the weather to forecasting stock prices, and will come from a broad range of disciplines.
Evaluation will be based primarily on performance on homework and exams.
Prerequisites: Mathematics 140 or 143 or 241 or 243, and 105, and 211; or permission of instructor.
Hour: 11:00-11:50 MWF
DE VEAUX

MATH 348 Mathematical Statistics ***(Not offered 1995-96; to be offered 1996-97)***
This course provides an introduction to the mathematical theory of statistics and to the application of that theory to the real world. The interrelationships among probability theory, mathematical statistics and data analysis will be emphasized throughout the course. Specific topics to be covered include estimation, testing statistical hypotheses, regression and the analysis of variance.
Evaluation will be based primarily on performance on homework and exams.
Prerequisites: Mathematics 243 or Economics 255, *and* Mathematics 211 *or* permission of instructor.
DE VEAUX

MATH 360T(S) Mathematical Logic
In 1931 Kurt Godel proved the famous Incompleteness Theorem, showing that any formal logical formulation of ordinary arithmetic must contain a statement which can neither be proved nor refuted. This discovery led to questions of solvability, computability, and decidability. In addition to working through a proof of the Incompleteness Theorem, students in this tutorial will consider the logical systems of statement and predicate calculus, formal structures (groups, arithmetic, set theory), algorithms and computability, Turing machines, and the word problem for semigroups.
Evaluation will be based on presentations, problem assignments, and a final exam.
Prerequisite: Mathematics 211.
Hour: TBA
V. HILL

MATH 361(F) Theory of Computation (Same as Computer Science 361)
(See under Computer Science for full description.)

MATH 381 History of Mathematics ***(Not offered 1995-96; to be offered 1996-97)***
A survey of the development of mathematical thought from ancient times to the present, with some consideration of its place in political, social, and intellectual history. Assigned problem studies will explore historical methods of solution, famous mathematical questions, the work of individual mathematicians, and the rise of various branches of mathematics.
Evaluation will be based primarily on performance on problem assignments and a final exam.
Prerequisite: Mathematics 211.
V. HILL

Williams 1995

MATH 397(F), 398(S), 497(F), 498(S) Independent Study
Directed independent study in Mathematics.
Prerequisite: permission of the department.
Members of the Department

MATH 402 Measure Theory and Probability ***(Not offered 1995-96)***
The study of measure theory arose from the study of stochastic (probabilistic) systems. Applications of measure theory lie in biology, chemistry, physics as well as in economics. In this course we develop the abstract concepts of measure theory and apply them to probability spaces. Included will be Lebesgue and Borel measures, measurable functions (random variables), Lebesgue integration, distributions, independence, convergence and limit theorems. Also included will be an introduction to L_p-spaces. This material provides excellent preparation for graduate school.
Evaluation will be based primarily on performance on homework assignments and exams.
Prerequisite: Mathematics 301 *or* 305, or permission of instructor.
O. BEAVER

MATH 403 Real Analysis II ***(Not offered 1995-96)***
Real analysis plays a central role in contemporary mathematics. This course includes measure spaces, Lebesgue integration, Hilbert space techniques, point set topology, and spectral theory. It provides good preparation for graduate work in pure or applied mathematics, statistics, or economics.
Evaluation will be based primarily on homework, projects, and exams.
Prerequisite: Mathematics 301, *or* 305 and permission of instructor.
SILVA

MATH 408 Analytic Number Theory ***(Not offered 1995-96)***
Obtaining precise information about certain number-theoretic phenomena (e.g. where primes occur) is extremely difficult. For this reason, mathematicians began looking for approximate results, discovering in their investigations that certain theorems from complex analysis were particularly useful. In this course, we examine the surprising connection between number theory and complex analysis, culminating in its most striking result, the Prime Number Theorem. We will develop all of the complex analysis we need, so previous exposure may be helpful, but is not required.
Evaluation will be based primarily on homework, projects, and exams.
Prerequisite: Mathematics 301 *and* either 312 or 313.

MATH 414(F) Abstract Algebra II
The relation of high school algebra to the abstraction of Mathematics 312 is not apparent, but Galois Theory shows the link. One goal of high school algebra is to solve (find roots of) linear equations ($ax + b = 0$) and quadratic equations. By the sixteenth century methods were found to solve third and fourth degree equations. Here progress stopped until the early nineteenth century, when Abel and Galois showed that no such general method for finding roots of equations of degree higher than four can exist. They needed totally new tools, which led to the mathematics of abstract algebra. The goal of Mathematics 414 is to develop through linear algebra, the deep connection between roots of polynomials and finite groups.
Evaluation will be based on homework and exams.
Prerequisites: Mathematics 312, or 315 and permission of the instructor.
Hour: 11:20-12:35 TR
GARRITY

MATH 417 Algebraic Number Theory ***(Not offered 1995-96)***
We all know that $12 = (2)(2)(3)$ and this factorization into prime numbers is essentially unique. But what does it really mean to factor integers into primes? Can this be done in a more abstract setting? The answer, perhaps surprisingly is: "sometimes yes, and sometimes no." Here we will answer these questions and discover issues involving unique factorization, Dedekind domains, class numbers, fractional ideals, and Dirichlet's Unit Theorem. It is interesting to note that this entire branch of mathematics arose from an attempt by the mathematician Kummer, in 1843, to correct his mistake in his proof of Fermat's "Last Theorem!"
Evaluation will be based primarily on projects, homework assignments, and exams.
Prerequisites: Math 211 and 312; or permission of instructor.
BURGER

MATH 421 Algebraic Geometry ***(Not offered 1995-96)***
Algebraic Geometry studies the geometry of polynomials and lies in the intersection of a tremendous amount of current mathematics, ranging from number theory to robotics. This course will be an introduction, emphasizing curves in the plane. In particular, we will study conics and cubics (books are written about the geometry of cubics; the depth of the ideas involved with cubics is amazing). Fundamental notions such as projective space, elliptic integrals, algebraic varieties, genus of a curve, the Riemann-Roch theorem, and rational points will be introduced.
Evaluation will be based primarily on homework and exams.
Prerequisites: Mathematics 312 *or* 315 *or* 317 *or* permission of instructor.

GARRITY

MATH 422(S) Differential Geometry
Differential geometry can describe the shapes and curvatures of roadways, soap films, and universes. Nowadays, geometry must also deal with singularities: junctions in roadways, soap bubbles meeting in clusters, black holes in universes.
Topics include curvature of curves, of surfaces, and in higher dimensions; second fundamental form; covariant derivative; Riemannian curvature tensor; general relativity; geometric measure theory.
Evaluation will be based primarily on classwork, homework, and exams.
Prerequisites: one of Mathematics 301, 305 *and* one of Mathematics 312, 315, 317, or permission of instructor.
Hour: 11:20-12:35 TR

MORGAN

MATH 424 Algebraic Topology ***(Not offered 1995-96)***
How can you be sure that a sphere is really different from a torus (the surface of a doughnut)? Algebraic topology utilizes algebraic objects in order to distinguish geometric objects. The course will include an introduction to both homotopy and homology theory. Fundamental groups, covering spaces and homology groups will be discussed.
Evaluation will be based primarily on performance on problem assignments and exams.
Prerequisites: Mathematics 301 *and one of* Mathematics 312, 315, 317; *or* permission of instructor.

ADAMS

MATH 431(F) Mathematical Modeling in the Life Sciences
Mathematics is increasingly being used to help understand many phenomena in the life sciences. In this course we shall develop and analyze models drawn from biochemistry, developmental biology, ecology, medicine and physiology. Specific topics will include: a simple model for alcohol uptake in the body; the modelling of wound healing and fibrocontractive diseases, and a mathematical "proof" of why an animal with a striped body coat pattern can not have a spotted tail!
Most of the models will take the form of systems of differential or partial differential equations. The applications lead naturally to the introduction and illustration of several of the techniques of applied mathematics such as stability theory, boundary layers, matching, two-timing, asymptotic analysis, phase plane analysis, and travelling wave analysis.
Evaluation will be based on homework, examinations and a project.
Prerequisite: Mathematics 210 and 211. (Note that no background knowledge in the life sciences will be assumed).
Hour: 9:55-11:10 TR

MAINI

MATH 433 Dynamic Mathematical Modeling ***(Not offered 1995-96)***
Mathematical modeling is concerned with translating a natural phenomenon into a mathematical form. In this abstract form the underlying principles of the phenomenon can be carefully examined and experiments that would be difficult or impossible to carry out in a laboratory can be carried out on a computer in a matter of seconds. The abstract process of modeling will be investigated by stepping through established techniques as they are applied to a number of exciting recently developed models.
The models we will investigate include simple and coupled oscillators, feedback phenomena, population dynamics, tidal dynamics, the pumping heart, reaction-diffusion, shock waves, morphogenesis, and the spread of pollution, forest fires, and diseases. We will employ tools from the fields of differential equations, dynamical systems, and catastrophe theory.
The course is intended for students in the mathematical, physical, and chemical sciences, as well as for students who are seriously interested in the mathematical aspects of physiology, economics, geology, biology, and environmental studies.

Williams 1995

Evaluation will be based primarily on performance of problem sets, exams, and a computer laboratory.
Prerequisites: Mathematics 105 *and* some background in differential equations, such as Mathematics 210 or 305. Permission of the instructor is required for those students who have not taken Mathematics 210 or 305.

S. JOHNSON

MATH 452 Combinatorics ***(Not offered 1995-96; to be offered Spring 1997)***
An advanced course in discrete mathematics (see Mathematics 151) with emphasis on counting and finite structures. Counting techniques will include generalized binomial coefficients, inclusion/exclusion, generating functions, partitions and Stirling numbers, and Polya counting. Structures studied will be drawn from: graphs and digraphs, networks, designs, posets and lattices, possibly with applications to the physical and social sciences. The theory will be developed with an emphasis on problem solving and independent work.
Evaluation will be based primarily on performance on problem sets and exams.
Prerequisites: Mathematics 151, 211 *and* permission of instructor.

LENHART

MATH 454(S) Graph Theory with Applications
Investigation of the structure and properties of graphs with emphasis both on certain classes of graphs such as multi-partite, planar, and perfect graphs and on application to various optimization problems such as minimum colorings of graphs, maximum matchings in graphs, network flows, etc.
Evaluation will be based primarily on problem sets and exams.
Prerequisite: Mathematics 211.
Hour: 10:00-10:50 MWF

LENHART

MATH W030 Senior Project
Taken by candidates for honors in Mathematics other than by thesis route.

MATH 493(F)-W031-494(S) Senior Honors Thesis
Senior Colloquium Required of senior mathematics majors. Meets every week for one hour both fall and spring.

Members of the Department

MATH 499(F,S) Mathematics Colloquium
Meets every week for two hours both fall and spring. Senior majors must participate at least one hour a week.
Hour: 1:00-2:00 MW

Members of the Department

MUSIC (Div. I)

Chair, Professor DOUGLAS B. MOORE

Professors: D. MOORE, K. C. ROBERTS, SUDERBURG. Associate Professors: BLOXAM, E. D. BROWN, KECHLEY. Visiting Assistant Professor: MARLES§. Part-time Lecturer: JAFFE.

MAJOR
Sequence courses
Music 104 Music Theory and Musicianship I
Music 201-202 Music Theory and Musicianship II
Music 207, 208, 209 Music in History I, Music in History II, and Music in History III
Music 402 Senior Seminar in Music

Elective courses
An additional year or two semester courses in music, to be selected from the following:
Group A: any Music 105-Music 131 course or Music 210, including direct supervision by instructor in supplementary readings, assignments, papers, and other projects appropriate for the music major.
Group B: Music 203T, 204T, 212, 220, 325, 326, 425, 426.
At least one of the two electives must be chosen from *Group B.*