

1975-1976

MATHEMATICS

Reed College

COURSE REQUIREMENTS

Exclusive of work needed to meet general college requirements. Mathematics 113, 122, and 210, or Math 113 and 210, are required for all mathematics courses including two units in analysis and two units in physics course. Mathematics 470.

Recommended but not required: one course in a foreign language.

FACULTY

and Professional Interests.
HUBERT CHRISTENSON
Analysis.

THOMAS DENNEHY
Analysis.

JOHN DUDMAN
Probability and statistics.

BURROWES HUNT
Analysis and number theory.

JOHN LEADLEY
Algebra.

V. RAO POTLURI
Finite group theory.

JOE ROBERTS
Number theory and combinatorics.

THOMAS WEITING
Differential geometry and group representation theory.

LLOYD B. WILLIAMS
Analysis.

Introductory courses in the Division of Mathematics and Natural Sciences help students become familiar with elementary principles which form a basis for understanding of each discipline. Instruction clarifies methods of observation, experiment, analysis, and reasoning by which insight is gained into the nature of the mathematical and physical worlds.

Introductory courses and subsequent more intensive courses in mathematics and the natural sciences are planned as part of the students' broad education in the liberal arts. Advanced courses in different scientific fields broaden students' knowledge and also give them training in specialized techniques characteristic of the individual sciences.

An important part of science students' experience at Reed is the thesis, an independent project of research or of critical or creative work carried out under guidance of a member of the staff. For several years mathematics, biology, chemistry, and physics faculty have received grants in support of research and instructional programs. These grants have greatly increased equipment and resources available for senior thesis projects. Qualified seniors may gain valuable experience by assisting in work covered by grants.

By national standards, an unusually high percentage of graduates of this division continue in graduate school the pursuit of their careers in scientific disciplines.

DIVISIONAL REQUIREMENTS

The Division of Mathematics and Natural Sciences maintains no specific requirements. A student in the division must fulfill all requirements for the department in which he or she has been selected as a major as well as all general college requirements.

Mathematics courses present a program of general studies in liberal arts students and also provide a basis in elements of the subject for the student who plans to specialize in mathematics or in a field using mathematics.

Mathematics 113 contains a closely reasoned introduction to mathematical thinking, and is followed by an introduction to elementary calculus in Mathematics 122. A course in combinatorial methods may be offered, following Math 113 if there is sufficient demand. Mathematics 122 is usual for science majors.

Course listings represent offerings of recent years. Courses often are prepared shortly before fall registration. Therefore for a specific topical description, consult the instructor at registration.



COURSE REQUIREMENTS

Inclusive of work needed to meet general college requirements.

Mathematics 113, 122, and 210, or Mathematics 113, 202 and 203. Eight units in mathematics courses numbered higher than 300, including two units in analysis and two in algebra. One physics course. Mathematics 470.

Recommended but not required: one course in a foreign language.

M

Reed College
1975-1976

representation theory.

ent a program of general studies for
so provide a basis in elements of the
o plans to specialize in mathematics
atics.

a closely reasoned introduction to
it is followed by an introduction to
Mathematics 122. A course in
y be offered, following Math 113,
d. Mathematics 122 is usual for

offerings of recent years. Courses
before fall registration. Therefore
ation, consult the instructor at

COURSE OFFERINGS

113/116 INTRODUCTION TO MATHEMATICS

Full course for one semester. A presentation of some of the most central ideas in mathematics. Concentration is on mappings and algebraic systems. Unifying thread of the course is construction of the real number system, starting with the axiom about mappings. Prerequisite: none; however, students should have the equivalent of two years of algebra and one year of geometry.

122/123 INTRODUCTION TO CALCULUS

Full course for one semester. A continuation of 113, using immediate ideas and results. The course presents the central theory of the calculus of one real variable: continuity, the intermediate value theorem, properties of a function continuous on a closed bounded interval; differentiation of elementary functions, with applications, the mean value theorem; the definite integral and the fundamental theorem of calculus. Prerequisite: Mathematics 113.

202 CALCULUS I

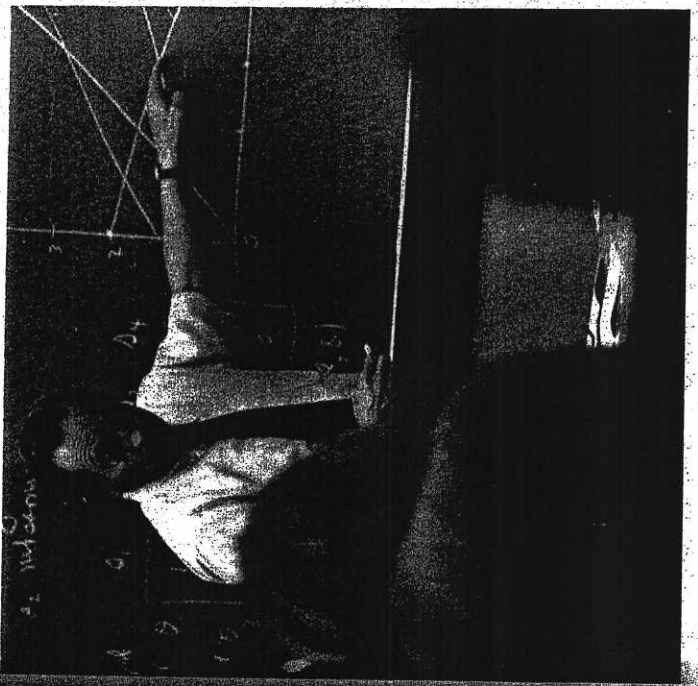
Full course for one semester. This course and its sequel, Mathematics 203, are designed to accommodate those entering freshmen who have had a year's work in calculus upon entrance. The material included is essentially that of Mathematics 210, with topics from Mathematics 122 as required. Prerequisite: Mathematics 113, one year of calculus, and permission of instructor.

203 CALCULUS II

Full course for one semester. Prerequisite: Mathematics 202. Not offered 1975-76.

210 MATHEMATICAL ANALYSIS II

Full course for one year. A continuation of 122, including Taylor's theorem, infinite series, ordinary differential equations, and an introduction to calculus of functions of several variables. Prerequisite: Mathematics 122.



Reed 1975-1976
col. 1, 2, 9

261 PROBABILITY AND STATISTICS I

Full course for one semester. An introduction to probability and mathematical statistics. Discrete and continuous probability distributions are studied as models for chance experiments, with particular emphasis on problems of estimation. Prerequisite: Mathematics 122 or 123.

263 PROBABILITY AND STATISTICS II

Full course for one semester. Estimation and tests of hypotheses, with particular emphasis upon linear models, regression and analysis of variance. Distribution-free tests of hypotheses. Prerequisite: Mathematics 261. Offered only alternate years beginning 1975-76.

300 GENERAL MATHEMATICS

Full course for one year. A terminal course in mathematics for junior and senior non-science students who have not taken 113. Topics chosen from arithmetic of number systems; linear algebra; calculus; and analytic geometry. Prerequisite: junior or senior standing or permission of instructor; open only to students with inadequate backgrounds for 113.

311 COMPLEX ANALYSIS

Full course for one semester. A study of complex functions: Cauchy's Theorem, the residue theorem, Laurent series, and analytic continuation. Prerequisite: Mathematics 210 or 203.

312 REAL ANALYSIS

Full course for one semester. A study of Lebesgue integral for functions defined on finite dimensional Euclidean spaces, including Fubini's Theorem, convergence theorems, and, if time permits, the L_p spaces. Prerequisite: Mathematics 210 or 203.



411 TOPICS IN ANALYSIS I
Full course for one semester. Topics selected from Mathematics 311 and 312, or permission of instructor.

412 TOPICS IN ANALYSIS II
Full course for one semester. Topics selected from Mathematics 311 and 312, or permission of instructor.

421 ELEMENTARY NUMBER THEORY
Full course for one semester. A study of divisibility, theory of prime numbers, congruences, and quadratic residues. Prerequisite: senior standing or permission of instructor. Offered 1975-76.

422 ADVANCED NUMBER THEORY
Full course for one semester. A more detailed study of the theory of quadratic forms, and other topics which require considerably greater background. Prerequisite: permission of instructor. Not offered 1975-76.

431 ALGEBRAIC STRUCTURES
Full course for one semester. A study of topics in groups, rings, fields, modules. Prerequisite: Mathematics 431, or permission of instructor.

432 TOPICS IN ALGEBRA
Full course for one semester. Topics selected from associative algebra, Galois theory, algebraic geometry. Prerequisite: Mathematics 431, or permission of instructor.

452 MATHEMATICS LOGIC II
Full course for one semester. A more detailed study of the foundations of mathematics, including set theory, the theory of ordinals, and the theory of models. Prerequisite: Mathematics 451, or permission of instructor.

470 THESIS
One-half or full course for one year.

480 SPECIAL TOPICS
One-half or full course for one semester or one year. Prerequisite: junior or senior standing and permission of instructor.

331 LINEAR ALGEBRA

Full course for one semester. A brief introduction to field structures, followed by presentation of the algebraic theory of finite dimensional vector spaces. Geometry of inner product spaces is examined in the setting of real and complex fields.

332 ELEMENTARY ALGEBRA

Full course for one semester. An elementary treatment of algebraic structure of groups, rings, fields, and/or algebras. The course may touch on a number of these areas but is primarily concerned with only one.

342 GEOMETRY

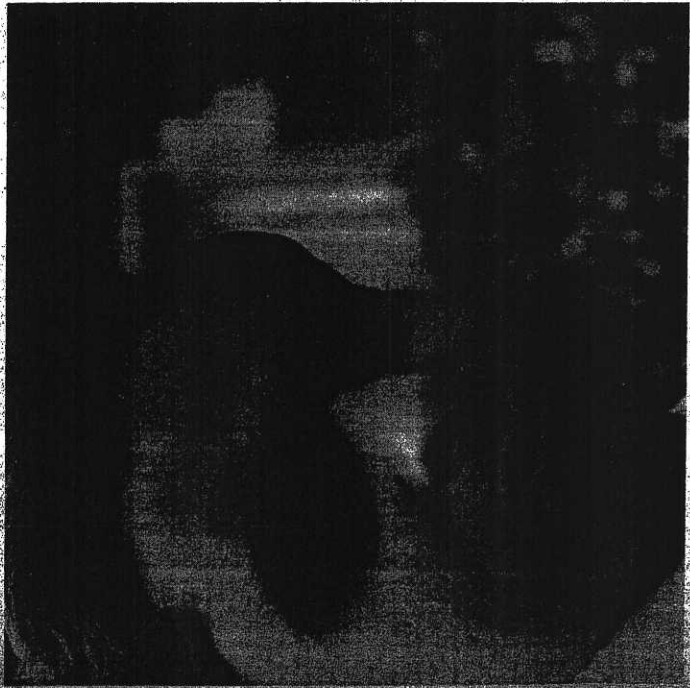
Full course for one semester. A study of geometry without the restriction of Euclidean axioms. Projective and affine geometry are examined synthetically, analytically, and as characterizations of the invariance properties of the geometric groups.

351 MATHEMATICAL LOGIC I

Full course for one semester. An examination of relations between Boolean algebra and propositional calculus. First order predicate calculus and first order theories are studied. The Skolem-Lowenheim theorem, Gödel's incompleteness theorem, and the completeness and undecidability of the pure predicate calculus of first order are discussed, and, as time permits, proved. Some set theory may be included. Prerequisite: Mathematics 113 and 122 or 124 and junior or senior standing, or permission of instructor.

400 STATISTICS: ADVANCED

Full course for one year. A development of probability theory in terms of random variables defined on discrete sample spaces. Continuous random variables are studied in the context of the theory of estimation and testing hypotheses. Prerequisite: concurrent enrollment in Mathematics 311, 312, or 210, with permission of instructor. Not offered 1975-76.



Reed 1975-1976
College

411 TOPICS IN ANALYSIS I

Full course for one semester. Topics selected by the instructor. Prerequisite: Mathematics 311 and 312, or permission of instructor.

412 TOPICS IN ANALYSIS II

Full course for one semester. Topics selected by the instructor. Prerequisite: Mathematics 311 and 312, or permission of instructor.

421 ELEMENTARY NUMBER THEORY

Full course for one semester. A study of integers, including topics such as divisibility, theory of prime numbers, congruences, and solutions of equations in integers. Prerequisite: senior standing or permission of instructor. Not offered 1975-76.

422 ADVANCED NUMBER THEORY

Full course for one semester. A more detailed analysis of problems arising in 421 but which require considerably greater mathematical background. For example, topics may be drawn from algebraic or analytic number theory. Prerequisite: permission of instructor. Not offered 1975-76.

431 ALGEBRAIC STRUCTURES

Full course for one semester. A study of topics selected from theory of groups, rings, fields, modules. Prerequisite: Mathematics 331 and 332 or permission of instructor.

432 TOPICS IN ALGEBRA

Full course for one semester. Topics selected by the instructor; for example, associative algebra, Galois theory, algebraic geometry, and geometric algebra. Prerequisite: Mathematics 431, or permission of instructor.

452 MATHEMATICS LOGIC II

Full course for one semester. A more detailed analysis of problems of the kind arising in Mathematics 351 but which require greater mathematical background. Topics will be chosen from the following: model theory, algebraic logic, existence of decision procedures and related questions for first order theories, conditions under which the consistency of a first order theory can be proven within the theory. Prerequisite: Mathematics 351 or permission of instructor. Not offered 1975-76.

470 THESIS

One-half or full course for one year.

480 SPECIAL TOPICS

One-half or full course for one semester or one year. Independent reading. Prerequisite: junior or senior standing and approval of instructor and division.

brief introduction to field structures, followed by theory of finite dimensional vector spaces as is examined in the setting of real and

elementary treatment of algebraic structures and bases. The course may touch on a number of topics not included in the above.

study of geometry without the restriction of Euclidean geometry are examined synthetically, and the invariance properties of the

examination of relations between Boolean algebras, first order predicate calculus and first order logic. Gödel's completeness theorem, Gödel's incompleteness theorem, and undecidability of the pure theory of arithmetic, and, as time permits, proved. Prerequisite: Mathematics 113 and 122 or permission of instructor.

element of probability theory in terms of finite sample spaces. Continuous random variables and the theory of estimation and testing. Prerequisite: Mathematics 311, 312, or 313. Not offered 1975-76.



1975-
1976
**PROGRESSION TO THE
BACHELOR OF ARTS DEGREE**

To be eligible to receive the bachelor of arts degree from Reed College, students must fulfill six basic requirements: sufficient units of academic work; college distribution requirements; major division and/or department distribution requirements; junior qualifying examination; senior thesis; and senior oral examination. A description of these requirements follows.

CREDIT REQUIREMENTS

Minimum credit required for graduation following a four or five year program of study is 30 units of academic work plus 1.5 units of physical education. Students of exceptional preparation and ability may be recommended by the faculty for graduation at the end of three years and upon completion of 27 units of academic work plus 1.5 units of physical education. (For a definition of the unit measurement and other specifics, see the paragraph headed Course Load.)

To be eligible for graduation, students completing work in three or four years must carry six academic units of work in their degree year; at least two academic units—one of which must be in a non-thesis course—must be carried in any semester. The six units, however arranged, constitute a full program for the academic year and require payment of full tuition each semester. The work of the degree year is to be done while attending Reed, except in pre-engineering, pre-forestry, pre-medical study, the Reed-Portland Museum Art School program, and when students' educational interests can be better served through other special arrangements.

**COLLEGE DISTRIBUTION
REQUIREMENTS**

The course distribution required of all Reed undergraduates is carefully designed and frequently re-evaluated to assure a broad understanding of the arts and sciences, which a liberal education signifies.

Humanities

Humanities 120, 130, or 140 is required of all freshmen. It may be required of transfer students if they lack background in this area.

Group A Literature, Philosophy, and the Arts

Minimum of one full-year course or the equivalent in semester courses totaling two units, which may be selected from the following: art (excluding studio courses), Humanities 210, music (excluding applied music courses), Philosophy 210, Religion 210, or Theatre 210, or advanced subject matter courses in any of these fields, or in English and foreign literature courses of 310 or higher.

Group B History and the Social Sciences

Minimum of two units in the same department from: Anthropology 211 and one additional advanced approved anthropology course, Economics 210, Humanities 210, Political Science 210, Sociology 201/202 or 210, or any two units in history.

Group C Mathematics and the Natural Sciences

Minimum of four units, only two of which may be in mathematics, chosen from any offering in biology, chemistry, mathematics, physics, Natural Science 110, or Psychology 220. Students may not use more than two units in their major field of study to satisfy the Group C requirement.

Proficiency in a foreign language as a requirement for graduation is a matter left to the discretion of the major departments or divisions. Some retain a language requirement, and most of those who do not require foreign language study do recommend that whenever possible such study should be included in the student's program.

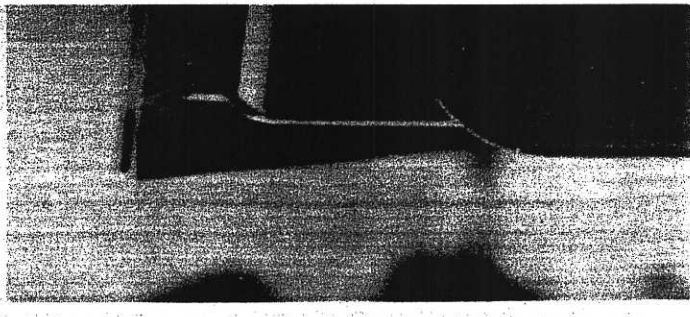
ACCEPTANCE AS A MAJOR

Students applying for acceptance as a major are evaluated by the division, department, or interdisciplinary committee at or near the end of the sophomore year. Students are advised of the faculty's current opinion of their prospects as a major. After acceptance, students carefully plan, in consultation with their advisors, a tentative schedule for their entire upperclass program. Specific course and credit distribution requirements for majors are detailed in descriptions of divisions, departments, and interdisciplinary programs.

QUALIFYING I

Students pass a qualifying exam in their major division and/or department at the end of the junior year, after preparation, grasp of major independent work, which is possible that a student's competence in a field may be encouraged to transfer to another review may also identify the work of the senior thesis.

The qualifying examination is given to the best students and in actuality student's performance in the previous course work is discussed in divisional meetings to assess work on a thesis.



TRIBUTION

red of all Reed undergraduates is
ntly re-evaluated to assure a
ris and sciences, which a liberal

required of all freshmen. It may
ts if they lack background in

W, and the Arts

88 or the equivalent in semester
ed) may be selected from the
o courses), Humanities 210,
c courses), Philosophy 210,
advanced subject matter
in English and foreign

Sciences

me department from:
ional advanced approved
e 210, Humanities 210, Political
or 210, or any two units

Natural Sciences

of which may be in
ffering in biology, chemistry,
cience 110, or Psychology 220.
two units in their major field
requirement.

as a requirement for
discretion of the major
tain a language requirement,
uire foreign language study
ssible such study should be

A MAJOR

as a major are evaluated by
disciplinary committee at or
r. Students are advised of
ir prospects as a major.
ly plan, in consultation with
e for their entire upperclass
it distribution requirements
ons of divisions,
r programs.

QUALIFYING EXAMINATION

Students pass a qualifying examination administered by the major division and/or department before being allowed to begin a thesis in the senior year. The examinations, given near the end of the junior year, are intended to test general preparation, grasp of major subjects, and capacity for independent work, which a satisfactory thesis requires. It is possible that a student who does not demonstrate competence in a field may be required to take further work. In some cases, it may be possible that a student may be encouraged to transfer to another department or division. The review may also identify those who appear to need more time to develop their capabilities for the sustained independent work of the senior thesis.

The qualifying examination is not meant to qualify only the best students and in actuality does not operate that way. The student's performance in the examination as well as in all previous course work is discussed in full departmental or divisional meetings to assess the student's readiness to begin work on a thesis.

THESIS

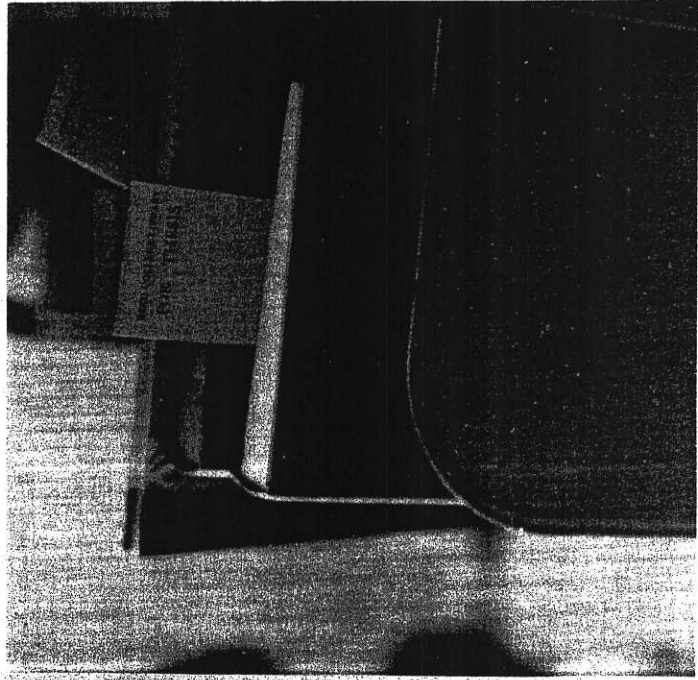
Reed 1975-1976
College

As part of the requirements for graduation, students must prepare an acceptable thesis upon a particular phase of their major. A thesis project must be approved by the major division, department, or interdisciplinary committee. It must be an integral part of the student's educational program and demonstrate powers of organization, general grasp of the field, and capacity for independent work and thought. Reed theses, averaging approximately one hundred pages, are bound and catalogued in the college library. Some have been of such quality that they have been published in scholarly journals.

The senior thesis is viewed as the capstone of the Reed education, providing an opportunity for sustained and developmental examination of a significant problem in the student's field of major study.

ORAL EXAMINATION

The candidate for graduation takes a final comprehensive two-hour oral review under the direction of the major division or department. The oral examination may cover the work of the student's entire program, but emphasis is on the thesis and major field. The committee of examiners will include faculty from the student's own department and division, a second division and, on occasion, professionals from outside the college.



Reed College
1975-1976

PROGRESSION TO THE BACHELOR OF ARTS DEGREE

The curriculum of undergraduate courses makes the process of achieving an education at Reed a stimulating and absorbing experience to be fully explored and valued.

The Reed undergraduate education combines broad understanding of arts and sciences with a comprehensive grasp of at least one academic discipline. Ensuring breadth are two aspects of the Reed undergraduate curriculum: first, the humanities program and second, distribution of courses.

Humanities courses at Reed examine selected landmarks in the political, philosophical, and artistic development of Western civilization. The approach is interdisciplinary; the subject matter derives from a variety of humanistic disciplines.

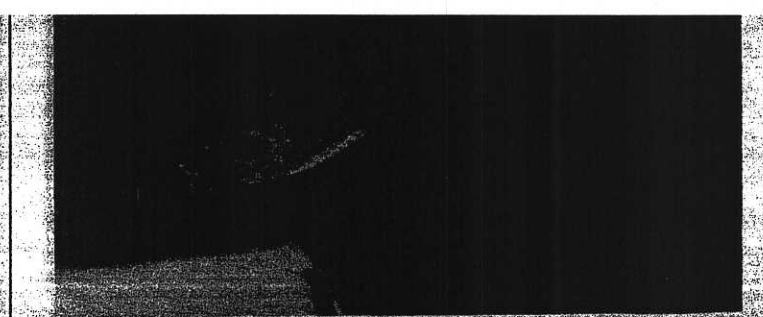
A course in humanities is the first of four distribution requirements fulfilled by Reed students to earn the bachelor of arts degree. In addition, the college requires a minimum of two units in literature, philosophy, religion or the arts (Group A); two units in history or the social sciences (Group B); and four units in mathematics and the natural sciences (Group C). Specifics of these requirements as well as an explanation of the unit measurement may be found in the section later in the catalog entitled Academic Policies.

In working toward the bachelor of arts degree, Reed students generally select and complete 30 units of academic work plus 1.5 units of physical education in four years, although students may, in special circumstances, complete the program in three years with 27 units of academic work.

Students should, whenever possible, complete the general college requirements within their first two years, so that they may focus much of their upperclass work on special fields of interest. At the same time, they should assure themselves of the necessary preparation for later courses within, or related to, their contemplated majors. In addition they must meet certain requirements of the division, department or both.

Typically students begin concentration in one particular field at the close of the sophomore year, when they are accepted as majors into a department and into the division to which that department belongs.

In their junior year, Reed students begin to explore their comprehension of the senior year which includes the thesis. The thesis is one of the most important aspects of education and gives Reed students a comprehensive work in the senior thesis is bound and published in the college library and is sometimes published in scholarly journals. In their senior year, seniors individually discuss their work with faculty and professionals in their field.



TO THE ARTS DEGREE

ate courses makes the process
lead a stimulating and absorbing
d and valued.

ation combines broad
aces with a comprehensive
discipline. Ensuring breadth
degraduate curriculum: first,
second, distribution of courses.

amine selected landmarks in
artistic development of
each is interdisciplinary; the
society of humanistic disciplines.

rst of four distribution
students to earn the bachelor
college requires a minimum of
ty, religion or the arts (Group
cial sciences (Group B); and
the natural sciences (Group C),
as well as an explanation of
und in the section later in the
ies.

of arts degree, Reed students
9 units of academic work plus
a four years, although students
complete the program in three
work.

ible, complete the general
or first two years, so that they
ess work on special fields of
should assure themselves of
er courses within, or related
addition they must meet
ion, department or both.

ration in one particular field
r, when they are accepted
into the division to which that

Reed 1975-1976

In their junior year, Reed students are reviewed to assure their comprehension of their chosen fields before beginning the senior year which includes preparation of a senior thesis. The thesis is one of the most important aspects of the Reed education and gives Reed students the opportunity to prepare a comprehensive work in their selected fields of interest. Each senior thesis is bound and catalogued for future use in the college library and is sometimes of such quality as to be published in scholarly journals. At the end of the academic year, seniors individually debate and defend their theses with faculty and professionals in the field.

A Reed student may select as a major field one of the following areas:

- Anthropology
- Art
- Biology
- Chemistry
- Classics
- Economics
- English Literature
- French Literature
- General Literature
- German Literature
- History
- Mathematics
- Music
- Philosophy
- Physics
- Political Science
- Psychology
- Religion
- Russian Literature
- Sociology
- Theatre

In addition, interdisciplinary majors are available in:

- American Studies
- Chemistry-Physics
- Dance-Theatre
- History-Literature
- History-Russian
- International Studies
- Literature-Philosophy
- Literature-Theatre
- Mathematics-Economics
- Mathematics-Physics
- Mathematics-Sociology
- Philosophy-Religion

To supplement these established interdisciplinary majors, special programs that temporarily link two or more disciplines can be approved if, in the faculty's judgment, a proposed program is a carefully reasoned alternative to an established major field of study and if the student is believed capable of integrating the constituent disciplines.

In pursuing his or her studies, the Reed student has the opportunity to examine an exciting number of fields. A summary of the specific courses available to the Reed undergraduate follows.

