

## MATHEMATICS

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### Mission and Goals

Consonant with the mission of the College, this department is “dedicated to providing for its students the means for their full realization of a dual goal of vocation and enlightenment.” Society requires competent professionals who can solve contemporary problems by using connections among disciplines, especially the humanities, engineering and technology, and the sciences. The Programs within this Department are designed to blend the unique characteristics of Catholic liberal arts education with preparation for productive and rewarding professional careers. The four professional educational objectives of this department are to produce graduates who have:

- 1) The specialized knowledge and skills necessary for initiation into their chosen profession,
- 2) A broad range of skills necessary for effective communication,
- 3) An appreciation for the interrelationships among the branches of knowledge,
- 4) The ethical, social, and aesthetic perspectives necessary for values-based judgment and decision-making.

## Major in Mathematics with a Cognate Concentration, Minor, or Second Major

The mathematics program has adopted the philosophy and goals of the department.

### I. Major Program Requirements

MA 131	Calculus of Single Variable Functions
or MA 121-122	Differential and Integral Calculus
MA 232	Differential Equations and Linear Algebra I
MA 233	Multivariable Calculus
MA 301	Foundations of Mathematics
MA 328	Modern Applications of Discrete Mathematics
MA 334	Differential Equations and Linear Algebra II
MA 336	Probability and Statistics I
MA 341	Probability and Statistics II
MA 342	Numerical Computing and Visualization
MA 366	Junior Seminar
MA 401	Abstract Algebra and Applied Geometry
MA 421	Optimization
MA 4xx	Honors Thesis/Senior Project (for a total of at least 3 credits)

### II. Required Cognate Concentration, Minor, or Second Major

The course of study for a Bachelor of Arts degree with a major in mathematics requires selection of a cognate concentration, a minor, or a second major, approved by the student’s faculty advisor and the chair of the mathematics department. Approved selections include Biology, Business and Economics, Chemistry, Computer Science, Engineering, and Environmental Science. In consultation with faculty advisors and the mathematics department chair, a student can develop a proposal for a cognate concentration, minor, or a second major other than those listed. Requirements for approved concentrations, minors, and second majors are as follows:

#### A. Concentration in Biology

A minor or a second major in biology.

#### B. Concentration in Business and Economics

BA 203-204	Principles of Accounting I and II
BA 313	Managerial Finance
BA 375	Fundamentals of Management
BA 409	Operations Research
EC 202	Principles of Economics II and
EC 201	Principles of Economics I
or EC 203	Project Management Economics
Plus 3 additional BA, CS, or EC credits at the 200 level or above approved by the mathematics department.	

#### C. Concentration in Chemistry

A minor or a second major in chemistry.

#### D. Concentration in Computer Science

A minor or a second major in computer science.

#### E. Concentration in Engineering

CH 101-102	General Chemistry
ENGR 104	Engineering Graphics and CAD
ENGR 302	Engineering Mechanics I: Statics
PHYS 205-206	Engineering Physics I and II
CS 110	Programming
Plus at least 12 additional semester-credit hours in engineering courses 300 or above.	

#### F. Concentration in Environmental Science

BI 161-162	Introductory Biology
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BI 211	Ecology
CH 111-112	Essentials of Chemistry
ENGR 313	Hydrology
ENGR 402	Environmental Engineering Principles
EAS 201	Earth Science
EAS 302	Advanced Earth Science

#### G. Concentration in Physics

A minor in physics.

#### III. Other Program Requirements

ENWR 305 Technical Writing  
or ENWR 301 Business Writing (for the Business and Economics Concentration only)

To earn a Bachelor of Arts degree with a major in mathematics, a student must earn a grade of "C" or better in all of the courses listed under "Major Program Requirements," "Required Cognate Concentration or Minor," and "Other Program Requirements." A lesser grade in any of these courses must be replaced before the Bachelor of Arts degree with a major in mathematics will be granted. In addition, lesser grades in any of these courses preclude taking subsequent courses for which the deficient courses are prerequisite.

### Major in Mathematics for Secondary Education

#### I. Broadfield Major Program Requirements

MA 131	Calculus of Single Variable Functions
or MA 121-122	Differential and Integral Calculus
MA 232	Differential Equations and Linear Algebra I
MA 233	Multivariable Calculus
MA 301	Foundations of Mathematics
MA 328	Modern Applications of Discrete Mathematics
MA 334	Differential Equations and Linear Algebra II
MA 336	Probability and Statistics I
MA 341	Probability and Statistics II
MA 342	Numerical Computing and Visualization
MA 401	Abstract Algebra and Applied Geometry
MA 421	Optimization
MA 471	History Seminar in Mathematics
MA 4xx	Honors Thesis/Senior Project (for a total of at least 3 credits)

#### II. Other Program Requirements

Two semesters of college science approved by the mathematics department.

ENWR xxx One English writing course above ENWR 102

#### III. Professional Education Requirements

AN/SO 218	Introduction to Native American Studies
ED 102	Foundations of Education
ED/PSY 229	Educational Psychology
ED 245	Diversity Field Experience
ED 309	Teaching in the Secondary School
ED 327	Content Area Reading/Language Arts
ED 405	Education Seminar
ED 410	Student Teaching
ED 412	Measurement & Assessment in Teaching
ED 418	Teaching Mathematics in the Secondary School
HPE 214	The School Health Program
PSY 228	Adolescent Psychology
SPED 300	Introduction to Exceptional Children

United States and contemporary world cultures course(s)  
see index for page number.

#### IV. Acceptance into the Teacher Education Program and the Student Teaching Program

- A. Teacher Education Program: Students pursuing academic programs that lead to teacher licensure must be accepted into the teacher education program by the end of their sophomore year.
- B. Student Teaching Program: All preservice teachers must obtain admission to the student teaching program in the spring semester of their junior year. For details see index for page numbers for Teacher Education and Student Teaching Programs.

Note: All secondary education students must consult both with the Department of Education: Health, Physical and Teacher and the Department of Mathematics, Engineering, and Computer Science.

### Minor in Mathematics

#### Minor Program Requirements

MA 131	Calculus of Single Variable Functions
or MA 121-122	Differential and Integral Calculus
MA 232	Calculus, Linear Algebra, and Differential Equations
MA 233	Multivariable Calculus
MA 334	Differential Equations and Linear Algebra
MA 336	Probability and Statistics I

Plus two more 3- or 4-credit mathematics courses at the 300 level or above approved by the mathematics program director.

## ENGINEERING (3-2)

GARRY FISCHER, M.S.  
 MARY E. KEEFFE, PH.D.  
 TERENCE J. MULLEN, P.E.  
 JOHN L. SCHARE, PH.D.  
 ANTHONY M. SZPILKA, PH.D.

### Mission and Goals

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- 1) The specialized knowledge and skills necessary for initiation into their chosen profession,
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### 3-2 Engineering: Major in Mathematics

A student who completes the requirements for the 3-2 Engineering Major in Mathematics earns two degrees:

1. A Bachelor of Arts degree with a major in mathematics from Carroll College, and
2. A Bachelor of Science degree with a major in a selected field of engineering (e.g., mechanical engineering) from one of the following affiliated engineering schools:
  - Columbia University, New York, NY
  - The University of Notre Dame, South Bend, IN
  - The University of Southern California, Los Angeles, CA
  - The University of Minnesota, Minneapolis, MN
  - Gonzaga University, Spokane, WA
  - Montana Tech of the University of Montana, Butte, MT
  - Montana State University, Bozeman, MT

Engineering fields, which 3-2 students may select, include the following:

- Aerospace Engineering
- Engineering Mechanics
- Chemical Engineering
- Engineering Science
- Civil Engineering
- Geological Engineering
- Computer Engineering
- Geophysical Engineering
- Electrical Engineering
- Industrial Engineering
- Environmental Engineering
- Material Science Engineering
- Mechanical Engineering
- Metallurgical Engineering
- Applied Biology
- Mineral or Mining Engineering
- Applied Chemistry
- Nuclear Science and Engineering

- Applied Geophysics
- Operations Research
- Biological Engineering
- Petroleum Engineering

The purposes of the 3-2 program are to provide the student with a traditional engineering education augmented with a strong liberal arts background and to provide a broader and deeper exposure to mathematics and its applications than would ordinarily be possible in a four year engineering program.

Under the 3-2 program, a student attends Carroll College for three years and then selects and transfers to one of seven affiliated engineering schools for two years of study. Upon successful completion of the five-year program, the student receives a Bachelor of Arts degree with a major in mathematics from Carroll College and a Bachelor of Science degree with a selected engineering major from the engineering school.

Carroll College continually reviews its curriculum with the seven affiliated schools to ensure that 3-2 students can complete any of the engineering majors in the five-year program.

A program to prepare students for graduate studies in engineering is offered via the mathematics major with a cognate concentration in engineering.

A student in the 3-2 engineering program will be accepted at any one of the seven engineering schools on the written recommendation of the engineering program faculty. Before a student will be considered for a recommendation, at least a 2.60 cumulative grade average and a 2.60 average in the “Major Program Requirements” and in the “Other Program Requirements” must be achieved by the end of the fifth semester at Carroll College.

#### I. Major Program Requirements

ENGR 104	Engineering Graphics and CAD Applications
ENGR 201	Engineering Design Process
ENGR 302	Engineering Mechanics I: Statics
ENGR 308	Thermodynamics

Technical Electives: Four courses of three or four credits each, selected on the basis of the engineering field of interest and with approval of the engineering advisor. Technical electives must be selected as follows: one from Category I, two from Category II, and one from Category III. Technical electives include the following courses:

CH 301-302	Organic Chemistry I and II (Category I and III)
CS 110	Programming (Category I)
CS 330	Computer Networking I (Category III)
ENGR 303	Engineering Mechanics II: Solids (Category II)
ENGR 304	Engineering Mechanics III: Dynamics (Category III)
ENGR 305-306	Electronics and Circuit Analysis I and II (Category I and III)
ENGR 307	Fluid Mechanics (Category II)
ENGR 309	Geotechnical Engineering (Category II)
ENGR 310	Structures I (Category III)
ENGR 313	Hydrology (Category III)

#### II. Other Program Requirements

CH 101-102	General Chemistry I and II
EC 201 or 202	Principles of Economics (EC 202 preferred)
EC 203	Project Management Economics
ENWR 305	Technical Writing
MA 131	Calculus of Single Variable Functions
or MA 121-122	Differential and Integral Calculus
MA 232	Differential Equations and Linear Algebra I
MA 233	Multivariable Calculus
MA 334	Differential Equations and Linear Algebra II
MA 336	Probability and Statistics I

MA 341 Probability and Statistics II  
or MA 342 Numerical Computing and Visualization  
PHYS 205-206 Engineering Physics I and II

### III. Carroll College Core Curriculum

To earn a Bachelor of Arts degree from Carroll College a student must complete the Carroll College Core Curriculum as listed in this catalog. However, since these requirements must be completed within 3 years, a total of only nine credits of philosophy and theology instead of twelve, six credits of one and three credits of the other. In addition, a student must earn a grade of "C" or better in all of the courses listed under "Major Program Requirements" and "Other Program Requirements." A lesser grade in any of these courses must be replaced before the Bachelor of Arts degree will be granted. In addition, lesser grades in any of these courses preclude taking subsequent courses for which the deficient courses are prerequisite.

### IV. Additional Requirements

1. The requirements for the Bachelor of Arts degree with a major in mathematics under the 3-2 program differ from those for the four-year mathematics majors. Students in the 3-2 engineering major are not required to fulfill the requirements for the four-year mathematics major.
2. The requirements listed in sections I, II, and III above must be completed before transferring to an affiliated engineering school and cannot be satisfied by credits earned at the engineering school after the student has transferred.
3. Students transferring to Carroll College and entering the 3-2 program must complete at least two full-time semesters at Carroll College before they will be considered for a recommendation to transfer to an affiliated school. In addition, these students must complete a minimum of eighteen credits in the Department of Mathematics, Engineering and Computer Science at Carroll College. Credits transferred to Carroll do not satisfy this requirement.
4. A Student who transfers to a non-affiliated engineering school and completes an engineering degree in an ABET accredited program is eligible to receive the Bachelor of Arts degree with a major in mathematics from Carroll College. The Carroll degree is awarded provided that the student has completed all requirements for the degree listed in sections I, II, III, and IV.
5. Some engineering schools and/or departments require a grade point average higher than 2.60 for admission to junior and senior level courses. Some departments may also require the completion of a summer field or laboratory course for graduation in that department. In rare cases, additional course work may be required to satisfy a specialized engineering curriculum. These are requirements that apply to all students entering these programs and must also be satisfied by 3-2 students. Students in 3-2 engineering must consult with the director of engineering programs at Carroll College to select a school and field of study for which they qualify.

CS 230	Software Engineering
CS 240	Software Engineering Project
CS 309	Computer Architectures
CS 310	Database Design & Implementation I
CS 430	Senior Project
CS 495	Computer Science Seminar

#### II. Other Program Requirements

CO 206	Small Group Communications
EN 325	Technical Writing
MA 131	Calculus of Single Variable Functions or MA 121-122 Differential and Integral Calculus
MA 328	Discrete Mathematics I

#### III. Required Area of Concentration

The course of study for a Bachelor of Arts degree with a major in computer science requires selection of an area of concentration. The approved areas of concentration are:

##### A. Computer Networking

CS 201	Web Design
CS 202	Web Development
CS 330	Computer Networking I
CS 331	Computer Networking II
CS/MA 403	Intro to Modern Cryptography
CS 410	Operating Systems
CS 421	Computer and Network Security

##### B. Computer Programming- Business

BA 203	Principles of Accounting I
BA 204	Principles of Accounting II
EC 201	Principles of Economics I
EC 202	Principles of Economics II
EC 203	Project Management
plus 3 additional courses from the following list:	
BA 306	Marketing
BA 313	Managerial Finance
BA 360	Computerized Accounting & Finance
BA 375	Fundamentals of Management
BA 380	E-Commerce
BA 409	Operations Research

##### C. Computer Programming - Physical Sciences

MA 232	Differential Equations & Linear Algebra I
MA 233	Multivariable Calculus
MA 334	Differential Equations and Linear Algebra II
CH 101	General Chemistry I
CH 102	General Chemistry II
PHYS 205	Engineering Physics I: Mechanics
PHYS 206	Engineering Physics II: Electricity & Magnetism

##### D. Computer Programming - Biological Sciences

BI 171	Biological Principle I
BI 172	Biological Principle II
CH 101	General Chemistry I
CH 102	General Chemistry II
plus 3 additional courses from the following list:	
BI 221	Cell Biology
BI 300	Genetics
BI 306	Plant Systematic
BI 308	Animal Physiology
BI 311	Ecology

## COMPUTER SCIENCE

R. STEPHEN HARPER, M.S.  
DAVID C. MARSHALL, M.S.  
PHILIP B. ROSE, M.SC.

### Mission and Goals

The computer science program is designed to:

- Provide a challenging and appropriate curriculum that will prepare students for productive careers or further education in graduate school.
- Provide an atmosphere in which learning can develop into a life long commitment to learning.
- Teach students to apply their knowledge to solving practical problems by working individually and collaboratively.
- Teach students to communicate effectively orally and in writing.

### Major in Computer Science

#### I. Major Program Requirements

CS 110	Introduction to Computer Science & Java Programming
CS 120	Data Structures and Program Design

BI 370 Evolutionary Analysis  
CH 301 Organic Chemistry I

#### E. Computer Science – Mathematics

MA 232 Differential Equations & Linear Algebra I  
MA 233 Multivariable Calculus  
MA 334 Differential Equations & Linear Algebra II  
MA 336 Probability and Statistics I  
MA 341 Probability and Statistics II  
MA 342 Numerical Computing  
MA 421 Advanced Applications & Optimization

#### F. Individually Designed Program

Since the standard tracks listed in A. through E. may not address every student's desired educational plan, students may design a custom area of concentration that better addresses their focus. This plan must be approved by the computer science faculty and the college registrar.

To earn a Bachelor of Arts degree with a major or minor in computer science, a student must earn a grade of "C" or better in all of the courses listed under "Major Program Requirements", "Required Area of Concentration", and "Other Program Requirements." A lesser grade in any of these courses must be replaced before the Bachelor of Arts degree with a major or minor in computer science will be granted. In addition, a "D" or "F" grade in any of these courses precludes taking subsequent courses for which the deficient course is a prerequisite.

### Major in Computer Information Systems (CIS)

#### I. Major Program Requirements

CS 110 Introduction to Computer Science & Java Programming  
CS 120 Data Structures and Program Design  
CS 230 Software Engineering  
CS 213 Computer Apps in Business  
or BA 365 Adv Spreadsheets  
or BA 380 Ecommerce  
CS 310 Database Design & Implementation I  
CS 311 Database II  
BA 360 Accounting IS Systems (Optional)  
BA 375 Fundamentals of Management  
CS 201-202 Web Design and Development  
CS 330-331 Networking I and II  
CS 410 Operating Systems  
CS 421 Computer and Network Security  
BA 301 Business Law  
CS 425/487 Internship

#### II. Other Program Requirements

CO 206 Small Group Communications  
EN 325 Technical Writing  
EC 203 Project Management  
BA 203 Accounting I  
MA 207 Probability and Statistics

### Minor in Computer Science

#### I. Programming Minor

CS 110 Introduction to Computer Science and Java Programming  
CS 120 Data Structures and Program Design  
CS 230 Software Engineering  
CS 240 Software Engineering Project  
CS 310 Database Design & Implementation I  
CS 430 Senior Project  
CS 495 Computer Science Seminar

#### II. Web Development Minor

CS 110 Introduction to Computer Science and Java Programming  
CS 120 Data Structures and Program Design  
CS 201 Web Graphics, Animation & Layout  
CS 202 Web Coding & Development  
CS 310 Database Design and Implementation I  
CS 330 Computer Networking I  
CS 331 Computer Networking II  
CS 495 Computer Science Seminar

#### III. Minor in Computer Science for Secondary Education

##### A. Minor Program Requirements

CS 110 Introduction to Computer Science and Java Programming  
CS 120 Data Structures and Program Design  
CS 213 Computer Applications in Business  
CS 309 Computer Architecture  
CS 330 Data Communications  
CS 495 Computer Science Seminar

##### B. Other Program Requirements

ED 418 Teaching Mathematics in the Secondary School  
MA 131 Calculus of Single Variable Functions  
or MA 121-122 Differential and Integral Calculus  
MA 207 Elementary Statistics  
MA 328 Discrete Mathematics

##### C. Professional Education Requirements. See

"Department of Education" and "Secondary Education Requirements" for the professional education requirements.

### Minor in Computer Science

#### Minor Program Requirements

Twenty-two semester credits including:

CS 110 Introduction to Computer Science & Java Programming  
CS 201-202 Web Coding and Development  
CS 310 Database Design and Implementation  
CS 330 Computer Networking

Plus 1 additional course:

CS 120 Data Structures and Program Design  
CS 311 Database II  
CS 331 Computer Networking II  
CS 410 Operating Systems

### Curriculum in Computer Science for the Associate of Arts Degree

Computer Science Course Requirements:

Completion of the requirements for the minor in computer science