

# Department of Mathematics, Engineering and Computer Science

## Majors for the Bachelor of Arts Degree

Civil Engineering (ABET accredited)  
Computer Science  
Mathematics with a Cognate Concentration  
Mathematics: 3-2 Engineering  
Mathematics for Secondary Education

## Minors for the Bachelor of Arts Degree

Computer Science  
Computer Science for Secondary Education  
Mathematics

## Associate of Arts

Computer Science

## Philosophy and Goals of the Department

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. To this end, we offer programs that are designed to blend the unique characteristics of Catholic liberal arts education with preparation for productive and rewarding professional careers. Our goal is to assist students:

- 1) In acquiring the specialized knowledge and skills necessary for initiation into their chosen professions,
- 2) In developing a full range of effective communication skills,
- 3) In learning an appreciation for the interrelationships among the branches of knowledge, and
- 4) In gaining perspectives about the ethical, social, and aesthetic considerations that are necessary for values-based professional judgment and decision-making.

## Major in Civil Engineering

The civil engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board of Engineering & Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012. Telephone: 410-347-7700.

### I. Major Program Requirements

ENGR 104 Engineering Graphics and CAD Applications  
ENGR 201 Engineering Design Process  
ENGR 202 Water Distribution Systems  
ENGR 302 Engineering Mechanics I: Statics  
ENGR 303 Engineering Mechanics II: Solids  
ENGR 305 Electrical Circuits and Electronics  
ENGR 307 Fluid Mechanics  
ENGR 308 Thermodynamics  
ENGR 309 Geotechnical Engineering  
ENGR 310 Structures I  
ENGR 313 Hydrology  
ENGR 401 Hydraulics  
ENGR 402 Environmental Engineering Principles  
ENGR 403 Structures I: Steel Design  
ENGR 405 Water and Wastewater Treatment

ENGR 406 Structures II: Reinforced Concrete Design  
ENGR 407 Transportation Engineering  
ENGR 411-412 Senior Design Project

### II. Other Program Requirements

EC 201 or 202 Principles of Economics (EC 202 preferred)  
EC 203 Project Management Economics (pending approval)  
CH 101-102 General Chemistry I and II  
EN 325 Technical Writing  
MA 131 Accelerated Calculus  
or MA 121-122 Calculus I and II  
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  
PHYS 205-206 Engineering Physics

Students must take the Fundamental of Engineering (FE) exam within nine months prior to receiving the degree.

To earn a Bachelor of Arts degree with a major in civil engineering, a student must earn a grade of “C” or better in all of the courses listed under “Major Program Requirements” and under “Other Program Requirements.” A lesser grade in any of these courses must be replaced before the Bachelor of Arts degree with a major in civil engineering will be granted. In addition, a lesser grade in one of these courses precludes taking subsequent courses for which the deficient course is a prerequisite.

### Statement of Goals for Computer Science

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

CS110 Introduction to Computer Science & C++ Programming  
CS120 Data Structures and Program Design  
CS230 Software Engineering  
CS240 Software Engineering Project  
CS309 Computer Architectures  
CS310 Database Design & Implementation I  
CS430 Senior Project  
CS495 Computer Science Seminar

### II. Other Program Requirements

CO206 Small Group Communications  
EN325 Technical Writing  
MA131 Accelerated Calculus  
or MA 121-122 Calculus I and II  
MA328 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

- CS201 Web Design
- CS202 Web Development
- CS330 Computer Networking I
- CS331 Computer Networking II
- CS410 Operating Systems
- PHYS205 Engineering Physics I: Mechanics
- PHYS206 Engineering Physics II: Electricity & Magnetism

#### B. Computer Programming– Business

- BA203 Principles of Accounting I
  - BA204 Principles of Accounting II
  - EC201 Principles of Economics I
  - EC202 Principles of Economics II
  - EC203 Project Management
- plus 3 additional courses from the following list:
- BA306 Marketing
  - BA313 Managerial Finance
  - BA360 Computerized Accounting & Finance
  - BA375 Fundamentals of Management
  - BA380 E-Commerce
  - BA409 Operations Research

#### C. Computer Programming – Physical Sciences

- MA232 Differential Equations & Linear Algebra I
- MA233 Multivariable Calculus
- MA334 Differential Equations and Linear Algebra II
- CH101 General Chemistry I
- CH102 General Chemistry II
- PHYS205 Engineering Physics I: Mechanics
- PHYS206 Engineering Physics II: Electricity & Magnetism

#### D. Computer Programming – Biological Sciences

- BI161 Introduction to Biology I
  - BI162 Introduction to Biology II
  - CH101 General Chemistry I
  - CH102 General Chemistry II
- plus 3 additional courses from the following list:
- BI211 Ecology
  - BI302 Genetics
  - BI307 Animal Physiology
  - BI321 Cell Biology
  - BI365 Evolutionary Analysis
  - CH301 Organic Chemistry I

#### E. Computer Science – Mathematics

- MA232 Differential Equations & Linear Algebra I
- MA233 Multivariable Calculus
- MA334 Differential Equations & Linear Algebra II
- MA336 Probability and Statistics I
- MA341 Probability and Statistics II
- MA342 Numerical Computing
- MA421 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 in computer science will be granted. In addition, a "D" or "F" grade in one of these courses precludes taking subsequent courses for which the deficient course is a prerequisite.

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

#### I. Major Program Requirements

- MA 131 Accelerated Calculus  
or MA 121-122 Calculus I and II
- 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 in biology plus at least twelve additional credits in science or engineering tailored to meet the student's particular interests and goals and approved by the mathematics department.

##### 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
  - CS 213 Computer Applications in Business
  - EC 201-202 Principles of Economics I and II
- Plus 6 additional BA or EC credits at the 200 level or above approved by the mathematics department.

### C. Concentration in Chemistry

A minor in chemistry plus at least nine additional credits in science or engineering tailored to meet the student's particular interests and goals and approved by the mathematics department.

### 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  
Plus at least 12 additional semester-credit hours in engineering courses 300 or above.

### F. Concentration in Environmental Science

BI 161-162 Introductory Biology  
BI 211 Ecology  
CH 101-102 General Chemistry  
ENGR 402 Environmental Engineering Principles  
ENGR 405 Water & Wastewater Treatment  
EAS 201 Earth Science  
EAS 302 Advanced Earth Science

### III. Other Program Requirements

EN 325 Technical Writing  
or EN 330 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, a lesser grade in one of these courses precludes taking subsequent courses for which the deficient course is a prerequisite.

### Major in Mathematics for Secondary Education

#### I. Broadfield Major Program Requirements

MA 131 Accelerated Calculus  
or MA 121-122 Calculus I and II  
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/Seminar (for a total of at least 3 credits)

#### II. Other Program Requirements

Two semesters of college science approved by the mathematics department.

EN xxx One English writing course above EN 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.

### 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 330 Data Communication (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

EC 201 or 202 Principles of Economics (EC 202 preferred)  
 EC 203 Project Management Economics (Pending approval)  
 CH 101-102 General Inorganic Chemistry I and II  
 EN 325 Technical Writing  
 MA 131 Accelerated Calculus  
 or MA 121-122 Calculus I and II  
 MA 232 Differential Equations and Linear Algebra I  
 MA 233 Multivariable Calculus  
 MA 341 Probability and Statistics II  
 or MA 342 Numerical Computing and Visualization  
 MA 334 Differential Equations and Linear Algebra II  
 MA 336 Probability and Statistics I  
 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. 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, a lesser grade in one of these courses precludes taking subsequent courses for which the deficient course is a 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.

### **Minor in Computer Science**

#### **I. Programming Minor**

- CS110 Introduction to Computer Science and C++ Programming
- CS120 Data Structures and Program Design
- CS230 Software Engineering
- CS240 Software Engineering Project
- CS310 Database Design & Implementation I
- CS495 Computer Science Seminar

#### **II. Web Development Minor**

- CS110 Introduction to Computer Science and C++ Programming
- CS120 Data Structures and Program Design
- CS201 Web Graphics, Animation & Layout
- CS202 Web Coding & Development
- CS310 Database Design and Implementation I
- CS330 Computer Networking I
- CS331 Computer Networking II
- CS495 Computer Science Seminar

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

##### **A. Minor Program Requirements**

- CS110 Introduction to Computer Science and C++ Programming
- CS120 Data Structures and Program Design
- CS213 Computer Applications in Business
- CS309 Computer Architecture
- CS330 Data Communications
- CS495 Computer Science Seminar

##### **B. Other Program Requirements**

- ED418 Teaching Mathematics in the Secondary School
- MA131 Accelerated Calculus  
or MA 121-122 Calculus I and II
- MA207 Elementary Statistics
- MA328 Discrete Mathematics

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

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

### **Minor in Mathematics**

#### **Minor Program Requirements**

#### **Twenty-four semester-credit hours of mathematics courses, including:**

- MA 131 Calculus, Difference and Differential Equations
- 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

Remaining credits in mathematics must be selected from 300-level courses or above and must be approved by the mathematics program director.

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

#### **Computer Science Course Requirements:**

Completion of the requirements for the minor in computer science