Mathematics and Computer Science

Computer and Information Science (BS)
Mathematics (BS)

The department of mathematics and computer science offers the bachelor of science degree with majors in mathematics and in computer and information science. Under each of these majors students have a choice of two concentrations. Those pursuing a major in computer and information science may choose to orient their programs toward either computer science or information systems. Those seeking a major in mathematics may pursue either secondary teaching certification or applied mathematics, which can be readily combined with a dual degree in engineering from Washington University in St. Louis.

Students may also choose minors in mathematics, computer science, and information systems. The department of mathematics and computer science, together with the department of fine arts, also offers a certificate in website development.

A graduate program in the department leads to a master of science degree in computer education (see the graduate programs section in this catalog.)

The rigorous curriculum in each program emphasizes thinking analytically, solving problems, and communicating effectively. Specifically, through its programs, the department seeks

- to acquaint students with current developments in computer science, information systems, applied mathematics, mathematics education, and computer education.
- to equip graduates with essential knowledge and skills to secure professional positions in their fields.
- to prepare students for successful transitions from the classroom to the workplace.

To achieve these objectives, the department encourages students to interact with faculty by providing individual advising and creating an environment that is conducive to continued professional growth. With the assistance of the department, students may pursue their professional goals through a cooperative education work experience (CO-OP), or other internship.

A student pursuing a major in the department must earn a grade of B- or better in CIS 160 to progress to CIS 161, and in CIS 161 to progress to CIS 210 and above. Students who do not earn a grade of at least C- in CIS 160 or in CIS 161 must repeat the entire course. Students who earn grades higher than D but below a B-, must repeat the "lab" portion of the appropriate course and achieve the required level of competency. In either case, only one repetition is allowed.

If a student intending to major in mathematics, or in computer and information science, is not ready for placement into MTH 150 upon matriculation, the student must meet the following minimum grade requirements in the prerequisite courses:

1. If placed into MTH 091, the student must earn a grade of at least A- to progress to MTH 095.
2. If placed into MTH 095, the student must earn a grade of at least A- to progress to MTH 105 and/or CIS 160.
3. If placed into MTH 105, the student must earn a grade of at least B- to progress to MTH 150.

FACULTY

M. Elizabeth Newton, professor of mathematics and computer science and chairperson of the department of mathematics and computer science

Mary Abkemeier, professor of mathematics and computer science and director of master of science in computer education program

Nancy English, assistant professor of mathematics and computer science

Robyn Goins, instructor of mathematics and mathematics education

Kathyrn Graves, affiliate instructor of mathematics and computer science

Anne S. Grice, instructor of mathematics

Theresa L. Jeevanjee, associate professor of mathematics and computer science

Jim Ma, assistant professor of computer science

UNDERGRADUATE PROGRAMS

Beginning students are required to earn a minimum cumulative grade point average of 2.5 in the courses specified below to continue in their major program at the time of application for major approval:

Mathematics Major:

MTH 115, MTH 120, MTH 150, MTH 151

Computer and Information Science Major:

MTH 120, MTH 150, CIS 160, CIS 161

For transfer students 12 hours of appropriate coursework will be stipulated by the faculty of the department. The department reserves the right to administer a test in the appropriate discipline for acceptance into its major programs when deemed necessary.

CONCENTRATIONS

A student must successfully complete, at Fontbonne, a minimum of 50 percent of the credit hours required for the concentration.

MAJOR IN MATHEMATICS

Secondary Mathematics Education Concentration

This program offers a curriculum designed specifically to meet the needs of the future secondary mathematics teacher. The curriculum for this major combines theory and applications of mathematics, principles and methods of secondary education, experience with mathematical software and computer programming, and field experience.

Baccalaureate Degree Requirements

The requirements for all undergraduate degrees are listed in the academic policies and regulations section in this catalog. These requirements include a course requirement in religion or theology.

Policies and Procedures for Students in Teacher Certification Programs

Students are responsible for obtaining a copy of policies and procedures for students in teacher certification programs when they begin their program at Fontbonne. These copies are available from the certification coordinator in the East Building, room 235. Students are responsible for carrying out all current policies, procedures, and requirements for graduation and for teacher certification.

The student must maintain a minimum cumulative grade point average of 2.75 on a 4.0 scale for coursework designated as "professional," and a cumulative grade point average of 2.5 on a 4.0 scale. These standards take into consideration all coursework taken at all colleges and universities. All candidates must pass all segments of the College Basic Skills Examination (C-BASE). Students earning certification in middle school and secondary programs must achieve a GPA of 2.5 in the relevant content areas.

Students who have "conditions" placed upon them by the teacher certification committee will not be approved for teacher certification. Conditions may be defined as deficiencies related to the potential success of the candidate to be an effective teacher. (Students should refer to the procedures manual for specific guidelines in this area.)

Students who transfer to Fontbonne University from another institution who have been granted transfer credit for courses equivalent to EDU 234 Philosophical Foundations and/or EDU 200/201 Introduction to Classroom Teaching are required to enroll for EDU 301 Teacher Education at Fontbonne University. While this course carries zero credit, it is a requirement for major approval. Students so designated will enroll for course during their first semester on campus. The course will be taught predominately online, but a limited number of

face-to-face meetings will be required. Students will receive a grade of P/NP. This course is required for all transfer students majoring in education or whose content major includes teacher certification and will be taught in the fall, spring, and summer.

All candidates for teacher certification must fulfill all Missouri Department of Elementary and Secondary Education requirements, including passing scores on entrance and exit tests, grade point average, culminating project, and criminal background checks. These requirements are subject to change. The most current requirements must be met.

Most school districts require that any individual who teaches, supervises, or has access to students in a school undergo an FBI fingerprint check, a criminal record check, and child abuse/neglect screening. The Missouri Highway Patrol and the Department of Social Services conduct these screenings. Every Fontbonne student engaged in clinical experiences in the pre-service teacher certification programs must complete background checks as required prior to placement in any school. Costs for these background checks will be borne by the student.

Acceptance into the Teacher Certification Program

Qualified students may apply for acceptance to the teacher certification program. Application should be made at the close of the second semester of the junior year for native students and no later than the third semester of attendance at Fontbonne University for transfer students. Acceptance into the teacher certification program is based upon major approval; final validation of professional (2.75) and cumulative (2.5) GPA; final validation of a 2.5 GPA in relevant content areas for middle/secondary candidates; successful completion of the C-BASE; and approval by the teacher certification committee. Without approval by the teacher certification committee, students cannot enroll for student teaching.

General Education Requirements

The 42 credit hours of general education requirements are presented in the academic information section in this catalog. A course that meets a general education requirement may also meet a course requirement in the major or a course requirement in another discipline.

The following specific general education courses must be chosen to meet the requirements for this major:

PSY200 Developmental Psychology (3 hours)

BIO112 General Biology I/Lab (4 hours)

CHM106 General Chemistry I/Lab (4 hours)

AND

CHM108 General Chemistry II/Lab (4 hours)

OR

PHY208 College Physics I/Lab (4 hours)

AND

PHY210 College Physics II/Lab (4 hours)

HST105 Introduction to American History I (3 hours)

OR

HST106 Introduction to American History II (3 hours)

Courses Required for the Major

MTH 115 Introduction to Statistics (3 hours)

MTH 120 Discrete Mathematics I (3 hours)

MTH 150 Calculus with Analytic Geometry I (4 hours)

MTH 151 Calculus with Analytic Geometry II (4 hours)

MTH 200 Linear Algebra (3 hours)

MTH 250 Calculus with Analytic Geometry III (4 hours)

MTH 300 Modeling and Numerical Approximation (3 hours)

MTH 305 Readings in the History of Mathematics (2 hours)

MTH 315 Advanced Statistics (3 hours)

MTH 320 Elements of Geometry (3 hours)

MTH 330 Discrete Mathematical Structures (3 hours)

MTH 360 Teaching Mathematics in Middle/ Secondary Schools (3 hours)

MTH 495 Senior Project (3 hours)

Courses Required in Other Disciplines

BUS 202 Principles of Macro Economics (3 hours)

OR

BUS 203 Principles of Micro Economics (3 hours)

CIS 160 Computer Science I (4 hours)

CIS 161 Computer Science II (4 hours)

Either of the following science sequences:

PHY 208 College Physics I/Lab (calculus-based) (4 hours)

AND

PHY 210 College Physics II/Lab (calculus-based) (4 hours)

OR

CHM 106 General Chemistry I/Lab (4 hours)

AND

CHM 108 General Chemistry II/Lab (4 hours)

Professional Courses Required For Certification

EDU 120 Psychology of the Exceptional Child (3 hours)

EDU 201 Introduction to Classroom Teaching (2 hours)

EDU 222 Educational Psychology (3 hours)

EDU 234 Philosophical Foundations of Education (3 hours)

EDU 300 Classroom/Behavior Management (3 hours)

EDU 350 Methods of Teaching Reading in the Content Area (2 hours)

EDU 447 Planning for Instruction and Assessment—Middle and Secondary (3 hours)

EDU 451 Student Teaching at the Secondary Level (10-16 hours)

PSY 200 Developmental Psychology (3 hours)

Concentration in Mathematics for Middle School

This concentration offers majors in middle school education exposure to areas of higher mathematics, which will enhance their understanding of the middle school mathematics curriculum.

Courses Required in the Concentration

MTH 105 College Algebra (4 hours)

MTH 108 Trigonometry (2 hours) (if needed)

MTH 115 Introduction to Statistics (3 hours)

MTH 120 Discrete Mathematics I (3 hours)

MTH 150 Calculus with Analytic Geometry I (4 hours)

MTH 320 Elements of Geometry (3 hours)

MTH 330 Discrete Mathematical Structures (3 hours)

MTH 360 Teaching Mathematics in Middle/Secondary Schools (3 hours)

MTH 495 Senior Project (3 hours)

MAJOR IN MATHEMATICS

Applied Mathematics Concentration

This major exposes students to various areas of applied mathematics, including mathematical modeling and statistics. Computer programming and software applications are also included in this major. Internships are available as MTH 184, 284, 384, and 484, but are not required.

Baccalaureate Degree Requirements

The requirements for all undergraduate degrees are listed in the academic policies and regulations section in this catalog. These requirements include a course requirement in religion or theology.

General Education Requirements

The 42 credit hours of general education requirements are presented in the academic information section in this catalog. A course that meets a general education requirement may also meet a course requirement in the major or a course requirement in another discipline.

Courses Required for the Major

MTH 115 Introduction to Statistics (3 hours)

MTH 120 Discrete Mathematics I (3 hours)

MTH 150 Calculus with Analytic Geometry I (4 hours)

MTH 151 Calculus with Analytic Geometry II (4 hours)

MTH 200 Linear Algebra (3 hours)

MTH 250 Calculus with Analytic Geometry III (4 hours)

MTH 300 Modeling and Numerical Approximation (3 hours)

MTH 310 Differential Equations (3 hours)

MTH 315 Advanced Statistics (3 hours)

MTH 316 Non-Parametric Statistics (3 hours)

MTH 330 Discrete Mathematical Structures (3 hours)

MTH 495 Senior Project (3 hours)

Courses Required in Other Disciplines

Business, biology, general science, or a minor in chemistry may be selected as an application area.

Business Application Area

BUS 203 Principles of Micro Economics (3 hours)

BUS 205 Financial Accounting (3 hours)

BUS 311 Intermediate Accounting (3 hours)

BUS 314 Cost Accounting (3 hours)

BUS 343 Managerial Finance (3 hours)

CIS 111 Computer Applications: Database (3 hours)

CIS 160 Computer Science I (4 hours)

One of the following:

CIS 320 Systems Analysis and Design (3 hours)

CIS 330 Database Management Systems (3 hours)

Biology Application Area

BIO 112 General Biology I/Lab (4 hours)

BIO 114 General Biology II/Lab (4 hours)

BIO 312 General Genetics (3 hours)

Note: has biology and chemistry prerequisites.

BIO 318 Cell and Molecular Biology (3 hours)

Note: has biology and chemistry prerequisites.

CIS 160 Computer Science I (4 hours)

CIS 161 Computer Science II (4 hours)

CIS 210 Object-Oriented Programming (4 hours)

General Science Application Area

CHM 106 General Chemistry I/Lab (4 hours)

CHM/108 General Chemistry II/Lab (4 hours)

PHY 208 College Physics I/Lab (calculus-based) (4 hours)

PHY 210 College Physics II/Lab (calculus-based) (4 hours)

CIS 160 Computer Science I (4 hours)

CIS 161 Computer Science II (4 hours)

CIS 210 Object-Oriented Programming (4 hours)

Chemistry Minor Application Area

The chemistry minor is defined in the department of biological and physical sciences section in this catalog. Students who elect this substitution will be required to take CIS 160, CIS 161, and CIS 210 for their three computer science courses.

MAJOR IN COMPUTER AND INFORMATION SCIENCE

Computer Science Concentration

This major includes both theory and application and prepares students for challenging careers in software development.

Baccalaureate Degree Requirements

The requirements for all undergraduate degrees are listed in the academic policies and regulations section in this catalog. These requirements include a course requirement in religion or theology.

General Education Requirements

The 42 credit hours of general education requirements are presented in the academic information section in this catalog. A course that meets a general education requirement may also meet a course requirement in the major or a course requirement in another discipline.

Courses Required for the Major

CIS 120 An Overview of Computer and Information Science (3 hours)

CIS 160 Computer Science I (4 hours)

CIS 161 Computer Science II (4 hours)

CIS 210 Object-Oriented Programming (4 hours)

CIS 250 Algorithms and Data Structures (4 hours)

CIS 310 Computer Architecture and Assembly Language (3 hours)

CIS 340 Concepts of Telecommunications and Networking (3 hours)

CIS 350 Compiling Theory and Programming Languages (3 hours)

CIS 355 Principles of Operating Systems (3 hours)

CIS 495 Senior Project (3 hours)

Three electives chosen from the following:

CIS 170 Visual Programming (3 hours)

CIS 300 Modeling and Numerical Approximation (3 hours)

CIS 316 Business Application Development (3 hours)

CIS 320 Systems Analysis and Design (3 hours)

CIS 330 Database Management Systems (3 hours)

CIS 360 Artificial Intelligence (3 hours)

CIS 375 Software Engineering (3 hours)

CIS 394 Topics in Computer Science (1-4 hours)

CIS 494 Advanced Topics in Computer Science (1-4 hours)

Courses Required in Other Disciplines

MTH 120 Discrete Mathematics I (3 hours)

MTH 150 Calculus with Analytic Geometry I (4 hours)

MTH 151 Calculus with Analytic Geometry II (4 hours)

MTH 200 Linear Algebra (3 hours)

MTH 330 Discrete Mathematical Structures (3 hours)

MAJOR IN COMPUTER AND INFORMATION SCIENCE

Information Systems Concentration

This program emphasizes the relationship between computer science and business and prepares students for professional careers in systems analysis and design.

Baccalaureate Degree Requirements

The requirements for all undergraduate degrees are listed in the academic policies and regulations section in this catalog. These requirements include a course requirement in religion or theology.

General Education Requirements

The 42 credit hours of general education requirements are presented in the academic information section in this catalog. A course that meets a general education requirement may also meet a course requirement in the major or a course requirement in another discipline.

Courses Required for the Major

CIS 120 An Overview of Computer and Information Science (3 hours)

CIS 160 Computer Science I (4 hours)

CIS 161 Computer Science II (4 hours)

CIS 210 Object-Oriented Programming (4 hours)

CIS 250 Algorithms and Data Structures (4 hours)

CIS 316 Business Application Development (3 hours)

CIS 320 Systems Analysis and Design (3 hours)

CIS 330 Database Management Systems (3 hours)

CIS 340 Concepts of Telecommunications and Networking (3 hours)

CIS 355 Principles of Operating Systems (3 hours)

CIS 495 Senior Project (3 hours)

Plus three electives chosen from the following:

CIS 170 Visual Programming (3 hours)

CIS 300 Modeling and Numerical Approximation (3 hours)

CIS 310 Computer Architecture and Assembly Language (3 hours)

CIS 350 Compiling Theory and Programming Languages (3 hours)

CIS 360 Artificial Intelligence (3 hours)

CIS 375 Software Engineering (3 hours)

CIS 394 Topics in Computer Science (1-4 hours)

CIS 494 Advanced Topics in Computer Science (1-4 hours)

Courses Required in Other Disciplines

BUS 202 Principles of Macro Economics (3 hours)

BUS 203 Principles of Micro Economics (3 hours)

BUS 205 Financial Accounting (3 hours)

BUS 230 Management Principles (3 hours)

BUS 233 Marketing Principles (3 hours)

BUS 343 Managerial Finance (3 hours)

MTH 115 Introduction to Statistics (3 hours)

MTH 120 Discrete Mathematics I (3 hours)

MTH 150 Calculus with Analytic Geometry I (4 hours)

MINORS

A student must successfully complete, at Fontbonne, a minimum of 50 percent of the credit hours required for the minor.

Minor in Mathematics

This minor provides students in other majors with a solid practical background in major branches of modern mathematics.

Courses Required in the Minor

MTH 115 Introduction to Statistics (3 hours)

MTH 120 Discrete Mathematics I (3 hours)

MTH 150 Calculus with Analytic Geometry I (4 hours)

MTH 151 Calculus with Analytic Geometry II (4 hours)

Plus two of the following:

MTH 300 Modeling and Numerical Approximation (3 hours)

MTH 315 Advanced Statistics (3 hours)

MTH 316 Non-Parametric Statistics (3 hours)

MTH 320 Elements of Geometry (3 hours)

MTH 330 Discrete Mathematical Structures (3 hours)

Minor in Computer Science

This minor provides a solid background in computer science.

Courses Required for the Minor

CIS 160 Computer Science I (4 hours)

CIS 161 Computer Science II (4 hours)

CIS 210 Object-Oriented Programming (4 hours)

CIS 250 Algorithms and Data Structures (4 hours)

Plus two of the following:

CIS 310 Computer Architecture and Assembly Language (3 hours)

CIS 340 Concepts of Telecommunications and Networking (3 hours)

CIS 355 Principles of Operating Systems (3 hours)

Minor in Information Systems

This minor offers exposure to the fundamentals of information systems.

Courses Required for the Minor

CIS 160 Computer Science I (4 hours)

CIS 161 Computer Science II (4 hours)

CIS 210 Object-Oriented Programming (4 hours)

CIS 250 Algorithms and Data Structure (4 hours)

Plus two of the following:

CIS 316 Business Application Development (3 hours)

CIS 320 Systems Analysis and Design (3 hours)

CIS 330 Database Management Systems (3 hours)

CIS 340 Concepts of Telecommunications and Networking (3 hours)

CIS 355 Principles of Operating Systems (3 hours)

CERTIFICATES

Certificate in Web Development

This certificate provides a solid foundation in all aspects of website development: graphics design, programming, and installation. (See undergraduate certificate programs in the academic policy and regulations section in this catalog.)

Courses required for the certificate

ART 115 Graphics Design I (3 hours)

ART 302 Designing for the Web (3 hours)

ART 402 Designing for the Web (Advanced) (3 hours)

CIS 150 Fundamentals of Programming for Business (3 hours)

CIS 115 Introduction to Server Technology (1 hour)

CIS 215 Database Fundamentals and SSP (Server-Side Programming) (2 hours)

CIS 315 Advanced SSP (Server-Side Programming) (3 hours)

ADVANCED PLACEMENT

An entering student who scores four or five on the Advanced Placement (AP) Test will receive equivalent placement and university credit. For students who score a four or five on the Calculus AB Examination, four credit hours are awarded for MTH150. For students who score a four or five on the Calculus BC Examination, eight credit hours are awarded for MTH150 and MTH151. For students who score a four or five on the Computer Science A Examination, eight credit hours are awarded for CIS160 & CIS 161. For students who score a four or five on Computer Science AB Examination, eight credit hours are awarded for CIS160 and CIS161. For students who score a four or five on Statistics Examination, three credit hours are awarded for MTH115.

DUAL DEGREE PROGRAM IN ENGINEERING WITH WASHINGTON UNIVERSITY in St. Louis

Students may choose a dual degree program of study in connection with the School of Engineering and Applied Science at Washington University. This program may be combined with any major, and can be conveniently combined with a major in applied mathematics. Students who have completed the first three years of required work for a major at Fontbonne and who have a cumulative grade point average of 3.0, both overall and in specified mathematics and science courses, may apply for admission to the dual degree program. Upon satisfactory completion of the program, the student will be awarded bachelor's degrees from both Fontbonne University and Washington University in St. Louis.

COURSES

COMPUTER AND INFORMATION SCIENCE

CIS 100 Computer Technology: Issues and Applications (3 hours)
Introductory course to computer technology and applications designed for non-computer science majors. Covers general computer knowledge associated with computer history, hardware, software, operating systems, and computer networks, Windows based applications such as word processors, presentation tools, spreadsheets, database systems, introduction to web page creation, and Internet browsers. Social and ethical issues related to technology are considered, such as software privacy, viruses, and security issues. Course will include development of an application project by the student. FA, SP

CIS 103 Microcomputer Applications in Education (3 hours)
Development of proficiency in the use of an integrated software package. All of the applications will be education-oriented, such as creating subject area databases and developing electronic grade sheets. Evaluation and use of educational software will also be included. FA, SP

CIS 110 Microcomputer Applications: Spreadsheet (3 hours)
Covers capabilities of Windows-based spreadsheet software. Presents spreadsheet terminology, basic commands, and features for data formatting, calculation, and creating tables and charts. Additional topics include building applications for data referencing, analysis and reports, advanced functions, and macros. Course will include development of a significant spreadsheet project by the student. FA, SP

CIS 111 Microcomputer Applications: Database (3 hours)
Covers the skills to design and implement a database as well as data entry, editing, and manipulation using Windows-based DBMS software. Includes applications of managing tables and files, using and creating queries, and designing forms and reports. Course will include development of a significant database project by the student. FA, SP

CIS 115 Introduction to Server Technology (1 hour)
An introduction to server technology. Topics include system architecture, file servers, FTP servers, web servers, database servers with an emphasis on server installation and configuration.

CIS 120 An Overview of Computer and Information Science (3 hours)
An introduction to computer and information science. Covers issues associated with both hardware and software, such as computer history, computer terminology, algorithm development and analysis with an emphasis on flowcharting, pseuodocode and design, basic number systems, data storage, data manipulation, operating systems, networks and computer engineering. Additional topics include programming languages, software engineering, data structures, file structures, database systems, the Internet and artificial intelligence. FA

CIS 150 Fundamentals of Programming for Business (3 hours)
This course introduces programming for solving business-related application problems. Topics include program design, the integrated development environment, graphical user interface, data types, control structures, and sub/function procedures. Additional topics include database programming and exception handling.

CIS 160 Computer Science I (4 hours)
Emphasis on programming in C and introduction to C++, including structural programming concepts, simple data types and structures, C and C++ syntax, operators, control structures and pointers. Lab exercises include techniques of coding, program design, and debugging. Students in this course who are majoring in mathematics or in computer and information science must earn grades of B- or better in this course to progress to CIS 161 and/or CIS 210. Prerequisite: Grades of A- or better in MTH 091 and MTH 095, or competency in arithmetic and algebra. FA

CIS 161 Computer Science II (4 hours)
Continuation of Computer Science I, with extensive programming in C++ language and introduction to Java. Includes string handling, file I/O, storage and static variables, structures, bitwise operations, and C++ library. Students in this course who are majoring in mathematics or in computer and information science must earn grades of B- or better to progress to CIS 210 and above. Prerequisite: CIS 160. SP

CIS 170 Visual Programming (3 hours)
Introduction to visual programming using Windows-

based packages. Exploring tools and utilities of Windows graphic user interface and multimedia capacity, such as menus, buttons, and other controls. Topics also include using object-linking and embedding, dynamically-linked libraries, dynamic data exchange, and Internet-related applications. Lab exercises include language syntax and coding, data structures, links and controls, parameter passing. Prerequisite: CIS 160 or consent of instructor. Offered as needed.

CIS 210 Object-Oriented Programming (Java) (4 hours)
Introduction to concepts of abstract data type and inheritance. Topics include the fundamentals of object-oriented program design, object-oriented programming using Java. Lab exercises include introductory to intermediate level software analysis and design. Prerequisite: CIS 161. FA

CIS 215 Database Fundamentals and SSP (Server-side Programming) (2 hours)
An introduction to database fundamentals and server-side programming. Topics include table design and management, creating and using queries, file management, and writing programs on the server to support a web site.

CIS 250 Algorithms and Data Structures (4 hours)
Introduction to the principles of algorithm analysis, abstract data types covering stacks, queues, lists, trees and recursion, algorithms of sorting and searching. Additional topics include graph algorithms, text compression, dynamic programming, and randomized algorithms. Prerequisite: CIS 210 or MTH 120. SP

CIS 293 Topics in the Business Computing Environment (3 hours)
Course addresses topics of current interest in the business computing environment. Offered as needed.

CIS 294-299 Cooperative Education (1-6 hours)
Supervised off-campus work experience. Cooperatively administered by employer and director of cooperative education. Credits are determined by the number of working hours in an approved job. Full-time (six hours) co-op positions should be taken in alternating semesters, excluding summer semester. These courses are graded solely on a pass/no pass basis. No more than eighteen hours may be taken. Prerequisite: At least sophomore status.

CIS 300 Modeling and Numerical Approximation (3 hours)
Principles of model construction with selected case studies from various fields. Also, techniques of numerical approximation. Prerequisites: CIS 160; MTH 150. Offered alternate years. SP

CIS 310 Computer Architecture and Assembly Language (3 hours)
Topics covering theoretical aspects and concepts of hardware and computer systems including logic gates, combinational and sequential circuits, memory and registers, control logic design, instructions and addressing. Teaches programming in one assembly language. Prerequisites: CIS 160; MTH 120. Offered alternate years. SP

CIS 315 Advanced Server-side Programming (3 hours)
This course teaches the advanced techniques of server-side programming over the Internet. Topics include using session control, accessing back-end database servers, E-commerce security issues, interacting with file systems, implementing secure transactions, and using network and protocol functions.

CIS 316 Business Application Development (3 hours)
Course covers the essentials of the COBOL programming language in the context of business application development. Topics include the fundamental design principles of business applications, application development processes, and program implementations using COBOL. Prerequisite: CIS 150 or CIS 160 or consent of the instructor.

CIS 320 Systems Analysis and Design (3 hours)
Includes the technological and managerial aspects of the analysis, design, and implementation of systems. Prerequisites: CIS 160 or consent of instructor. Offered alternate years. SP

CIS 330 Database Management Systems (3 hours)
Fundamental design principles of database systems. Implementational design using data models, relational algebra, and relational calculus. Relational implementation with SQL. Microcomputer DBMS, and distributed database systems. Prerequisite: CIS 111 or consent of instructor. Offered alternate years. FA

CIS 340 Concepts of Telecommunications and Networking (3 hours)
Introduction to the principles and practice of data communication and computer networking. Topics include the theoretical aspects of various methods, media, protocols, data compression, and security in telecommunication. Also includes lab exercises of network and remote access configuration and data exchange. Prerequisites: CIS 160; MTH 120; either MTH 150 or consent of the instructor. Offered alternate years. FA

CIS 350 Compiling Theory and Programming Languages (3 hours)
Comparative study of programming languages and concepts such as grammars and parse trees, interpretation and compilation, and generation of optimal code. A number of programming languages will be studied relative to their history, design implementation, and evaluation. Prerequisites: CIS 160; MTH 120. Offered alternate years. SP

CIS 355 Principles of Operating Systems (3 hours)
Topics cover the theoretical aspects and concepts of operating systems including system structures, scheduling, concurrent processes and deadlock handling, storage and file management, system protection and security. Also includes lab exercises in UNIX system configuration. Prerequisites: CIS 160; MTH 120. Offered alternate years. SP

CIS 360 Artificial Intelligence (3 hours)
A survey of concepts, techniques, and applications of AI, including knowledge abstraction and representation, knowledge-based systems, heuristic searching, natural language understanding, machine learning, and automated reasoning. Use of LISP or PROLOG, or other appropriate language, to develop a substantial project in expert systems is required. Offered as needed. Prerequisite: CIS 250 or consent of the instructor.

CIS 375 Software Engineering (3 hours)
Course introduces classical and object-oriented software engineering principles. Topics include the scope of software engineering, the software process, software life cycle models, documentation, tools, testing, quality assurance, project management, object-oriented analysis and design, system views, patterns, and modeling using UML, in the context of generic object-oriented development process. Students are required to design and build software projects through team effort. The projects cover the principal system development life-cycle phases. Offered as needed.

CIS 394 Topics in Computer Science (1-4 hours)
Course generated by the department to supplement regular course listings. Addresses topics in computer science. Prerequisite: Junior or senior status, or consent of instructor. Offered on a one-time or irregular basis.

CIS 490 Independent Study (1-4 hours)
Study in a specialized area, to be arranged according to student need and interest. Prerequisite: Junior or senior status.

CIS 494 Advanced Topics in Computer Science (1-4 hours)
Topics similar to those offered in CIS 394, offered on an as-needed basis, at a more advanced level.

CIS 495 Senior Project (3 hours)
Prerequisite: Senior status. FA, SP

MATHEMATICS

MTH 091 College Mathematics Skills (3 hours)
Emphasizes computing with whole numbers and fractions, both common and decimal; percentages; application of the ability to compute word problems. In general, students must earn a grade of C- or better in this course to satisfy the prerequisite for further mathematics courses. However, students in this course who intend to major in mathematics or computer and information science must earn grades of A- or better in this course to progress to MTH 095. Offered as needed.

MTH 095 Fundamentals of Algebra (4 hours)
Study of basic algebra required for all mathematics courses at Fontbonne. Topics include: real numbers, exponents, radicals, rational expressions, linear equations and inequalities, polynomials, quadratic equations, systems of linear equations, functions, and graphing. In general, students must earn a grade of C- or better in this course to satisfy the prerequisite for further mathematics courses. However, students in this course who intend to major in mathematics or computer and information science must earn grades of A- or better in this course to progress to MTH 105 and/or CIS 160. Prerequisite: A grade of C- or better in MTH 091 or competency in arithmetic. FA, SP

MTH 100 Topics in Algebra for Statistics (2 hours)
This course covers the essential topics in algebra that are needed specifically to do common statistical calculations. Topics include: sets, signed numbers, exponents and radicals, algebraic and rational expressions, factoring, linear equations, an introduction to two-dimensional graphing, and an introduction to quadratic equations. Application problems are included. (Topics may be added at the instructor's discretion, as time allows, but not deleted from the preceding list.) Offered in the OPTIONS Gateway program only.

MTH 102 Contemporary Topics in Mathematics for Educators (3 hours)
Problem solving, elementary set theory and logic, development of the real number system. Topics in geometry and statistics. Education certification majors only. Prerequisites: Grades of C- or better in MTH 091 and MTH 095 or competency in arithmetic and algebra. FA, SP

MTH 103 Excursions into Modern Mathematics (3 hours)
This course presents mathematics in such a way that the student can see immediate connections between what is learned in the mathematics classroom and real-life problems. It is geared toward liberal arts majors. The choice of topics is such that a heavy mathematical infrastructure is not needed. A fundamental objective of the course is to develop an appreciation for the aesthetic elements of mathematics. Prerequisites: Grades of C- or better in MTH 091 and MTH 095 or competency in arithmetic and algebra. FA, SP

MTH 105 College Algebra (4 hours)
Topics covered: sets, number systems, polynomials, equations and graphing, inequalities, relations and functions, systems of equations, exponential and logarithmic equations, rational zeros of polynomials, matrices and determinants, sequences and series. Students in this course who are majoring in mathematics or computer and information science must earn grades of B- or better in this course to progress to MTH 150. Prerequisites: Grade of C- or better in MTH 091 and MTH 095, or competency in arithmetic and algebra. FA, SP

MTH 108 Trigonometry (2 hours)
Covers the standard introductory trigonometry topics — the six standard trigonometric functions, right triangle trigonometry, radian measure, graphs of function and their inverses, identities and formulas, equations, triangles, and complex numbers and polar coordinates. MTH 108 is a pre- or co-requisite for MTH 150, Calculus I.

MTH 115 Introduction to Statistics (3 hours)
Topics covered: descriptive statistics, probability, binomial, chi-squared and normal probability distributions, tests of hypotheses, linear correlation and regression, and analysis of variance. Prerequisites: Grades of C- or better in MTH 091 and MTH 095 or competency in arithmetic and algebra. FA, SP

MTH 120 Discrete Mathematics I (3 hours)
Topics include: sets, relations, functions, matrices, graphs, binary, octal, and hexadecimal number systems, combinatorics, induction and recursion, algorithms. Prerequisite: Competency in arithmetic and algebra. FA

MTH 150 Calculus with Analytic Geometry I (4 hours)
Differential and integral calculus of the algebraic and transcendental functions associated with analytic geometry. Prerequisite: Three years of high school mathematics including trigonometry, or MTH 105, MTH 108, or the consent of the instructor. SP

MTH 151 Calculus with Analytic Geometry II (4 hours)
A continuation of MTH 150, continuation of differential and integral calculus; infinite series. Prerequisite: MTH 150. FA

MTH 184, MTH 284, MTH 384, and MTH 484 Internships in Applied Mathematics (1-3 hours each)
Supervised work experience in applied mathematics. Credits are determined by the number of hours working in an approved job; course number is determined by the level of mathematical complexity likely to be involved. The internship is cooperatively administered by an employer-supervisor and a member of the faculty. Each internship also requires a comprehensive paper at the culmination of the work experience. Grading is pass/no pass only. Prerequisite: Student must be pursuing a major in mathematics, and have completed the following courses:

For MTH 184: MTH 150 required and MTH 115 recommended

For MTH 284: MTH 151 and MTH 115

For MTH 384: At least one of: MTH 200 Linear Algebra; MTH 250 Calculus with Analytic Geometry III; MTH 310 Differential Equations

For MTH 484: At least two 300-level courses

MTH 200 Linear Algebra (3 hours)
Topics include: vector spaces, linear transformations, and matrices. Prerequisite: MTH 151. Offered alternate years. FA

MTH 250 Calculus with Analytic Geometry III (4 hours)
Vector calculus, the differential, multivariate calculus with applications. Prerequisite: MTH 151. SP

MTH 294 Topics in Mathematics (1-4 hours)
Course generated by the department to supplement regular course listings. Addresses topics in mathematics. Offered on a one-time or irregular basis.

MTH 300 Modeling and Numerical Approximation (3 hours)
Principles of model construction with selected case studies from various fields. Also, techniques of numerical approximation. Prerequisites: MTH 150; CIS 160. Offered alternate years. SP

MTH 305 Readings in the History of Mathematics (2 hours)
Readings in the history of mathematics and in the mathematics contributions of both Western and non-Western cultures. The interplay between mathematics and culture is emphasized. Prerequisites: MTH 150; MTH 120. SP

MTH 310 Differential Equations (3 hours)
Techniques for solving ordinary differential equations. Investigation of existence and uniqueness of solutions; a variety of applications. Prerequisite: MTH 151. Offered alternate years. SP

MTH 315 Advanced Statistics (3 hours)
Uses statistical software to analyze data sets. Topics include widely used statistical tools such as linear and nonlinear regression, analysis of variance, expected mean squares, pooling. Prerequisites: MTH 115; MTH 150 or consent of instructor. Offered alternate years. FA

MTH 316 Non-Parametric Statistics (3 hours)
An introduction to nonparametric statistical procedures. Topics include order statistics, rank order statistics and scores, tests of goodness of fit, linear rank tests for location and scale problems, applications. Prerequisite: MTH 115. Offered alternate years. SP

MTH 320 Elements of Geometry (3 hours)
Transformational approach to isometries and similarities; studies of Euclidean and non-Euclidean geometries. Prerequisite: MTH 150 or consent of instructor. Offered alternate years. FA

MTH 330 Discrete Mathematical Structures (3 hours)
Covers discrete algebraic structures including Boolean algebra, groups, rings, integral domains and fields and their applications. Prerequisites: MTH 120; MTH 150. Offered alternate years. SP

MTH 350 Methods of Teaching Mathematics in the Early Childhood and Elementary School (3 hours)
Methods for teaching the real number system, diagnostic mathematics and remedial methods, probability, statistics, geometry, metric system, algebra, applications of computer to mathematics education. Education certification majors only. Prerequisite: MTH 102. FA, SP

MTH 360 Teaching Mathematics in Middle/ Secondary Schools (3 hours)
Study of models of teaching mathematics, diagnostic mathematics, and remedial methods at the middle school or secondary level. Education certification majors only. Prerequisite: Junior or senior status. FA

MTH 490 Independent Study (1-4 hours)
Study in a specialized area, to be arranged according to student need and interest. Prerequisite: Junior or senior status.

MTH 494 Advanced Topics in Mathematics (1-4 hours)
Course generated by the department to supplement regular course listings. Addresses topics in mathematics. Prerequisite: Junior or senior status, or consent of instructor. Offered on a one-time or irregular basis.

MTH 495 Senior Project (3 hours)
Prerequisite: Senior status. FA, SP