**COMPUTER SCIENCE (COMPSCI)***

**Courses**

**COMPSCI 162  COMPUTER APPLICATIONS  3 Units**
A thorough introduction to commonly used computer applications, covering word processing, spreadsheets, data storage and retrieval, and presentation software. Students will learn the vocabulary of computing, the concepts of computing and problem solving, and how computer applications can be applied to a wide range of problems.

**COMPSCI 170  INTRODUCTION TO PYTHON PROGRAMMING  3 Units**
An introduction to computational thinking and computer programming using the Python language, with applications in science, business, education, and other areas. Students will develop structured programs based on simple algorithms that involve input, output, mathematical operations, decisions, and loops. No previous programming experience is needed.

**COMPSCI 171  INTRODUCTION TO VISUAL BASIC PROGRAMMING  3 Units**
An introduction to computer programming and its applications to science, business, and education. Opportunity for extensive experience in designing and writing structured programs in the Visual Basic language.

**COMPSCI 172  INTRODUCTION TO JAVA (GM)  3 Units**
This course teaches basic programming skills using the structured high-level language C++. Topics include basic input and output, declaration and use of variables, use of control statements, implementation of functions using value and reference parameters, arrays, classes, and objects. Students will write moderately complex applications using C++.

**COMPSCI 174  INTRODUCTION TO C++ (GM)  3 Units**
This course teaches basic programming skills using the structured high-level language C++. Topics include basic input and output, declaration and use of variables, use of control statements, implementation of functions using value and reference parameters, arrays, classes, and objects. Students will write moderately complex applications using C++.

**COMPSCI 178  DATA SCIENCE FOR EVERYONE  3 Units**
An introduction to data science and its implementation using the R language, with applications in natural and social science, public health and welfare, and other areas. Students will explore methods of data analysis and visualization and cultivate marketable data-literacy skills. No prior knowledge of statistics or programming is needed.

**COMPSCI 181  INTRODUCTION TO DATABASE AND THE WEB  3 Units**
This course provides the student with a comprehensive working knowledge of a modern database package including the creation of a database, construction of a wide range of queries, use of forms, and report writing features. The course also gives an introduction to the creation of World Wide Web pages using the Extended Hypertext Markup Language (XHTML).

**COMPSCI 215  DISCRETE STRUCTURES  3 Units**
The course offers a formal approach to the mathematics of Computer Science, including set theory, methods of proof, propositional logic, discrete probability, sequences, recurrence relations, introduction to graphs, and algorithmic analysis.

**COMPSCI 217  DISCRETE STRUCTURES II  3 Units**
The course covers issues of data structures, professional software development methodologies including software patterns, and advanced object-oriented techniques. Topics include lists, queues, stacks, and trees. Complex data structures and object-oriented design techniques, including inheritance and polymorphism, are applied to develop larger projects.

**COMPSCI 220  INTERMEDIATE JAVA  3 Units**
This course covers more advanced topics in object-oriented program design and the Java programming language. Coverage includes multi-dimensional arrays, methods, error handling, strings, regular expressions, encapsulation, inheritance, polymorphism, generic types, program debugging and testing, database and file processing, event-handling, and graphical user interfaces.

**COMPSCI 222  INTERMEDIATE C++  3 Units**
This course will cover more advanced issues of C++, including memory management, pointers and user-defined data types. Topics will include reading and writing files, dynamic arrays, implementation of the principles of object oriented design including encapsulation, and inheritance, planning and testing. Students will write complex applications using C++.

**COMPSCI 223  DATA STRUCTURES  3 Units**
This course covers issues of data structures, professional software development methodologies including software patterns, and advanced object-oriented techniques. Topics include lists, queues, stacks, and trees. Complex data structures and object-oriented design techniques, including inheritance and polymorphism, are applied to develop larger projects.

**COMPSCI 271  ASSEMBLY PROGRAMMING  3 Units**
This course covers the use of an assembly language based on the RISC processor architecture including writing, linking, and executing a program. Also covered are number systems, instructions for arithmetic and logical operations, memory access, loops, declaring variables, interrupts, machine language, segments, stacks, procedure writing, and file handling.

**COMPSCI 296  SPECIAL STUDIES  Repeatable  1-3 Units**
Variable topics. Group activity. Not offered regularly in the curriculum but offered on topics selected on the basis of timeliness, need, and interest, and generally in the format of regularly scheduled Catalog offerings. Repeatable. Instructor Consent required.
COMPSCI 310 INTERMEDIATE DATA SCIENCE 3 Units
This course introduces intermediate data science and its implementation using R and Python, with applications in natural and social science, public health and welfare, and other areas. Students will explore methods of data analysis, cleaning, simulation and visualization and machine learning. Prior knowledge of programming and statistical analysis is assumed.
PREREQ: COMPSCI 170 AND (COMPSCI 180 OR COMPSCI 220 OR COMPSCI 222) AND 1 COURSE IN STATISTICS (BIOLOGY 303 OR ECON 245 OR MATH 230 OR MATH 342 OR PSYCH 215 OR SOCIOLOGY 295 OR SOCWORK 250), OR PERMISSION OF INSTRUCTOR

COMPSCI 320 CONCEPTS OF PROGRAMMING LANGUAGES 3 Units
An exploration of the core concepts upon which all programming languages are built. Students will apply these concepts to write programs in several specialized programming languages, including functional and logic programming languages. Emphasis is placed upon evaluating the strengths and weaknesses of particular languages for various tasks.
PREREQ: COMPSCI 223 AND (COMPSCI 215 OR MATH 280)

COMPSCI 322 COMPUTER LANGUAGES AND COMPILERS 3 Units
In this course, we will study the process of translating computer programs into machine code that runs on a computer. Students will learn the structure and functionality of a compiler, program working versions of all parts of a simple compiler, and test the various parts of a simple compiler for bugs.
PREREQ: COMPSCI 223 AND COMPSCI 271

COMPSCI 332 INTRODUCTION TO ARTIFICIAL INTELLIGENCE 3 Units
This course introduces basic artificial intelligence principles including simple representation schemes, problem solving paradigms, constraint propagation, search strategies and learning approaches. Knowledge representation, natural language processing, gaming, machine learning and user modeling will be explored. Students should have written moderately complex computer programs in a high level language.
PREREQ: COMPSCI 222 OR COMPSCI 220

COMPSCI 347 SCIENTIFIC COMPUTING 3 Units
This course provides the applied scientist with the basic tools needed to perform computing within a scientific context. The computational aspects focus on two major areas: (1) the development and implementation of numerical algorithms in computer programs, and (2) the analysis and visualization of complex data sets. Numerical methods covered include finding roots of nonlinear equations, solving linear systems, the eigenvalue problem, numerical integration, the initial value problem, and data fitting. The high-level computer packages used are Mathematic and Matlab.
PREREQ: MATH 253 WITH A C OR BETTER OR CONSENT OF INSTRUCTOR

COMPSCI 353 CYBERSECURITY LAW AND POLICY 3 Units
This course will provide students exposure to the key legal and policy issues related to cybersecurity. It includes such topics as data security laws and enforcement actions, cybersecurity litigation, anti-hacking laws, cybersecurity and corporate governance, privacy law, the Fourth Amendment, surveillance, and international cybersecurity law.

COMPSCI 354 INTRUSION DETECTION AND INCIDENT RESPONSE 3 Units
A blend of theoretical and practical knowledge on design and implementation of intrusion detection and incident response. Topics include intrusion prevention systems, anomaly and signature-based intrusion detection, host-based and network-based intrusion detection, tools for intrusion detection and response, automated and manual response to attacks, and legal/organizational issues of intrusion detection and incident response systems.
PREREQ: ITSCM 221 OR COMPSCI 460 OR EQUIVALENT BACKGROUND IN COMPUTER NETWORKING

COMPSCI 366 DATABASE MANAGEMENT SYSTEMS 3 Units
This course offers an introduction to the design and programming of databases and the implementation of database management systems from a computer science perspective. Contents include the relational model; SQL; database application development; and concepts and algorithms for building database management systems.
PREREQ: COMPSCI 223 OR CONSENT OF INSTRUCTOR

COMPSCI 381 JAVASCRIPT AND DHTML 3 Units
JavaScript is a computer language for adding flexibility and functionality to web pages. A powerful language in its own right, it also has the capability to interact with HTML forms, browsers, Java applets, and other objects found on a web page. Students in this course will gain a thorough understanding of JavaScript, and learn to harness its abilities to manage windows, forms, events, cookies, etc.
PREREQ: COMPSCI 172 OR COMPSCI 174 OR EQUIVALENT PREPARATION AND CONSENT OF INSTRUCTOR

COMPSCI 382 SERVER-SIDE SCRIPTING 3 Units
Server-side scripting is key to processing web forms, as well as for automating a wide range of server tasks. This course will provide a thorough introduction to the Server-side scripting languages. Students will learn to create a data-driven web application that uses Structured Query Language (SQL) to access and update the information in a database.
PREREQ: COMPSCI 172 OR COMPSCI 174 OR EQUIVALENT PREPARATION AND CONSENT OF INSTRUCTOR

COMPSCI 412 COMPUTER ORGANIZATION AND SYSTEM PROGRAMMING 3 Units
Introduction to organization of modern digital computers - understanding the various components of a computer and their interrelationships. Study of systems programming in C/Linux.
PREREQ: COMPSCI 271 OR CONSENT

COMPSCI 424 OPERATING SYSTEMS 3 Units
This course covers problems encountered by computer operating systems including resource management, memory management, virtual memory, concurrent programming, and distributed systems. Algorithms are presented for deadlock, memory paging, job scheduling, memory allocation, and performance measurement. Operating systems such as WINDOWS, DOS, UNIX, VMS, and MVS are discussed.
PREREQ: COMPSCI 223 AND COMPSCI 271

COMPSCI 433 THEORY OF ALGORITHMS 3 Units
This course is a survey of algorithms needed for searching, sorting, pattern matching, analyzing graphs, and a variety of other problems of discrete mathematics. Analysis of algorithm efficiency and space/time tradeoffs are discussed.
PREREQ: COMPSCI 223 AND (COMPSCI 215 OR MATH 280)
COMPSCI 434  THEORY OF COMPUTATION  3 Units
This course is an introduction to the theory of computation. It discusses
finite automata and Turing machines as models of computation. It
includes discussions of regular sets, recursive and partially recursive
functions, context free grammars, the halting problem, undecidable
problems, complexity, and NP-completeness.
PREREQ: MATH 280 OR COMPSCI 215

COMPSCI 448  BIOINFORMATICS  3 Units
Bioinformatics is an introduction to computer applications and
algorithms currently used in the analysis of biological data, especially
genomic and sequence data. The course entails lectures, discussions,
readings and hands-on experience with bioinformatic software. Through
exercises and individual research projects students acquire a working
knowledge of contemporary computational methods and software.
PREREQ: BIOLOGY 141 WITH A GRADE OF C OR BETTER AND ONE OF
THE FOLLOWING WITH A GRADE OF C OR BETTER: BIOLOGY 303, PSYCH
215, MATH 230, OR MATH 342
CROSS-LISTED: BIOLOGY 448 AND COMPSCI 448

COMPSCI 451  TOPICS IN APPLIED COMPUTING  Repeatable  3 Units
This course covers emerging topics in modern applied computing.
Sample topics include: new computing platforms, blockchain, machine
learning, cloud computing, data mining and recommender systems, user
modeling, and human-computer interaction. Repeatable with change in
topic.
PREREQ: COMPSCI 223

COMPSCI 455  CRYPTOGRAPHY AND NETWORK SECURITY  3 Units
This course covers the fundamental cryptographic algorithms and
security protocols for computer networks. Topics include security
attacks and security services, classical ciphers, modern block and stream
ciphers, public key cryptography, digital signatures, key management and
distribution, authentication, and security network protocols. The class
involves a significant amount of programming projects and assignments
about cipher algorithms and security protocols.
PREREQ: COMPSCI 223 AND COMPSCI 271 OR CONSENT OF
INSTRUCTOR

COMPSCI 456  COMPUTER SYSTEM SECURITY  3 Units
General concepts and applied methods of computer system security,
especially as they relate to confidentiality, integrity, and availability of
information assets. Topics include system security analysis, access
control and various security models, information flow, protection against
external and internal threats, malware, and reverse engineering. This
is a hands-on course, where you will learn by working on programming
assignments and projects.
PREREQ: COMPSCI 223 AND COMPSCI 271 OR CONSENT OF
INSTRUCTOR

COMPSCI 460  COMPUTER NETWORKING  3 Units
This course introduces the principles, applications, protocols, and
architectures of data networks. It places an equal emphasis on practical
experience as well as theoretical foundations. There will be abundant
network programming and lab activities around application layer,
transportation layer, and routing.
PREREQ: COMPSCI 223 AND COMPSCI 271 OR CONSENT OF
INSTRUCTOR

COMPSCI 461  MOBILE COMPUTING ARCHITECTURE  3 Units
This course discusses fundamentals of wireless communication and
mobile computing, and emphasizes the analysis and design of network
architectures in support of mobility related services. It involves intensive
critical thinking practices, programming, and hands-on experiments.
PREREQ: COMPSCI 223 AND COMPSCI 271 OR CONSENT OF
INSTRUCTOR

COMPSCI 476  SOFTWARE ENGINEERING  3 Units
This capstone course introduces concepts and techniques relevant to
the production of large software systems. Topics include: modularity;
specification; data abstraction; object modeling; design patterns; and
testing. Students work in groups to complete a significant software
development project using concepts taught in this course and in prior
Computer Science courses.
PREREQ: COMPSCI 223

COMPSCI 481  WEB SERVER AND UNIX ADMINISTRATION  3 Units
This course is intended to introduce students to Web Server software
and UNIX and UNIX-like operating systems from the perspective of the
System Administrator. Linux, the fastest growing operating system, will
be studied in detail, together with the Apache web server. Web server
configuration will be studied, including optimization, security issues
and virtual server administration. Additional topics will include shell
programming, system monitoring, file systems and the X Windows GUI.
This course will focus on common system administration duties on
the Linux platform. Students will acquire competency in using shell
programming skills to automate the maintenance of server activity.
Emphasis will be placed on using Linux as an Internet server.
PREREQ: COMPSCI 172 OR COMPSCI 174 OR EQUIVALENT
PREPARATION AND CONSENT OF INSTRUCTOR

COMPSCI 482  ADVANCED WEB APPLICATION DEVELOPMENT  3 Units
This course will introduce students to popular technologies utilized
in building database-driven Web applications. These include scripting
languages (PHP, Ruby, JSP, NET), Web application frameworks, Web
application design patterns, Web services, databases, and security.
PREREQ: COMPSCI 381 AND COMPSCI 382 OR EQUIVALENT
PREPARATION OR CONSENT OF INSTRUCTOR

COMPSCI 485  PROJECT  Repeatable  1-3 Units
This course provides students with the opportunity to participate on a
student project team under the management of a faculty member and
industry practitioners. The project will be sponsored by a partnering
business firm and may involve a wide array of technologies, functional
areas and geographically dispersed teammates. This course will only be
offered when projects are available. Students will be carefully chosen
through an interview process. The number of credits will be determined
by the complexity of the project and the level of student involvement.
PREREQ: COMPSCI 223 AND CONSENT OF DEPARTMENT

COMPSCI 490  WORKSHOP  Repeatable  1-3 Units
Variable topics. Group activity oriented presentations emphasizing
"hands on" and participatory instructional techniques. Repeatable.
Instructor Consent required.

COMPSCI 493  INTERNSHIP IN COMPUTER SCIENCE  Repeatable  1-12
Units
S/NC grade basis only.

COMPSCI 494  SEMINAR  2 Units
Variable topics. Group activity. An advanced course of study in a defined
subject matter area emphasizing a small group in intense study with a
faculty member.
COMPSCI 496   SPECIAL STUDIES  Repeatable  1-3 Units
Variable topics. Group activity. Not offered regularly in the curriculum but offered on topics selected on the basis of timeliness, need, and interest, and generally in the format of regularly scheduled Catalog offerings. Repeatable. Instructor Consent required.

COMPSCI 497   EXCHANGE STUDY  Repeatable  1-12 Units
Variable topics.

COMPSCI 498   INDEPENDENT STUDY IN COMPUTER SCIENCE  Repeatable  1-3 Units
Study of a selected topic or topics under the direction of a faculty member. Repeatable. Department Consent required.

COMPSCI 498R  INDEPENDENT STUDY - UNDERGRADUATE RESEARCH  Repeatable  1-3 Units
Study of a selected topic or topics under the direction of a faculty member. Repeatable. Department Consent required.