Computer/Electrical Engineering

ECE 160 Introduction to Engineering (3)

This course will provide an introduction to the practice of engineering
by reviewing its history and current state. Students are informed about
various areas within the discipline of engineering, e.g., chemical,
agricultural, and electrical. Finally, the impact of engineering from a
global, social, and political perspective is presented through a number
of case studies.

   ECE 220 Computer Systems and C Programming (5) [NOT YET IMPLEMENTED]

   Fundamentals of procedural programming in an electrical engineering
   context. Topics include data types, control structures, functions,
   arrays, pointers, structures, standard and file I/O. Basic data
   structures, including stacks, queues, and linked lists. Introduction
   to hardware and software organization.
   Prerequisite: Pre-Calculus Readiness.

ECE 304 Signals and Systems I (5)

Time and frequency domain techniques for signal and system analysis.
Fourier series and transforms, and Laplace transforms. Topics in
differential equations and probability. Use of a numerical computing
environment such as MATLAB. Each week lecture meets for 200 minutes
and lab meets for 150 minutes. Prequisite: MATH 204 or consent of the
instructor.

ECE 306 Complex Analysis in Engineering (5)

The complex number field, harmonic and analytic functions, conformal
mapping, integregration, Cauchy's Theorem, singularities, calculus
of residues, applications to elliptic systems arising in engineering.
Use of a numerical computing environment such as Matlab.
Prerequisite: MATH 204 or consent of the instructor.

ECE 307 Analog Circuits (5)

Design, construction, and debugging of analog electronic circuits.
Diodes, filters, oscillators, transistors, JFETs, op-amps, and basic
analog circuit design. Broadband applications in networking and
communications. Four hours lecture/discussion and three hours
laboratory per week. Prerequisite: ENGR 207 or consent of the
instructor.

ECE 320/CMPS 320 Digital Circuits (5)

An introduction to the logical design of digital computers including
the analysis and synthesis of combinatorial and sequential circuits,
and the use of such circuits in building processor components and
memory. The course will apply the circuit theory to the design of an
elementary processor with a small instruction set with absolute
addressing and a hard-wired control unit. An assembly language for this
processor will also be developed. This course includes a laboratory
which will cover a mix of actual circuit work together with circuit
synthesis and testing using software. Four hours lecture/discussion and
three hours laboratory per week. Prerequisite: One course in programming
or permission of the instructor.

ECE 322/CMPS 322 Digital Design with VHDL (5)

This course uses a hardware description language (HDL) to design application-specific integrated circuits. The continuation of CMPS 320 includes modern digital design technology, in-depth treatment of algorithms and architectures for digital machines and comprehensive treatment of behavioral modeling in advanced digital design. Four hours lecture/discussion and three hours laboratory per week. Prerequisite: CMPS 320.

ECE 325 Properties of Materials (5)

Fundamental electrical, optical, and magnetic properties of materials, elementary quantum mechanics, crystal structure, energy bands, metals and semiconductors. Prerequisite: ECE 307 and PHYS 223.

ECE 330 Signals and Systems II (5)

analysis of both continuous-time and discrete-time signals, convolution, frequency domain analysis, Fourier series, Fourier transforms, and z-transforms, filters, applications to communications and control systems. Prerequisite: MATH 204 and PHYS 207.

ECE 332 Fields and Waves (5)

Vector analysis, electrostatic and magnetic fields, Maxwell's equations, plane waves. Reflection, attenuation, and impedance. Prerequisite: MATH 204 and PHYS 223.

ECE 336 Electrical Machinery (5)

This course is an introduction to the analysis and design of electromechanical energy conversion systems, magnetic circuit theory, general transformer and machinery theory, DC and AC motors and generators. Prerequisite: ECE 304 and ECE 307.

ECE 337 Fundamentals of Power Systems (5)

This course is an introductory subject in the field of electric power systems. Electric power systems have become increasingly important as a way of transmitting and transforming energy in industrial, military and transportation uses. The course covers basic elements of power system, three-phase circuit analysis, transformers, transmission line configuration, the per unit system and power flow. Prerequisites: ENGR/PHYS 207 and ECE 304 or consent of the instructor.

ECE 420/CMPS 420 Embedded Systems (5)

Built on logic designs, using assembly and C languages to study embedded systems with regard to their software, hardware, theories and implementation methodology. Various embedded system development tools, such as assemblers, debuggers and cross compilers, will be introduced and used in the course. Four hours lecture/discussion and three hours laboratory per week. Prerequisites: CMPS 224 and CMPS 320.

ECE 422/CMPS 422 Digital Signal Processing (5)

Introduction to principles of Digital Signal Processing (DSP) including sampling theory, aliasing effects, frequency response, Finite Impulse Response filters, Infinite Impulse Response filters, spectrum analysis, Z transforms, Discrete Fourier Transform and Fast Fourier Transform. Emphasis on hardware design to achieve high-speed real and complex multiplications and additions. Pipelining, Harvard, and modified Harvard architectures. Overviews of modern DSP applications such as modems, speech processing, audio and video compression and expansion, and cellular protocols. Four hours lecture/discussion and three hours

laboratory per week. Prerequisites: CMPS 320.

ECE 423 Digital Communications (5)

Principles and techniques fundamental to the analysis and design of digital communication systems. The basic building blocks of a digital communication system including channel encoder/decoder, digital modulator/demodulator and channel characteristics. Channel impairments such as signal-to-noise rations, distortion, interference, transmission errors and fading. Wired and wireless systems. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 320.

ECE 424 Microprocessor System Design (5)

Architecture and hardware design of microprocessor-based systems, including bus structure, interrupts handling, I/O ports, control signal, and peripherals. Prerequisite: CMPS 224 and ECE 320.

ECE 425 Wireless Communications (5)

In this course analytical characterizations of mobile communications channels are developed. The main techniques for mitigating the mobile communication channel effects such as Equalization, Diversity, etc. are then examined. Multiple access techniques used in wireless communications, such as FDMA as well as digital TDMA and CDMA techniques are presented. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: ECE 304 and ECE 330 or consent of the instructor.

ECE 426 Wireless Networks (5)

This course focuses on wireless data communications including wireless Internet. The students acquire knowledge into the current and future state-of-the-art of technology in the field of wireless communications. Another goal of the course is to ensure student can explain the impact of commercial, political, and regulatory factors on the design of wireless systems. The course will treat current relevant technologies, and the exact content may change from year to year. Prerequisites: ECE 304 or consent of the instructor.

ECE 432 Instrumentation, Control, and Data Acquisition (5)

Study of analog (and computer-controlled) systems, classical and modern system design methods, s-domain (and z-domain) transfer function models, state space, dynamics of linear systems, and frequency domain analysis and design techniques. Introduction to controllability and observability. Implementation of PID controllers. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: MATH 206 or CMPS 304 or consent of the instructor.

ECE 433 Mechatronics (5)

Intelligent electro-mechanical systems. Topics include electronics (A/D, D/A converters, op-amps, filters, power devices), software program design (event-driven programming, state machine-based design), DC and stepper motors, basic sensing and basic mechanical design. Prerequisite: ECE 307, ECE 320, and CMPS 223.

ECE 434 Introduction to Control Theory (5)

This course is an introduction to the analysis and design of feedback control systems, including classical control theory in the time and frequency domain. Modeling of physical, biological and information systems using linear and nonlinear differential equations. Stability and performance of interconnected systems, including use of block

diagrams, Bode plots, Nyquist criterion, and Lyapunov functions.
Robustness and uncertainty management in feedback systems through
stochastic and deterministic methods. Introductory random processes,
Kalman filtering, and norms of signals and systems.
Prerequisite: ECE 304, ECE 306, ECE 330, and MATH 340.

ECE 446 Image Processing (5)

Digital image acquisition, image enhancement and restoration, image
compression, computer implementation and testing of image processing
techniques. Students gain hands-on experience of complete image processing
systems, including image acquisition, processing, and display through
laboratory experiments. Each week lecture meets for 200 minutes and
lab meets for 150 minutes. Prerequisites: CMPS 223 and CMPS 304.

ECE 447 Computer Vision (5)

Imaging formation, early vision processing, boundary detection, region
growing, two-dimensional and three-dimensional object representation
and recognition techniques. Each week lecture meets for 200 minutes
and lab meets for 150 minutes. Prerequisites: CMPS 223 and ECE 304 or
consent of the instructor.

ECE 457/CMPS 457 Robotics (5)

The course will provide an opportunity for students to understand
intelligent robot system architecture and to design algorithms and
programs for control and planning of intelligent robot systems based on
analytical modeling and behavior modeling. Students will use simulation
software (Webots) and hardware test-bed (Kheraper II) to verify their
algorithm and program performance during their project work. Four hours
lecture/discussion and three hours laboratory per week. Prerequisite: CMPS 223

ECE 464 Power Electronics and Semiconductors (5)

The course is an introduction to switched-mode power converters. It
provides a basic knowledge of circuitry for the control and conversion
of electrical power with high efficiency. These converters can change
and regulate the voltage, current, or power; dc-dc converters, ac-dc
rectifiers, dc-ac inverters, and ac-ac cycloconverters are in common use.
Applications include electronic power supplies, aerospace and vehicular
hybrid power systems, and renewable energy systems.
Prerequisite: ECE 304 and ECE 307.

ECE 477 Special Topics in Computer Engineering (1-5)

This course will often be used to supplement other courses with
additional work at a more advanced level. Prerequisite: permission of
instructor.

ECE 480 Research Participation (1-5)

Individual study, under supervision, in scientific investigation. May
be repeated. Prerequisite: consent of instructor.

ECE 489 Experiential Prior Learning (1-5)

Majors in Computer Engineering with significant prior experience in
computers may have some of their experience count for academic credit
toward their degree. In order to be considered for experiential
learning credit the student must have completed CMPS 223 and have the
approval of the department.

CMPS/ECE 490A SENIOR PROJECT I (3)

After consultation with the faculty supervisor and investigation of relevant literature, the student(s) shall prepare a substantial project with significance in the designated area. The timeline, teamwork responsibilities, milestones, and presentation(s) will be scheduled. Prerequisite: upper-division standing.

CMPS/ECE 490B SENIOR PROJECT II (3)

This is the completion phase of the project. The student(s) will present a project report to the entire class, explaining the nature of the work, the finished product, and its relationship to the field. Prerequisite: upper-division standing and 490A.

ECE 496 Internship in Computer Science (1-5)

Internships may be arranged by the department with various agencies, businesses, or industries. The assignments and coordination of work projects with conferences and reading, as well as course credits, evaluation, and grading are the responsibility of the faculty liaison (or course instructor), working with the field supervisor. Offered on a credit, no-credit basis only. The department will determine credits and application of credit.

ECE 497 Cooperative Education (5)

The Cooperative Education program offers a sponsored learning experience in a work setting, integrated with a field analysis seminar. The field experience is contracted by the Cooperative Education office on an individual basis, subject to approval by the department. The field experience, including the seminar and reading assignments, is supervised by the cooperative education coordinator and the faculty liaison (or course instructor), working with the field supervisor. Students are expected to enroll in the course for at least two quarters. The determination of course credits, evaluation, and grading are the responsibility of the departmental faculty. Offered on a credit, no-credit basis only. The department will determine application of credit.

Computer Science

CMPS 120 Computer Skills and Concepts I (5)

Instruction and tutoring in basic computer skills. An overview of computer terminology, hardware and software. Included: storage devices, input/output devices, the internet, operating systems, word processing, sreadsheets, presentation software, creating web pages and simple databases. Meets for 250 minutes. Prerequisites: None

CMPS 150 Introduction to Unix (1)

Basic Unix commands and programming utilities will be introduced. Students will learn how to use email, a text editor, and manage files and directories. This course is designed for students who have no experience with Unix.

CMPS 211 Internet Programming and Web Design (5)

Introduction to internet programming using HTML and JavaScript or other scripting language. The course is intended for students with no programming experience. Students will learn the concepts of structured programming and control structures. They will become familiar with HTML interfaces by designing interactive web sites. This course may be used

as an elective in the CIS track. Prerequisite: None.

CMPS 215 Unix Programming Environment (3)

This course covers common Unix commands, shell scripting, regular
expressions, tools and the applications used in a Unix programming
environment. The tools to be introduced include make utility, a
debugger, advanced text editing and text processing (vi, sed, tr). Each
week lecture meets for 100 minutes and lab meets for 150 minutes.
Prerequisite: None.

CMPS 216 Unix System Administration (3)

This course covers the knowledge and skills critical to administering a
multi-user, networked Unix system. The course assumes a basic
knowledge of Unix commands and an editor (vi or Emacs). Topics
include: kernel and network configuration, managing daemons, devices,
and critical processes, controlling startup and shutdown events,
account management, installing software, security issues, shell
scripting. Many concepts will be demonstrated during hands-on labs.
Each week lecture meets for 100 minutes and lab meets for 150 minutes.
Prerequisite: CMPS 215.

CMPS 221 Programming Fundamentals (5)

Introduces the fundamentals of procedural programming. Topics include:
data types, control structures, functions, arrays, and standard and
file I/O. The mechanics of compiling, linking, running, debugging and
testing within a particular programming environment are covered.
Ethical issues and a historical perspective of programming within the
context of computer science as a discipline is given. Prerequisite:
MATH 85 or other satisfaction of the ELM requirement.

CMPS 222 Object-Oriented Programming (5)

Builds on foundation provided by CMPS 221 to introduce the concepts of
object-oriented programming. The course focuses on the definition and
use of classes and the fundamentals of object-oriented design. Other
topics include: an overview of programming language principles, basic
searching and sorting techniques, and an introduction to software
engineering issues. Each week lecture meets for 200 minutes and lab
meets for 150 minutes. Prerequisite: CMPS 221.

CMPS 223 Data Structures and Algorithms (5)

Builds on the foundation provided in CMPS 221 to introduce the fundamental
concepts of data structures and algorithms that proceed from them within the
framework of object-oriented programming technology. Topics include:
recursion, fundamental data structures (including lists, stacks, queues,
hash tables, trees and graphs) and basics of algorithmic analysis.
Necessary components of object-oriented programming method will be
introduced. Each week lectures meets for 200 minutes and lab meets for 150
minutes. Prerequisite CMPS 221.

CMPS 224 Assembly Language Programming (5)

Introduction to machine architecture and program structure; code, data,
and stack segments; programming with an assembly language.
Prerequisite: CMPS 221.

CMPS 270 Introduction to CAD in Engineering (3)

Use of computer-aided design software, such as AutoCAD, in engineering.
CAD concepts including drawing setups, commands and system variables,
layers and object properties, 2-dimensional entity creation, coordinate

systems, creating objects, drawing with precision, plotting, and editing methods are applied to a variety of engineering applications. Two hours lecture/discussion and three hours laboratory per week.

CMPS 271 Intermediate CAD in Engineering (3)

Intermediate topics in computer-aided design using AutoCAD. Introduction to 3-dimensional drawing and modeling with engineering applications, adding text to drawings, creating dimensions, using blocks and external references, managing content with Autocad Design Center, creating a layout to plot, plotting your drawings, working with raster images, creating compound documents with OLE, and using other file formats. Two hours lecture/discussion and three hours laboratory per week. Prerequisite: CMPS 270

CMPS 277 Topics in Programming Languages (1-5)

A study of programming languages not offered otherwise. Prerequisite: Knowledge of a high-level programming language or permission of the instructor.

CMPS 280 X-Windows (3)

This course is an introduction to the use of an X-Windowing environment. The course is designed more for the end user than for X11 programmers. Its goal is to familiarize the applications user with the standard X11 productivity tools as well as explain the underlying principles, configuration questions, and security considerations involved in working or administering an X-Workstation with Internet access. Each week lecture meets for 100 minutes and lab meets for 150 minutes.

CMPS 281 Problem Solving in Compute Science (1)
This workshop is designed for students in the Louis Stokes alliance for Minority Participation Program (LSAMP), but is open to other students as well. It covers topics from CMPS 221. Typically students work during the meeting on problems related to their class, being helped by a facilitator.

CMPS 295 Discrete Structures (5)

Discrete structures and applications in computer science. Proofs, with a focus on induction. Introduction to propositional and predicate logic, functions, relations and sets, algorithm analysis, counting techniques, recursion and solution of recurrence relations, graph theory and trees. Prerequisite: CMPS 221 and MATH 190/191.

CMPS 305 Numerical Analysis (5)

Number representation and basic concepts of error; numerical solutions of nonlinear equations and systems of equations; interpolation and extrapolation; numerical differentiation and integration; numerical solution of ordinary differential equations; approximation by spline functions. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 221 and MATH 203 or permission of instructor. Cross-listed with MATH 305: Numerical Analysis.

CMPS 311 Server Scripting Languages (5)

Languages, principles and techniques fundamental to web application development on the server side. The latest languages and technologies are addressed, to include ASP, PHP, Perl, Python. Prerequisites: CMPS 221 and CMPS 211 or instructor approval.

CMPS 312 Algorithm Analysis and Design (5)

Algorithm analysis, asymptotic notation, hashing, hash tables, scatter tables, and AVL and B-trees, brute-force and greedy algorithms, divide-and-conquer algorithms, dynamic programming, randomized algorithms, graphs and graph algorithms, and distributed algorithms. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 295 or CMPS 300 and CMPS 223.

CMPS 321 Computer Architecture (5)

This course follows the Digital Logic Design course and focuses on the design of the CPU and computer system at the architectural (or functional) level: CPU instruction sets and functional units, data types, control unit design, interrupt handling and DMA, I/O support, memory hierarchy, virtual memory, and buses and bus timing. In contrast, the Digital logic Design course is primarily concerned with implementation; that is, the combinatorial and sequential circuits which are the building blocks of the functional units. Four hours lecture/discussion and three hours laboratory per week. Prerequisite: CMPS 223.

CMPS 335 Software Engineering (5)

A general introduction to Software Engineering. Deals with the specification, development, management, and evolution of complex software systems. Shows how to cost-effectively apply the methods and theory from Computer Science to solve difficult problems. The course presents a broad perspective on software and system engineering and surveys a wide spectrum of tools and techniques. Students are required to complete a project as part of a small software engineering team. Students may choose system projects involving software and hardware integration. Prerequisite: CMPS 223.

CMPS 340 Introduction to Digital Forensics (5)

Investigative techniques, evidence handling procedures, forensics tools, digital crime reconstruction, and legal guidelines. Case studies cover a range of hardware and software platforms. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: None (CMPS 215 or a good working knowledge of Unix is recommended)

CMPS 342 Database Systems (5)

Basic issues in data modeling, database application software design and implementation. File organizations, relational model, relational database management systems, and query languages are addressed in detail. Two-tier architecture, three-tier architecture and development tools are covered. Meets for 200 minutes of lecture and 150 minutes of lab. Prerequisite: CMPS~295.

CMPS 350 Programming Languages (5)

An examination of underlying concepts in high level programming languages and techniques for the implementation of a representative sample of such languages with regard to considerations such as typing, block structure, scope, recursion, procedures invocation, context, binding, and modularity. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 223.

CMPS 356 Artificial Intelligence (5)

This course is intended to teach the fundamentals of artificial intelligence which include topics such as expert systems, artificial neural networks, fuzzy logic, inductive learning and evolutionary algorithms. Prerequisite: CMPS 312 or consent of the instructor.

CMPS 360 Operating Systems (5)

A study of the introductory concepts in operating systems: historical development of batch, multiprogrammed, and interactive systems; file, memory, device, process, and thread management; interrupt and trap handlers, abstraction layer, message passing; kernel tasks and kernel design issues; signals and interprocess communication; synchronization, concurrency, and deadlock problems. Prerequisite: CMPS 223

CMPS 371 Computer Graphics (5)

Introduction to computer graphics hardware, animation, two-dimensional transformations, basic concepts of computer graphics, theory and implementation. Use of graphics API's such as DirectX or OpenGL. Developing 2D graphics applications software. Prerequisite: CMPS 223.

CMPS 376 Computer Networks (5)

A study of computer networks focusing on the TCP/IP Internet protocols and covering in detail the four layers: physical, data link, network, and transport. This course includes a laboratory in which students will cover important network utilities, debugging tools, process and thread control as it relates to network programming, and the coding of programs which do interprocess communication over sockets. The typical Internet client program which accesses a TCP network server daemon will be covered in detail. Prerequisite: CMPS 223.

CMPS 377 Special Topics in Computer Science (3-5)

This course will be used to supplement other courses with additional work at the intermediate level. Prerequisite: Permission of instructor.

CMPS 394 Client, Server, Internet and Hand-Held Device Programming

This course will use Java's features and libraries to explore client-side, server-side, and internet programming. The concepts of multi-threading, synchronization, and network programming (socket and remote-method invocation) will be introduced and used to develop internet client-server programs such as chat room, on-line help, file transfer, etc. The concepts of graphic user interfaces (GUIs) and hand-held devices (such as Android phone or tablets) will be discussed and applied in student projects.

CMPS 410 Theory of Language Translation (5)

A study of techniques relevant to the theory of language translation including finite state machines, formal languages, grammars, lexical and syntactic analysis. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 350.

CMPS 411 Theory of Automata (5)

A study of algorithms as they relate to nonlinear data structures and external files. Time and space analysis of several popular algorithms, and a discussion of NP-hard and NP-complete problems. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 223.

CMPS 421 Advanced Computer Architecture (5)

Continuation of CMPS 321 including speed-up arithmetic algorithms, vector and parallel processing, organization of memory for high performance processors, and a comparative study of supercomputer architectures. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 321.

CMPS 435 Advanced Software Engineering (5)

Continuation of study of the software lifecycle. Methods and tools for
the implementation, integration, testing and maintenance of large,
complex software systems. Program development and test environments.
Group laboratory project. Technical presentation methods and practice.
Ethical and societal issues in software engineering. Each week lecture
meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 335.

CMPS 442 Advanced Database Systems (5)

A wide range of topics such as query processing and optimization,
object-oriented database systems, distributed database systems,
database warehousing and data mining will be discussed. The course
will also be used to introduce emerging issues related to database
systems. Each week lecture meets for 200 minutes and lab meets for 150
minutes. Prerequisite: CMPS 342.

CMPS 445 Data Mining and Visualization (5)

Knowledge discovery in and visualization of large datasets, including data
warehouses and text-based information systems. Topics covered include
data mining concepts, information retrieval, analysis methods, storage
systems, visualization, implementation and applications. Each week lecture
meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 312

CMPS 450 Compiler Construction (5)

An introduction to the construction of compilers, including lexical and
syntactic analysis, code generation, and error detection. This course
includes a 2 1/2 hours per week laboratory in which students will
implement a compiler for a given programming language. Each week
lecture meets for 200 minutes and lab meets for 150 minutes.
Prerequisite: CMPS 350.

CMPS 451 Vulnerability Analysis (5)

Identification and quantification of security weaknesses in programs,
systems and networks. Topics covered include professional ethics, static
binary analysis, dynamic binary analysis, anti-analysis techniques,
risk assessment, penetration testing, vulnerability classification and
mitigation techniques. Each week lecture meets for 200 minutes and lab
meets for 150 minutes. Prerequisite: CMPS 350

CMPS 456 Advanced Artificial Intelligence (5)
Continuation of CMPS 356. This course is intended to teach about
advances in artificial intelligence. It includes advanced topics on
artificial neural networks such as distributed and synergistic neural
network models, hybrid artificial intelligence techniques such as
neuro-fuzzy models, advanced machine learning techniques and
meta-heuristic evolutionary algorithms. Each week lecture meets for 200
minutes and lab meets for 150 minutes. Prerequisites: CMPS 356 and MATH 340.

CMPS 460 Advanced Operating Systems (5)

Continuation of CMPS 360. Various topics in popular operating systems.
Real-time and distributed operating systems will be addressed. Each
week lecture meets for 200 minutes and lab meets for 150 minutes.
Prerequisite: CMPS 360.

CMPS 465 Advanced System Analysis and Design (5)

Design and construction of sizeable software products. Technical
management of software development teams. Software development process
models, software design, documentation, quality assurance during

development, software unit and integration testing, CASE tools,
development environments, test tools, configuration management. Each
week lecture meets for 200 minutes and lab meets for 150 minutes.
Prerequisite: CMPS 335.

CMPS 471 Advanced Computer Graphics (5)

Continuation of CMPS 371. 3D graphics transformations,
multi-resolution model building and rendering. Advanced computer
graphics concepts - theory and implementation. Advanced animation
techniques in a 3D environment. This course includes a laboratory.
Each week lecture meets for 200 minutes and lab meets for 150 minutes.
Prerequisites: CMPS 371, and MATH 330.

CMPS 472 AI Agents in Virtual Environments (5)

Continuation of CMPS 471. This course is about creating and
interacting with intelligent three-dimensional virtual environments.
Topics covered will include hierarchical architecture of
three-dimensional virtual environments, and a framework of
incorporating intelligent agents within the virtual environment. Each
week lecture meets for 200 minutes and lab meets for 150 minutes.
Prerequisite: CMPS 371.

CMPS 473 Computer Game Design (5)

The course will cover fundamental concepts behind designing a game
engine. The concepts, theories, and programming aspects of physics
engine, graphics engine, and control engine will be covered. Each week
lecture meets for 200 minutes and lab meets for 150 minutes.
Prerequisite: CMPS 223.

CMPS 476 Advanced Computer Networks and Computer Security (5)

Continuation of CMPS 376. Various advanced topics in computer networks
and computer security will be addressed. Each week lecture meets for
200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 376

CMPS 477 Special Topics in Computer Science (1-5)

This course will often be used to supplement other courses with
additional work at a more advanced level. Prerequisite: permission of
instructor.

CMPS 489 Experiential Prior Learning (1-5)

Majors in Computer Science with significant prior experience in
computers may have some of their experience count for academic credit
toward their degree. In order to be considered for experiential
learning credit the student must have completed CMPS 223 and have the
approval of the department.

CMPS/ECE 490A SENIOR PROJECT I (3)

After consultation with the faculty supervisor and investigation of
relevant literature, the student(s) shall prepare a substantial project
with significance in the designated area. The timeline, teamwork
responsibilities, milestones, and presentation(s) will be scheduled.
Prerequisite: upper-division standing.

CMPS/ECE 490B SENIOR PROJECT II (3)

This is the completion phase of the project. The student(s) will present
a project report to the entire class, explaining the nature of the work,
the finished product, and its relationship to the field. Prerequisite:

upper-division standing and 490A.

CMPS 496 Internship in Computer Science (1-5)

Internships may be arranged by the department with various agencies, businesses, or industries. The assignments and coordination of work projects with conferences and reading, as well as course credits, evaluation, and grading are the responsibility of the faculty liaison (or course instructor), working with the field supervisor. Offered on a credit, no-credit basis only. The department will determine credits and application of credit.

CMPS 497 Cooperative Education (5)

The Cooperative Education program offers a sponsored learning experience in a work setting, integrated with a field analysis seminar. The field experience is contracted by the Cooperative Education office on an individual basis, subject to approval by the department. The field experience, including the seminar and reading assignments, is supervised by the cooperative education coordinator and the faculty liaison (or course instructor), working with the field supervisor. Students are expected to enroll in the course for at least two quarters. The determination of course credits, evaluation, and grading are the responsibility of the departmental faculty. Offered on a credit, no-credit basis only. The department will determine application of credit.