### **Course Descriptions for Courses Offered by the CE Program**

#### CENG 315 Microprocessors

(3:3:0)

Pre-requisite(s): CSCI 112 and ECEN 331

Microprocessors as components in a computer system; programmer's view of a microprocessor's architecture; microprocessor instruction set; assembly language programming; interrupts; input and output; interfacing a microprocessor to memory and I/O devices from the programmer's view. At the end of the course, the students should be able to program a modern microprocessor in assembly or C language, and perform hardware I/O interfacing.

### CENG 316 Microprocessors Lab

(1:0:3)

Pre-requisite(s): CSCI 112 Co-requisite(s): CENG 315

Laboratory experiments to accompany the Microprocessors course. Topics include: Assembly Language Programming; Hardware interface and design with common microprocessor peripherals such as analog-to-digital and digital-to-analog converters, LCD, 7-segment display, motors and sensors. A comprehensive project combines and analyzes the interaction of hardware and software to address certain problem.

#### **CENG 335** Computer Architecture

(3:3:0)

Pre-requisite(s): ECEN 331 Co-requisite(s): CENG 336

This course covers details of microprocessor design including the instruction set architecture, memory design, and data path and control design. The course also emphasizes memory performance related concepts such as associativity and multi-level caching. Additional topics include virtual memory and performance speed-up techniques using pipelining, multithreading, and multiprocessing.

#### **CENG 336** Computer Architecture Lab

(1:0:3)

Pre-requisite(s): ECEN 331 Co-requisite(s): CENG 335

This course covers modern computer system architecture and computer design principles. A Hardware Description Language is used to design basic components of a microprocessor datapath and control. Additional topics covered include Adders, MUX, Counters, ALU, registers/shift registers, RAM, pipelining, and cache memory.

# CENG 401 Network Servers and Architecture

(3:3:0)

Pre-requisite(s): CSCI 462

This course discusses socket programming, client -server applications, peer-to-peer networks and applications, Web servers, datacenters and load balancing, CDNs, IPV6, NAT, anycasting, DHCP, multimedia networking, network operation and management and basic Internet measurements.

### CENG 411 Software Engineering

(3:3:0)

Prerequisite(s): CSCI 215

This course examines in detail the software development process. Topics include concepts such as software processes, software specification, software design implementation, software testing, software evolution, and software reuse.

## CENG 431 Embedded Systems Design

(3:3:0)

Pre-requisite(s): CENG 315 Co-requisite(s): CENG 432

Introduction to the design of embedded systems. Topics include hardware and software architectures, assembly and C programming, real-time design, interrupts, multitasking, embedded software tools and embedded systems performance. Comprehensive project to design, implement and evaluate a prototype embedded system.

### CENG 432 Embedded Systems Design Lab

(1:0:3)

Co-requisite(s): CENG 431

Lab to accompany CENG 431. Labs cover topics such as hardware and software architectures, assembly and C programming, I/O, real-time design, interrupts, embedded systems performance.

### **CENG 435** Parallel Computer Architectures

(3:3:0)

Pre-requisite(s): CENG 335

This course provides students with a deep understanding of parallel computing architectures including multicore CPUs and GPUs. The course emphasizes trade-offs involved in design of modern parallel computing systems, and techniques necessary to effectively utilize these machines. Topics covered include data-level parallelism, thread-level parallelism, GPU architectures, cache coherence, memory consistency, interconnection networks, reconfigurable computing and domain-specific parallel programming systems.

#### CENG 437 Introduction to Robotics

(3:3:0)

Pre-requisite(s): CENG 431 or CSCI 315

This course introduces fundamentals of robot modelling and control. Topics include forward and inverse kinematics, Jacobians, trajectory design, motion planning, in addition to relevant applications and technologies such as mobile robotics, industrial robotics and computer vision.

#### CENG 461 Network Security

(3:3:0)

Pre-requisite(s): MATH 225 and CSCI 462 or ECEN 462

This course examines information security services and mechanisms in a network context. Cryptographic tools such as message authentication codes, hash functions, digital signatures, and digital certificates are covered. Also, the course includes other topics such as access control, intrusion detection, database security, Internet security, and common threats on them.

#### CENG 466 Wireless Communications and Networking

(3:3:0)

Pre-requisite(s): CSCI 462 or ECEN 462

This course covers fundamental principles underlying wireless communications and networking. Topics covered include wireless transmission principles, protocols, satellite communications, cellular wireless networks, cordless systems, the wireless local loop, mobile IP, and wireless networking technologies, including IEEE 802.11 and Bluetooth standards.

## CENG 492 Senior Design Project I

(2:0:6)

Pre-requisite(s): Senior Standing

Co-requisite: ECEN 491

The course requires seniors to work in small teams to solve significant problems. Over the duration of CENG 492 and CENG 493, students design, implement, and evaluate a solution to the problem in conjunction with a faculty advisor. The course reinforces gained design principles and serves as a capstone for computing knowledge obtained in the BSCE curriculum. The recognition of the ethical and legal principles are also aspects of the course.

## CENG 493 Senior Design Project II

(4:0:12)

Pre-requisite(s): CENG 492

Implementation of the project for which preliminary work was done in CENG 492. Project includes designing and constructing software and/or hardware, conducting experiments or studies, and testing and validating a complete system. At the end of the term, each team presents to a committee information related to its project in both written and oral formats.