II. UNDERGRADUATE COURSES (COURSE DESCRIPTIONS)

DEPARTMENT OF COMPUTER ENGINEERING

CMPE 100 Introduction to Computer Engineering

A series of seminars are held in current topics and areas of specialization in Computer Engineering. Speakers are invited from different departments of EMU including Computer Engineering Department or other International Universities, Industry and Consulting firms, to deliver seminars in all aspects of engineering that are not normally covered in the lecture courses.

CMPE 101 Foundations of Computer Engineering

This course introduces the student to the fundamental concepts of the computer engineering discipline. Topics covered include: Computers and information processing - notion of computers, concepts of data and information, applications of computers, history of computing. Computer hardware - CPU, memory, input/output interface, secondary storage, ports, types of computer systems, computer software - system software, utilities, application software, data communication, an overview of operating systems. General Problem Solving Concepts: basic data types, constants and variables, basic operators and expressions, algorithms, pseudo codes, and flow charts, sequential, and conditional problem solving (IF statements and CASE logic), looping (WHILE/WHILE-END, REPEAT-UNTIL, FOR structures), formatted output, examples in C programming language. (Pre-requisite: none)

CMPE 112 Programming Fundamentals

An overview of C programming language, Sequential structure Data types and classes of data, arithmetic operators and expressions, assignment statements, type conversions, simple I/O functions (printf, scanf, fprintf, fscanf, gets, puts, fgets, fputs). Selective structure Relational operators, logical operators, conditional expression operator, conditional statements (if, switch). Repetitive structures While, do-while, for loops, loop interruptions (goto, break, continue), Null statement, comma operator. Functions Function definition and function call, external variables, storage classes, recursion. Arrays Array declaration, array initialization, arrays as function arguments. Pointers Basics of pointers, functions and pointers, arrays and pointers, strings and pointers, library functions for processing strings, pointer arrays. Structures Basics of structures, structures and functions, arrays of structures. (Pre-requisite: CMPE 101)

CMPE 211 Object-Oriented Programming

of structures, class declarations, constructors, constructor initialization lists. Class destructor, member access specifiers public and private, const member functions, friend functions and classes, static data and function members. Operator Overloading. Fundamentals and restrictions of operator overloading, this pointer, overloading unary and binary operators. Composition and Inheritance. Base classes and derived classes, protected class members, virtual functions and polymorphism, virtual destructors, private access vs. protected access, abstract base classes. Revision of the material discussed in the course. (Pre-requisite: CMPE 112)

**CMPE 223 Digital Logic Design**

(4, 1) 4


**CMPE 224 Digital Logic Systems**

(4, 1) 4


**CMPE 226 Electronics for Computer Engineers**

(4, 1) 4

CMPE 231 Data Structures


CMPE 242 Operating Systems

Operating system definition, simple batch systems, multiprogramming, time-sharing, personal computer systems, parallel systems. introduction to process, process scheduling, operations on processes, cooperating processes, interprocess communications, interrupts, process synchronization, critical-section problem, atomic instructions, semaphores, synchronization problems, CPU scheduling, scheduling criteria and algorithms, multiple processes and real-time scheduling, algorithm evaluation, deadlocks, characterization and handling of deadlocks, deadlock prevention avoidance and detection, deadlock recovery, memory management and virtual memory, address spaces, swapping, memory allocation, paging, segmentation, file-systems, file concepts, access methods, directory structure. (Pre-requisite: CMPE 112)

CMPE 318 Principles of Programming Languages


CMPE 321 Signals and Systems for Computer Engineers

Fundamental concepts of signals and systems for computer engineers with focus on discrete-time systems. Sinusoids, complex numbers, spectrum representation, sampling, frequency response, filters, and the z-Transform. Digital signal processing of multimedia signals. (Pre-requisite: CMPE 226)

CMPE 323 Microprocessors

Introduction to computing: Inside the computer, CPU-RAM-ROM. 80x86 microprocessor: short history, registers, mov and add instructions, program segments, data segments, logical and physical addresses, stack, push, pop, flag register, addressing modes. Assembly Language Programming: Directives, .asm, .lst, .obj, .map, linking, and .exe files, control transfer instructions, data types and data definition. Arithmetic Logic Instructions: unsigned multiplication and division, unsigned, signed, bcd, packed-bcd and ascii number conversion, rotate and shift instructions. Bios and DOS programming: bios display and keyboard interrupts, int 21h dos function calls. Macro definitions: mouse button and cursor position. 8088 PC/XT expansion slot, 80286 and the ISA bus, Memory and memory interfacing: EPROM, SRAM and DRAM devices, address decoding circuits, ISA bus memory interfacing. Memory mapped and Isolated I/O methods and device interfacing: ISA bus I/O address decoding and simple I/O ports, Programmable
Peripheral Interface 8255 and LED, 7-segment display, switch, button, keypad, stepper motor interfacing. D/A converters, A/D converters. Hardware Interrupts: NMI and INTR pins, interrupt servicing and TSR programs. Serial Data Communication and 8251 USART. (Pre-requisite: CMPE 224)

CMPE 324 Computer Architecture and Organization (4, 1) 4

Introduction to RISC architecture, MIPS Instruction set: Representing instructions in the computer, Linkers, Supporting procedures in computer hardware, Passing the arguments to a procedure, Constant or immediate operands in MIPS, Addressing in branches and jumps in MIPS, MIPS addressing modes, MIPS assembly program. Integer Arithmetics: Negative number representations, Addition and subtraction, Logic operations, Constructing the Arithmetic Logic Unit (ALU), Multiplication algorithms, Division algorithms, Floating point arithmetic algorithms. Design Performance Measures: CPU performance, Evaluating the performance. Processor Data path: Logic conventions and clocking, MIPS single clock cycle implementation: (Building a datapath), The simple implementation scheme, The multiple clock cycle implementation, Designing the control unit for the multiple clock cycle implementation: Finite state machines (FSM) and Microprogramming. Enhancing Performance with Pipelining: A pipelined datapath, Pipelined control, Data hazards, Control for data hazards, Reducing data hazards, Branch hazards, Exceptions, Performance of pipelined systems. (Pre-requisite: CMPE 224)

CMPE 343 Systems Programming (4, 1) 4


CMPE 344 Computer Networks (4, 1) 4

CMPE 354 Database Management Systems (4, 1) 4

This course introduces the student to the fundamentals of database management. Topics covered include: the Entity-Relationship model; the Relational model and its mathematical foundations; most important features of Structured Query Language (including basic structure, aggregate functions, nested queries, index definition, stored procedures and functions, views, database modification, domain constraints, assertions, triggers, transaction definition, data definition language, granting privileges, security), query languages Datalog and QBE; Object-Oriented and Object-Relational databases; design principles of Relational databases (normal forms, functional dependencies, decomposition). (Pre-requisite: CMPE 231)

CMPE 371 Analysis of Algorithms (4, 1) 4


CMPE 400 Summer Practice (-, -) 0

As a part of the fulfillment of the graduation requirements, all students must complete 40 work days of summer training after the second and/or third year, during summer vacations. The summer training should be carried out in accordance with the rules and regulations set by the department. (3rd/4th year standing)

CMPE 405 Graduation Project I/II (-, -) 1

The main aim of this course is to involve a student, as a team member and under the supervision of an instructor, in a preferably interdisciplinary capstone design project. The project, to be completed in CMPE406, includes a technical survey, the problem description and formulation, and detailed preliminary design documentation for the solution of a realistic computer engineering problem. It is an extended exercise in the professional application of the skills and experience gained in the undergraduate program. Students form teams, and each team chooses exactly one topic proposed by course instructors, and is expected to present its progress in the form of reports and presentation, both during the semester and at the end of the semester.

CMPE 406 Graduation Project II/II (-, -) 3

This course is the sequel to CMPE405. It consists in the implementation of a realistic, preferably interdisciplinary, engineering capstone project emphasizing engineering design principles on a computer engineering topic. It is carried out by a team of students under the supervision of an instructor. The team must complete the detailed design and implementation of the preliminary design they started in the CMPE 405 course. It is an extended exercise in the professional application of the skills and experience
gained in the undergraduate program. The team has to make a presentation and submit a detailed final report which documents the design, implementation and testing. (Pre-requisite: CMPE 405)

CMPE 412 Software Engineering

The software life cycle and the phases in software development: Project scheduling, feasibility study, analysis, specification, design, implementation, testing, quality assurance, documentation, maintenance. Management issues: Planning, organization, control. Also included are formal specification techniques, structured programming, modular system design and other current issues. (Pre-requisite: CMPE 211)

CMPE 413 Compiler Construction

This area elective course mainly focuses on the following topics: Introduction to compilers, A simple one-pass compiler, Lexical analysis, Syntactic specification of programming languages, The parsing problem, top-down and bottom-up parsing, Syntax-directed translation, Symbol tables, Run time environment and storage administration, Code generation and optimization, Compiler development (Pre-requisite: CMPE 318)

CMPE 414 Modern Programming Platforms

This course covers software development in the .Net framework and the C# programming language that makes full use of this framework and has all the important features that a modern language should have. The topics include the philosophy of the .Net framework and the .Net class library, object-oriented programming, event handling, graphical user interfaces, graphics and media, multithreading, exception handling, strings and characters, files and database connections. (Pre-requisite: CMPE 211)

CMPE 415 Visual Programming

The main concern of this course is to teach Graphical User Interface, event-driven programming and object-oriented programming for Windows and Internet environments with a visual programming language. Windows Presentation Foundation (WPF) Graphical User Interface, WPF Graphics and Multimedia, XML and XAML, Strings, and Database and Web Application development will also be introduced. (Pre-requisite: CMPE 231)

CMPE 416 Object-Oriented Programming and Graphical User Interfaces

The purpose of this course is to expose the Object Oriented Programming approach and its use in building Graphical User Interfaces. It will be done in fact through the presentation of the JAVA language. The student is to learn the language structure of JAVA, its object oriented aspect, the similarities and differences with C. He must also acquire a practical programming experience in Java through a number of exercises and projects. Concerning the applications of the language, we will focus on the implementation of Graphical User Interfaces as well as animation programs. Blueprints and a practical object oriented development methodology will be given for such applications. (Pre-requisite: CMPE 211)

CMPE 417 Advanced Topics in C

New C99 Standard (ISO/IEC 9899:1999). Historical notes (ANSI C committee & Numerical C Extensions Group, NCEG), borrowings from C++, new keywords and new types, headers stdint.h and inttypes.h, implicit/explicit int type, conversion specifiers in functions printf( ) and scanf( ), new preprocessor features, variable length arrays (VLA), designated initializers, declarations and executable statements within the block, etc. C Interfaces and Implementations. Memory management (automatic storage, static
storage, POD and non-POD objects, new and delete operators (C++) – examples of usage, guidelines for effective memory management). Key facts about pointers, using heap and stack, dynamic arrays, common memory usage errors, restricted pointers, pointers to functions, pointers to members (C++).


CMPE 418 Internet Programming

This course is an introduction to the tools, technologies, and languages used for the design and implementation of Web applications. Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), Extensible Markup Language (XML), Extensible Stylesheet Language transformations (XSLT), JavaScript and AJAX are covered for programming on the client side. XML Web services, a scripting language and the corresponding Web application development environment, session tracking, and using database are covered for programming on the server side. (Pre-requisite. CMPE354)

CMPE419 Mobile Application Development

This course is an introduction to mobile device programming that will cover the fundamental programming principles, software architecture and their development environments. Event-driven programming, object-oriented programming, graphical user interface design, database programing and developing Internet based applications for mobile devices will be the main topics of this course.

CMPE 421 Parallel Computer Architecture

This course discusses various processing techniques used to improve the performance of computing systems. MIPS architecture is considered as an example to Pipelined processing. Memory issues and cache memories are discussed, followed by main topics of parallel processing including a taxonomy of parallel computers, interconnection schemes, single-bus MIMD’s and networked MIMD’s. Memory bottleneck, memory consistency models and cache coherence issues are also considered. (Pre-requisite: CMPE 324)

CMPE 422 Microprocessor Systems

This unit aims to study the main aspects in microprocessor systems; Microprocessors: CISC and RISC microprocessor concepts. The Intel 80386 microprocessor: Addressing and memory, segmentation, and protection mechanisms. Tasking, virtual memory, and exceptions. The Motorola 68030 microprocessor: The user programming model. The 68030 supervisor state. (Pre-requisite: CMPE 323)

CMPE 423 Embedded System Design

The objective of the course is to introduce the concept of Harvard + RISC architecture microcontrollers and design of embedded computing systems on typical applications including interrupts, timers, LCD and LED displays, keypads, a/d converters, rotary coders, stepper motors, serial and parallel communication interfacing. The design applications are introduced on a very widely used typical 16-bit embedded microcontroller unit, PIC18F452. The scope of the course is the simple, distinct PIC18F452 embedded
system design with the applications in C and RISC assembly programming. The design/theory scale of
the course is around 60/40. (Pre-requisites: CMPE 224)

CMPE 424 Introduction to Image Processing

Introduction to image processing, digital image fundamentals, image enhancement, image restoration,
image analysis, segmentation, image compression. (Pre-requisite: CMPE 321)

CMPE 426 Digital Signal Processing

Course topics are as follows: Discrete-Time Signals, Discrete-Time Systems, Z-Transform, Frequency
analysis of Continuous-Time and Discrete-Time Signals, Frequency Domain Sampling, The Discrete
Fourier Transform (DFT), Efficient Computation of the DFT: FFT Algorithms, Realization of Discrete-
Time Systems, Design of FIR and IIR digital Filters, Adaptive digital filtering applications. Course
objective is to introduce the fundamentals of digital signal processing. The emphasis will be on analysis
tools, the design of digital filters, and on the computation of the Discrete Fourier Transform (DFT). The
theory developed in class will be confirmed by computer programming using MATLAB simulation
package. (Pre-requisite: CMPE 321)

CMPE 427 Hardware Realization of Algorithms

The course introduces students to the key ideas and concepts of fast hardware implementation of
algorithms in contrast to software realization. The organization of designing hardware is studied including
hardware description languages, hardware-oriented algorithms and CAD-systems for FPGA
implementation. Active student participation is expected for the successful completion of this course.
Students must attend the lectures regularly and are responsible for all the reading assignments,
homework, quizzes and other materials discussed in class. (Pre-requisite: CMPE 224)

CMPE 443 Real-time System Design

Course goal is to introduce students to key ideas, concepts and tools of Real-time systems design.
Introduction to real-time systems, ADA programming, architecture and design of real-time systems,
concurrent programming and synchronization, real-time scheduling, reliability and exception handling,
real-time OS, and distributed real-time systems. (Pre-requisite: CMPE 242)

CMPE 444 Data Communications

This course concentrates on the exchange of data between devices. The key aspects of transmission,
interfacing, link control, and multiplexing will be examined. The course then will proceed with wide area
networks in examining the internal mechanisms and user network interfaces that have been developed
to support voice, data, and multimedia communications. The traditional technologies of packet switching
and circuit switching will be examined, as well as the more recent ATM. (Pre-requisite: CMPE 344)

CMPE 445 Internet Architecture and Protocols

Addressing and routing datagrams in the Internet. Internet Control Message Protocol (ICMP) for
dissemination of error and control messages. Transport layer, UDP and TCP protocols. Flow control and
congestion control in TCP. Stream Control Transport Protocol (SCTP) for new applications. Routing
protocols and communication between routers. Multicasting in the Internet and creation of multicast
trees. Multicast routing protocols. Monitoring and managing IP networks with Simple Network

**CMPE 446 Networked computing**

Peer-to-peer (P2P) systems, Grids and Web services represent recent innovations in distributed networked computing on top of the Internet. In particular, in a P2P system, interacting entities are peer processes that perform in collaboration a broad range of tasks on remote data discovery, storage and management. Grid represents a distributed computing infrastructure for accessing computing resources for advanced science and engineering. Together, on the base of computing resources, that are available in the Internet, these technologies can be used to create a globally distributed and coordinated environment for the solution of those information processing tasks that require a huge size of memory and a super-high throughput. This course aims to give undergraduates the basic knowledge of these technologies and prepare students for a range of careers within this emerging area of the global networked computing industry. The course brings together information related to P2P systems, Grids and Web services. It will show, how these technologies can be used in science, research and industry. The experience, obtained by students during this course is a prerequisite for any professional work related to the design, implementation and usage of the highly effective networked computing systems and distributed applications. (Pre-requisite: CMPE 344)

**CMPE 447 Fiber Optic Computer Communication**

This course will describe the basic principles of fiber optics, light propagation theories, attenuation of optical fibers, dispersion and dispersion compensation of fiber optics. In addition, optical fiber transmitters, receivers and fiber optic system design are also discussed. Finally, an introduction to fiber optic network is considered. (Pre-requisite: CMPE 344)

**CMPE 451 Information Security**

Information security requirements, security threats, attacks, and methods providing information protection, discretionary and mandatory access models. Malicious software. Symmetric and asymmetric cryptographic methods, DES, AES, RSA. Authentication, digital signature, certificates, one-time passwords, hash functions. Practical aspects of information security in operating systems, databases, network applications.

**CMPE 461 Artificial Intelligence**

CMPE 462 Functional and Logic Programming

This course is about the two main declarative programming paradigms, namely functional and logic. Prolog will be taught as a representative of the Logic programming paradigm, and ML will be the language used to demonstrate the functional paradigm. (Pre-requisite: CMPE 218)

CMPE 466 Computer Graphics

Fundamentals of computer graphics. Topics include graphics hardware and software, basic raster graphics algorithms, 2D and 3D geometric transformations, 2D and 3D viewing, color and illumination models, texture mapping. Programming examples in C/C++ and OpenGL. (Pre-requisite: CMPE 211)

CMPE 471 Automata Theory


CMPE 474 Performance Analysis of Computer Systems and Networks


CMPE 475 Operations Research

This course focuses on: Linear programming. Solution techniques of linear programs. The transportation problem. Project scheduling by critical path method. Nonlinear programming. Integer programming. (Pre-requisite: MATH 241)

CMPE 476 System Simulation


MATH 151 Calculus I


MATH 152 Calculus II


MATH 163 Discrete Mathematics

Set theory, functions and relations; introduction to set theory, functions and relations, inductive proofs and recursive definitions. Combinatorics; basic counting rules, permutations, combinations, allocation problems, selection problems, the pigeonhole principle, the principle of inclusion and exclusion. Generating functions; ordinary generating functions and their applications. Recurrence relations; homogeneous recurrence relations, inhomogeneous recurrence relations, recurrence relations and generating functions, analysis of algorithms. Propositional calculus and boolean algebra; basic boolean functions, digital logic gates, minterm and maxterm expansions, the basic theorems of boolean algebra, simplifying boolean function with karnaugh maps. Graphs and trees; adjacency matrices, incidence matrices, eulerian graphs, hamiltonian graphs, colored graphs, planar graphs, spanning trees, minimal spanning trees, Prim's algorithm, shortest path problems, Dijkstra's algorithms. (Pre-requisite: none)

MATH 241 Linear Algebra and Ordinary Differential Equations

Linear Algebra; Matrix algebra, special matrices and row operations, Gaussian elimination method, determinants, adjoint and inverse matrices, Cramer's rule, linear vector spaces, linear independence, basis and dimension. First order ordinary differential equations; definitions and general properties of solutions, separable, homogeneous and linear equations, exact equations and integration factors. Higher order equations with constant coefficients; Basic theory and the method of reduction of order, second order homogeneous equations with constant coefficients, nonhomogeneous equations, the method of undetermined coefficients, the method of variation of parameters, the Cauchy-Euler equations. Power series solutions; classification of points, ordinary and singular points, power series solutions about ordinary points, power series solutions about regular singular points, the method of frobenuis. Systems of differential equations; general properties of constant coefficient systems, eigenvalues and eigenvectors, diagonalizable matrices, solutions of linear systems with constant coefficients. Boundary value problems. (Pre-requisite: MATH 152)

MATH 322 Probability and Statistical Methods

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<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 373</td>
<td>Numerical Analysis for Engineers</td>
<td>(3, 1) 3</td>
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<tr>
<td>PHYS 101</td>
<td>Physics I</td>
<td>(4, 1) 4</td>
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<tr>
<td>PHYS 102</td>
<td>Physics II</td>
<td>(4, 1) 4</td>
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<tr>
<td>ENGL 191</td>
<td>Communication in English – I</td>
<td>(3, 1) 3</td>
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<td></td>
<td>The contents of the GEED192 course do not appear to exclusively focus on English language development. Instead they are becoming tutorials for the Critical Thinking Skills Courses. (Pre-requisite: none)</td>
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<tr>
<td>ENGL 192</td>
<td>Communication in English – II</td>
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<tr>
<td>ENGL 201</td>
<td>Communications Skills</td>
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<td></td>
<td>EFL 201/203/205 is a second year Basic/Mainstream/Advanced Communication Skills course for students at the Faculty of Engineering. The course aims to introduce a range of skills, including effective written and oral communication, research skills and study skills. Throughout the course the students will be involved in project work intended to help them in their immediate and future academic and professional life. This will include library research, technical report writing and an oral presentation. By investigating a topic of their own choice, students will develop their understanding of independent research skills. During the report writing process, students will improve their writing and develop the ability to produce organized, cohesive work. The oral presentation aims to enhance spoken fluency and accuracy and provide training in the components of a good presentation. (Pre-requisite: ENGL192)</td>
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<td>IENG 355</td>
<td>Ethics in Engineering</td>
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<td>This course is designed to introduce moral rights and responsibilities of engineers in relation to society, employers, colleagues and clients. Analysis of ethical and value conflict in modern engineering practice. Importance of intellectual property rights and conflicting interests. Ethical aspects in engineering design, manufacturing and operations. Cost benefit-risk analysis, safety and occupational hazard considerations. (Pre-requisite: none)</td>
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IENG 420 Engineering Economy


IENG 450 Industrial Management

The objective of this course is to equip engineers with the necessary modern managerial skills, which are essential to increase productivity in organizations through employee empowerment and effective communication, to develop plans that will put the organization ahead of the international marketing game, to overcome obstacles to personal and professional growth, to attain organizational strategic goals, and to develop action plans for organizational change. (Pre-requisite: none)

HIST 280 History of Turkish Reforms

A history of the foundation of the Turkish Republic under the light of Kemal Atatürk's principles. A required course for all Turkish students (This course is given in Turkish). (Pre-requisite: none)

TUSL 181 Introduction to Turkish Language

TURK 100/199 is a Basic Turkish course introducing the Turkish language. It incorporates all four language skills and provides an introduction to basic grammar structures. Students will be encouraged to develop their writing skills through a variety of tasks. The aim of this course is for students to be able to understand and communicate in everyday situations, both in the classroom and in a Turkish-speaking environment. (Pre-requisite: none)