1. CMPE100 Introduction to Computer Engineering

A series of seminars are held in current topics and areas of specialization in Software 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.

Credits: (0 / 0 / 2) 0 Prerequisites: None
ECTS: 1

Abbreviated Title: Introduction to Computer Engineering Category: Faculty Core Course Teaching Language: English

Keywords: Computer Engineering

Department offering the course: Computer Engineering

2. CMPE107 Foundations of Computer Engineering

Design of computer algorithms with pseudo-code to solve problems, analyze engineering related problems using computer. Basic elements of a high level computer programming language: Data types, constants and variables, arithmetic and logical operators and expressions. Fundamental components of Python programming language: Storing and manipulating user-input data, design and use of selection structures, design and use of repetition structures, lists and other data structures, functions, modular designs, dictionaries and sets, file input/output.

Credits: (4 / 1 / 0) 4 Prerequisites: None ECTS:7

Abbreviated Title: Foundations of Computer Engineering Category: Area Core Course Teaching Language: English

Keywords: Computer Engineering

Department offering the course: Computer Engineering

3. CMPE112 Programming Fundamentals

An overview of C programming language. Sequential structures, 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 structures, relational operators, logical operators, conditional expression operator, conditional statements (if, switch). Repetitive structures, while, do-while, for loops, loop interruptions (goto, break, continue). Functions, function definitions and function calls. 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.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE107 ECTS:7

Abbreviated Title: Programming Fundamentals Category: Area Core Course Teaching Language: English

Keywords: Computer programming

Department offering the course: Computer Engineering

4. CMPE211 Object-Oriented Programming

Basics of Java programming language. Introduction to object-oriented programming. Classes, objects, methods, access modifiers (private, public, protected). Class derivation, abstract classes, interfaces,

static class members. Inheritance, encapsulation, polymorphism. Object construction and destruction, namespaces, exception handling. Function overloading and overriding, container classes, template classes. Unified Modeling Language (UML) class diagrams.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE112 ECTS:7

Abbreviated Title: Object-Oriented Programming Category: Area Core Course Teaching Language: English

Keywords: Object-oriented programming

Department offering the course: Computer Engineering

5. CMPE223 Digital Logic Design

Binary Systems (Binary Numbers, Octal and Hexadecimal Numbers, Number Base Conversions, Complements, Signed Binary Numbers, Binary Codes, Binary Logic). Boolean Algebra and Logic Gates (Basic Definitions, Basic Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms. Simplification of Boolean Functions (The Map Method, Two- Three- and Four-Variable Maps, Product of Sums Simplification, NAND and NOR Implementation, Other Two-Level Implementations, Don't-Care Condition). Combinational Logic (Design Procedure, Adders, Subtractors, Code Conversion, Analysis Procedure, Multilevel NAND Circuits, Multilevel NOR Circuits, Exclusive-OR Functions). MSI Components (Binary Adder and Subtractor, Decimal Adder, Decoders and Encoders, Multiplexers). Synchronous Sequential Logic, Flip-Flops, Analysis of Clocked Sequential Circuits. Design of Clocked Sequential Circuits: Design Procedure, State Reduction, State Assignment and FF Excitation Tables.

Credits: (4/ 1 / 0) 4 Prerequisites: MATH163 ECTS: 7

Abbreviated Title: Digital Logic Design Category: Area Core Course Teaching Language: English

Keywords: Digital Logic Design

Department offering the course: Computer Engineering

6. CMPE224 Digital Logic Systems

Registers. Design and analysis of synchronous counters. Design and analysis of ripple counters. Algorithmic state machines (ASM). Design of control and datapath units using ASM. Introduction to computer architecture. A generic RISC processor architecture and its associated Assembly programming language.

Credits: (4 / 1 / 0) 4 ECTS:7 Prerequisites: CMPE223

Abbreviated Title: Digital Logic Systems Language: Category: Area Core Course Teaching English

Keywords: Digital Logic Systems

Department offering the course: Computer Engineering

7. CMPE226 Electronics for Computer Engineers

Circuits, currents and voltages, power and energy, Kirchoff's current and voltage laws. Circuit elements and circuits. Resistive circuits: resistance in series and parallel, resistive network analysis by series and parallel equivalents, node and mesh analysis. Thevenin and Norton equivalents. Superposition. Inductance and Capacitance, physical characteristics, practical capacitor and inductors. Basic diode concepts: Zener diode, Ideal diode model, rectifiers and waveshaping. Basic amplifier concepts cascaded, ideal, and differential amplifiers offset voltage, bias current and offset current. Bipolar

Junction Transistors: Current and voltage relationship, common emitter characteristics, pnp BJT LargeSignal DC Circuit models. Common Emitter amplifiers. Emitter Follower. Operational Amplifiers: ideal OPAmp, summing point, inverting and noninverting amplifiers, Nonlinear imperfection, Differential and Instrumentation Amplifiers, Integrators and Differentiatiors. Logic Circuits: Basic concepts: TTL and CMOS implementation of logic gates.

Credits: (4 / 1 / 0) 4 Prerequisites: MATH241 ECTS:7

Abbreviated Title: Electronics for Computer Engineers Category: Area Core Course Teaching Language: English

Keywords: Electronics for Computer Engineers

Department offering the course: Computer Engineering

8. CMPE231 Data Structures

Primitive data structures. Arrays of structures, self-referential structures, structures and functions in C programming language. Dynamic memory allocation. Stack as an abstract data type, primitive stack operations, representing the stack in C. Infix, postfix, and prefix notations; infix-to-postfix conversion using the stack. Recursion and recursive function definition. Recursion versus iteration; examples: factorial function, Fibonacci sequence, binary search, the towers of Hanoi problem. The queue as an abstract data type, C implementation of queues. Linked Lists: inserting and removing nodes from a list, linked list implementation using dynamic variables in C, circular and doubly linked lists, linked implementation of stacks and queues. Binary trees, operations on binary trees, tree traversals, binary search trees, deleting nodes from a binary search tree, tree representation of expressions. Sorting, the O notation, bubble sort, quick sort.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE112 ECTS:6

Abbreviated Title: Data Structures Category: Area Core Course Teaching Language: English

Keywords: Data structures

Department offering the course: Computer Engineering

9. CMPE242 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, basic concepts of threads, 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.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE112 ECTS:7

Abbreviated Title: Operating Systems Category: Area Core Course Teaching Language: English

Keywords: operating systems

Department offering the course: Computer Engineering

10. CMPE312 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.

Credits: (4 / 1 / 0) 4 ECTS:7 Prerequisites: CMPE211

Abbreviated Title: Software Engineering Teaching Category: Area Core Course
Language: English
Keywords: Software Engineering

Department offering the course: Computer Engineering

11. CMPE321 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.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE226 ECTS:6

Abbreviated Title: Signals and Systems for Computer Engineers Category: Area Core Course Teaching
Language: English

Keywords: Signals and Systems for Computer Engineers

Department offering the course: Computer Engineering

12. CMPE325 Computer Architecture and Organization

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.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE224
ECTS:7

Abbreviated Title: Computer Architecture and Organization Category: Area Core Course Teaching
Language: English

Keywords: Computer Architecture and Organization

Department offering the course: Computer Engineering

13. CMPE326 High End Embedded Systems

Application areas, common characteristics, and challenges in embedded system design. Requirement specification, models of computation and modeling methods such as automata, and statecharts, data flow modeling. Embedded system hardware, ASICs, processors, memories, communication, conversion

between analog and digital inputs and outputs, sampling, and actuators, secure hardware. Embedded operating systems, general requirements, RTOS, virtual machines, real time databases. IoT projects and implementation. Evaluation and validation, performance evaluation, energy and power models, simulation, rapid prototyping, emulation. Test, test pattern generation, evaluation of test patterns, design for testability.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE224 ECTS:6

Abbreviated Title: High End Embedded Systems Category: Area Core Course
Teaching Language: English

Keywords: High End Embedded Systems

Department offering the course: Computer Engineering

14. CMPE342 Client / Server Programming

This course is an introduction to the tools, technologies, and languages used for the design and implementation of Web applications. This course covers the following topics: Hypertext Markup Language (HTML), a client side Web programming language (e.g. JavaScript), multithreaded programming, a server side Web programming language (e.g. ASP.Net) and Graphical User Interface (GUI). Group projects will also be given in the course.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE231
ECTS:7

Abbreviated Title: Client / Server Programming Category: Area Core Course Teaching Language: English

Keywords: Client / Server Programming

Department offering the course: Computer Engineering

15. CMPE344 Computer Networks

Introduction to fundamental concepts of computer networks. Basic performance and engineering tradeoffs in the design and implementation of computer networks. Network hardware/software, protocols and layers, OSI and TCP/IP reference models. Data link layer design issues including encoding, framing, error detection, reliable delivery, and multiple accesses. Multiplexing, switching, and routing. LANs, wireless LANs, cellular networks. TCP/IP protocol family. Network applications. New trends in computer communication networks.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE242-MATH322 ECTS:6

Abbreviated Title: Computer Networks Teaching Language: English
Category: Area Core Course

Keywords: Computer Networks

Department offering the course: Computer Engineering

16. CMPE353 Database Management Systems

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).

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE231
ECTS:6

Abbreviated Title: Database Management Systems Category: Area Core Course Teaching Language: English

Keywords: Database Management Systems

Department offering the course: Computer Engineering

17. CMPE371 Analysis of Algorithms

Definition and properties of Algorithms. Design, analysis, and representation of Algorithms. Data abstraction. Pseudo code conventions. Models of computation. Mathematical Foundations: Growth of functions, asymptotic notations. Study of recursive algorithms and associated recurrence relations (substitution method, iteration method, master method, recursion trees). Design paradigms for algorithms: Brute-Force (Exhaustive Search), Divide-and-Conquer (Merge Sort, Binary Search Tree) Dynamic Programming (Matrix-Chain multiplication, LCS-length, 01-Knapsack Problem). Greedy algorithms (Greedy Activity Selector, Fractional Knapsack Problem). Graph Algorithms: Representation of sets and graphs. Breadth-first search, depth-first search. Minimum spanning trees. Single-source shortest paths. All-pairs of shortest paths.
Credits: (4 / 0 / 1) 4 ECTS:6 Prerequisites: CMPE231

Abbreviated Title: Analysis of Algorithms
Language: English

Keywords: Analysis of Algorithms

Category: Area Core Course Teaching

Department offering the course: Computer Engineering

18. CMPE400 Summer Practice

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)

Credits: (0 / 0 / 0) 0 Prerequisites: None ECTS:1

Abbreviated Title: Summer Practice Category: Faculty Core Course Teaching
Language: English

Keywords: Summer Practice

Department offering the course: Computer Engineering

19. CMPE 405 Graduation Project I/II

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.

Credits: (1 / 0 / 0) 1 Prerequisites: None ECTS:1

Abbreviated Title: Graduation Project I/II Category: Faculty Core Course Teaching Language: English

Keywords: Graduation Project I/II

Department offering the course: Computer Engineering

20. CMPE 406 Graduation Project II/II

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 6 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.

Credits: (3 / 0 / 1) 3 Prerequisites: CMPE405 ECTS:8 Abbreviated Title: Graduation Project II/II Language: English

Keywords: Graduation Project II/II

Category: Faculty Core Course
Teaching

Department offering the course: Computer Engineering

21. CMPE 410 Principles of Programming Languages

Evolution of programming languages and concepts. Syntax and semantics of programming languages. Context-free grammars. Lexical analysis. Syntax analysis. Top-down vs. bottom-up parsing. LR parsing tables. Names, scope and lifetime. Expressions. Statements. Subprogram linkage. Stack implementation of subprogram calls. Parameter passing methods. Object oriented concepts. Implementation of inheritance: virtual method tables. Concurrency. Exception handling. Functional or Logic programming.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE211
ECTS:7

Abbreviated Title: Programming Languages Category: Area Core Course Teaching Language: English

Keywords: programming languages

Department offering the course: Computer Engineering

22. CMPE 413 Compiler Construction

This area elective course mainly focuses on the following topics; Introduction to compilers, A simple onepass 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.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE211 ECTS:6

Abbreviated Title: Compiler Construction Teaching Category: Area Elective Course
Language: English

Keywords: Compiler Construction

Department offering the course: Computer Engineering

23. CMPE 414 Modern Programming Platforms

This course introduces fundamentals of Python programming language for developing particular artificial intelligence applications. The following topics will be covered: Control Statements and programming development, functions, lists, tuples, dictionaries, sets, array-oriented programming, strings, files, recursion, searching, sorting, database, graphical user interface, natural language processing, classification, regression, clustering and deep learning.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE231
ECTS:6

Abbreviated Title: Modern Programming Platforms Category: Area Elective Course Teaching Language: English

Keywords: Modern Programming Platforms

Department offering the course: Computer Engineering

24. 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.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE231 ECTS:6

Abbreviated Title: Visual Programming Category: Area Elective Course Teaching Language: English

Keywords: Visual Programming

Department offering the course: Computer Engineering

25. CMPE416 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE211 ECTS :6

Abbreviated Title: Object-Oriented Programming and Graphical User Interfaces
Category: Area Elective Course

Teaching Language: English

Keywords: Object-Oriented Programming and Graphical User Interfaces

Department offering the course: Computer Engineering

26. 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 7 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++). Date and Time Library. Retrieving current time, breaking into tokens, time differences and time zones, measuring execution time. Traditional Error-handling methods. C-based Approaches to Handling Errors (exit( )/atexit( ), assert( ), return, setjmp( )/ longjmp( )). Reliability of the code. Exceptions and Assertions. Exceptions and Performance. Misuses of Exception Handling. Manual code optimization. Exceptions during construction and destruction (C++). Advanced Exception handling Techniques (C++). Rapid Sorting Techniques. Sorting Algorithms (fundamentals). Brief discussion of Insertion, Shell, Quick, etc. sorting techniques. Comparison and implementations.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE211 ECTS :6

Abbreviated Title: Advanced Topics in C Category: Area Elective Course Teaching Language: English

Keywords: Advanced Topics in C

Department offering the course: Computer Engineering

27. CMPE 418 Internet Programming

This is an advanced course for 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 (such as VB.Net and C#) and the corresponding Web application development environment, session tracking, and using database are covered for programming on the server side.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE353 ECTS :6

Abbreviated Title: Internet Programming Category: Area Elective Course Teaching Language: English

Keywords: Internet Programming

Department offering the course: Computer Engineering

28. 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE211 ECTS :6 Abbreviated Title: Mobile Application Development Category: Area Elective Course Teaching Language: English

Keywords: Mobile Application Development

Department offering the course: Computer Engineering

29. 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 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE325 ECTS :6

Abbreviated Title: Parallel Computer Architecture Category: Area Elective Course Teaching
Language: English

Keywords: Parallel Computer Architecture

Department offering the course: Computer Engineering

30. 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE224 ECTS :6

Abbreviated Title: Microprocessor Systems Category: Area Elective Course Teaching
Language: English

Keywords: Microprocessor Systems

Department offering the course: Computer Engineering

31. CMPE 423 Low End Embedded Systems

The objective of the course is to introduce the concept of Harvard + RISC architecture microcontrollers and design of low end 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. The scope of the course is the simple, distinct embedded system design with the applications in C and RISC assembly programming. The design/theory scale of the course is around 60/40.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE224 ECTS :6

Abbreviated Title: Low End Embedded Systems Category: Area Elective Course Teaching
Language: English

Keywords: Low End Embedded Systems

Department offering the course: Computer Engineering

32. CMPE 424 Introduction to Image Processing

Introduction to image processing, digital image fundamentals, image enhancement, image restoration, image analysis, segmentation, image compression.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE321 ECTS :6

Abbreviated Title: Introduction to Image Processing Category: Area Elective Course Teaching Language: English

Keywords: Introduction to Image Processing

Department offering the course: Computer Engineering

33. 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 DiscreteTime 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE321 ECTS :6

Abbreviated Title: Digital Signal Processing Category: Area Elective Course Teaching Language: English

Keywords: Digital Signal Processing

Department offering the course: Computer Engineering

34. 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE224 ECTS :6

Abbreviated Title: Hardware Realization of Algorithms Category: Area Elective Course Teaching Language: English

Keywords: Hardware Realization of Algorithms

Department offering the course: Computer Engineering

35. CMPE 428 Data Science

Introduction to data science process and its lifecycle. The role of data scientist, problem definition, data preparation, model planning and building, delivery of the results. Introduction to R and Rstudio. Graphical user interfaces, data import from different sources such as csv, xls, JSON, SPSS, SAS, ARFF and online sources (URLs). Attributes and their types. Vectors, matrices, lists and classes in R. Data frames and operations on data frames. Data Exploration and wrangling using R. Cleaning data. Data Visualization using ggplot2. Supervised versus unsupervised learning from data. Clustering for unsupervised learning. Supervised learning for regression and evaluation of the models in terms of degree of fit. Logistic regression models. Classification models. Decision trees and naïve Bayes classifier. Implementation of the classifiers and their evaluation. Performance metrics. Extraction and selection of attributes. Dimensionality reduction using principal component analysis and exploratory factor analysis. Selecting most discriminative attributes using forward and backward selection methods. Visualization of highdimensional data using principal components.

Credits: (4 / 1 / 0) 4 Prerequisites MATH322 ECTS :6

Abbreviated Title: Data Science Teaching Category: Area Elective Course
Language: English
Keywords: Data Science

Department offering the course: Computer Engineering

36. CMPE 429 Deep Learning

A brief review of data pre-processing, linear algebra, automatic differentiation and essential packages from Python. Basic elements of linear regression, loss functions and their optimization. Softmax regression, vectorization for minibatch-based training based on cross-entropy loss function. Introduction to convolution layers, multi-channel inputs and cross-correlation operations in convolutional neural network architectures. Input padding, convolution window striding, maximum and average pooling. Implementation of convolutional neural networks and discussions on widely used architectures such as AlexNet, GoogLeNet and ResNet. Modelling sequential data using recurrent neural networks (RNN). Modern recurrent neural networks employing gated recurrent units and long short-term memory, and their applications. Unsupervised learning using autoencoder architectures. Discussions on various types such as simple and sparse autoencoders and their implementations.

Credits: (4 / 1 / 0) 4 Prerequisites MATH241 ECTS :6

Abbreviated Title: Deep Learning Teaching Category: Area Elective Course
Language: English
Keywords: Deep Learning

Department offering the course: Computer Engineering

37. 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE242 ECTS :6

Abbreviated Title: Real-time System Design Category: Area Elective Course Teaching
Language: English

Keywords: Real-time System Design

Department offering the course: Computer Engineering

38. 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE344 ECTS :6

Abbreviated Title: Data Communications Category: Area Elective Course Teaching
Language: English

Keywords: Data Communications

Department offering the course: Computer Engineering

39. CMPE 445 Internet Architecture and Protocols

An overview of the Internet architecture and its TCP/IP reference model. Protocols of the network layer. 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. Protocols for real-time applications. Voice and video over IP. Resource reservation and quality of service. IPv6 protocol and trends in the evolution of the Internet. Monitoring and managing IP networks with Simple Network Management Protocol (SNMP). Securing TCP/IP environments. Diagnostic tools and protocol analyzers for the Internet.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE344 ECTS :6

Abbreviated Title: Internet Architecture and Protocols Category: Area Elective Course Teaching Language: English

Keywords: Internet Architecture and Protocols

Department offering the course: Computer Engineering

40. CMPE 446 Networked computing

This course aims to give undergraduates the basic knowledge of network 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE344 ECTS :6

Abbreviated Title: Networked computing Category: Area Elective Course Teaching Language: English

Keywords: Networked computing

Department offering the course: Computer Engineering

41. 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE344 ECTS :6

Abbreviated Title: Fiber Optic Computer Communication Category: Area Elective Course Teaching Language: English

Keywords: Fiber Optic Computer Communication

Department offering the course: Computer Engineering

42. CMPE451 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE353 ECTS :6

Abbreviated Title: Information Security Category: Area Elective Course Teaching Language: English

Keywords: Information Security

Department offering the course: Computer Engineering

43. CMPE 455 Security of Computer Systems & Networks

Computer systems and network security requirements, security threats, and attacks. Confidentiality, integrity, availability, assurance, authenticity, anonymity, nonrepudiation. Methods providing physical security, hardware, software, and information protection. Access control models, discretionary, mandatory, and role-based access models; Kerberos. Malicious software. Symmetric and asymmetric cryptographic methods, DES, AES, RSA, ECC. Authentication, digital signature, certificates, one-time passwords, hash functions. Key management. Link, network, and transport layers security. Wireless network security. Browser security. Ethical and legal issues.

Credits: (4 / 1 / 0) 4 Prerequisites: CMPE344 ECTS:6

Abbreviated Title: Security of Computer Systems & Networks Category: Area Core Course Teaching Language: English

Keywords: Security of Computer Systems & Networks

Department offering the course: Computer Engineering

44. CMPE 461 Artificial Intelligence

Definitions of AI from different point of views, intelligent agents and agent architectures, rational intelligent agents, how agents should act and environments of intelligent agents. Problem solving agents, formulating problems, and searching for solutions. Uninformed search strategies: BFS, DFS, DLFS, IDFS. Informed search methods: Greedy algorithms, uniform cost search, heuristic functions, A*-search, memory-bounded search, iterative improvement algorithms. Constraint satisfaction problems (CSPs): Definitions, Backtracking search for CSPs, The structure of SCPs. Adversarial search: Games, Optimal decisions in games. Alpha-Beta pruning. Agents that reason logically: knowledge-based agents, representation of knowledge, reasoning, logic, and inference in propositional logic. First-order logic: syntax and semantics, extensions and notational variations, elements of first order logic, and inference in first-order logic.

Credits: (4 / 1 / 0) 4 :6 Prerequisites CMPE231 ECTS

Abbreviated Title: Artificial Intelligence Teaching Category: Area Elective Course
Language: English
Keywords: Artificial Intelligence

Department offering the course: Computer Engineering

45. 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.

Credits: (4 / 1 / 0) 4 Prerequisites CMPE211 ECTS :6

Abbreviated Title: Functional and Logic Programming Category: Area Elective Course
Teaching Language: English

Keywords: Functional and Logic Programming

Department offering the course: Computer Engineering

46. 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.
Credits: (4 / 1 / 0) 4 :6 Prerequisites CMPE211 ECTS

Abbreviated Title: Computer Graphics Teaching Category: Area Elective Course
Language: English
Keywords: Computer Graphics

Department offering the course: Computer Engineering

47. CMPE 471 Automata Theory

Mathematical preliminaries and basic concepts. Strings, Languages and Grammars. Chomsky hierarchy of grammars. Deterministic and nondeterministic finite automata. Equivalence of deterministic and nondeterministic finite automata. Minimization of finite automata. Regular grammars and regular expressions. Pushdown automata. Context free grammars. Chomsky normal form. Greibach normal form. Correspondence of pushdown automata and context free grammars. Introduction to Parsing.
Credits: (4 / 1 / 0) 4 :6 Prerequisites MATH163 ECTS

Abbreviated Title: Automata Theory Category: Area Core Course
Teaching Language: English
Keywords: Automata Theory

Department offering the course: Computer Engineering

48. CMPE 474 Performance Analysis of Computer Systems and Networks

Queuing models of computer systems and networks and applications of queuing theory to computer network modeling. Bounds on system performance. Mean-value analysis of computer systems. Modeling specific subsystems. Queuing models for analysis. Limitations of queueing models. Analysis of transaction processors, terminal-oriented systems, and batch processing.

Credits: (4 / 1 / 0) 4 Prerequisites MATH322 ECTS :6

Abbreviated Title: Performance Analysis of Computer Systems and Networks Category:
Area Elective Course

Teaching

Language: English

Keywords: Performance Analysis of Computer Systems and Networks

Department offering the course: Computer Engineering

49. 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.

Credits: (4 / 1 / 0) 4 Prerequisites MATH241 ECTS :6

Abbreviated Title: Operations Research Category: Area Elective Course Teaching
Language: English

Keywords: Operations Research

Department offering the course: Computer Engineering

50. CMPE 476 System Simulation

General concepts of systems. Discrete and continuous systems. State variables. Models, modeling and simulation of systems. Principles and techniques for system modeling and simulation. Comparison of analytical modeling and simulation modeling techniques. General structure of a simulation system. Probability aspects of simulation. Techniques and methods of generation of random numbers and random variates with the desired probability distribution. Simulation languages and packages. Transaction-oriented and event-oriented simulation. Queuing systems in simulation. Validation and verification of simulation models. Output (statistical) analysis and representation of simulation results.

Credits: (4 / 1 / 0) 4 :6 Prerequisites MATH322 ECTS

Abbreviated Title: System Simulation Teaching Category: Area Elective Course
Language: English
Keywords: System Simulation

Department offering the course: Computer Engineering

Course Descriptions – II - English : All compulsory courses offered by other academic units

1. MATH151 Calculus - I

Limits and continuity. Derivatives. Rules of differentiation. Higher order derivatives. Chain rule. Related rates. Rolle's and the mean value theorem. Critical Points. Asymptotes. Curve sketching. Integrals. Fundamental Theorem. Techniques of integration. Definite integrals. Application to geometry and science. Indeterminate forms. L'Hospital's Rule. Improper integrals. Infinite series. Geometric series.

Power series. Taylor series and binomial series.

Credits: (4 / 0 / 1) 4 Prerequisites: None ECTS:7

Abbreviated Title: Calculus I Category: Faculty Core Course Teaching Language: English

Keywords: limit, continuity, derivative, asymptotes, integral, infinite series.

Department offering the course: Mathematics

2. MATH152 Calculus - II

Vectors in R3. Lines and Planes. Functions of several variables. Limit and continuity. Partial differentiation. Chain rule. Tangent plane. Critical Points. Global and local extrema. Lagrange multipliers. Directional derivative. Gradient, Divergence and Curl. Multiple integrals with applications. Triple integrals with applications. Triple integral in cylindrical and spherical coordinates. Line, surface and volume integrals. Independence of path. Green's Theorem. Conservative vector fields. Divergence Theorem. Stokes' Theorem.

Credits: (4 / 0 / 1) 4 ECTS:7 Prerequisites: MATH151

Abbreviated Title: Calculus II Language: Category: Faculty Core Course Teaching English

Keywords: limit, continuity, derivative, asymptotes, integral, infinite series.

Department offering the course: Mathematics

3. MATH163 Discrete Mathematics

Sets and set operations. Relations and functions: binary relation, equivalence relation, partial order, types of functions, composition of functions, inverse function. Integers and their properties: integers, primes, divisibility, fundamental theorem of arithmetic. Logic and proofs: propositions, theorem, tautology and contradiction, direct proof, proof by contradiction, proof by contraposition, proof by induction. Recursion: recursively defined sequences, homogeneous and inhomogeneus recursive relations, characteristic polynomial, solving recurrence relations. Principles of counting: the addition and multiplication rules, the principle of inclusion-exclusion, the pigeonhole principle. Introduction to Combinatorics: permutations and combinations, repetitions, derangements, the binomial theorem. Boolean algebra: basic Boolean functions, digital logic gates, minterm and maxterm expansions, the basic theorems of Boolean algebra, simplifying Boolean function with Karnaugh maps.

Credits: (3 / 0 / 1) 3 Prerequisites: None ECTS:5

Abbreviated Title: Discrete Mathematics Category: Area Core Course Teaching Language: English

Keywords: set, function, relation, permutation, combination, pigeonhole principle, principle of inclusion and exclusion, recurrence relations, Boolean algebra, graph, tree.

Department offering the course: Mathematics

4. MATH241 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 frobenius. 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.

Credits: (4 / 0 / 1) 4 Prerequisites: MATH151 ECTS:6

Abbreviated Title: Differential Equations Category: Area Core Course Teaching Language: English

Keywords: linear algebra, differential equations

Department offering the course: Faculty of Arts & Sciences

5. MATH322 Probability and Statistical Methods

Introduction to probability and statistics. Operations on sets. Counting problems. Conditional probability and total probability formula, Bayes' theorem. Introduction to random variables, density and distribution functions. Expectation, variance and covariance. Basic distributions. Joint density and distribution function. Descriptive statistics. Estimation of parameters, maximum likelihood estimator. Hypothesis testing.

Credits: (3 / 0 / 1) 3 Prerequisites: MATH151 ECTS:5

Abbreviated Title: Probability & Statistics Category: Faculty Core Course Teaching Language: English

Keywords: conditional probability, random variable, expectation, distribution function, statistics.

Department offering the course: Mathematics

6. MATH373 Numerical Analysis for Engineers

Numerical error. Solution of nonlinear equations, and linear systems of equations. Interpolation and extrapolation. Curve fitting. Numerical differentiation and integration. Numerical solution of ordinary differential equations.

Credits: (3 / 0 / 1) 3 Prerequisites: MATH241 ECTS:5

Abbreviated Title: Numerical Analysis for Eng Category: Area Core Course Teaching Language: English

Keywords: numerical error, nonlinear equation, linear system of equations, interpolation, extrapolation, numerical differentiation, numerical integration. Department offering the course: Mathematics

7. PHYS101 Physics - I

Physical quantities and units. Vector calculus. Kinematics of motion. Newton`s laws of motion and their applications. Work-energy theorem. Impulse and momentum. Rotational kinematics and dynamics. Static equilibrium.

Credits: (4 / 1 / 0) 4 Prerequisites: None ECTS:7 Abbreviated Title: Physics I Category: Faculty Core Course Teaching Language: English

Keywords: physics

Department offering the course: Faculty of Arts & Sciences

8. PHYS102 Physics - II

Kinetic theory of ideal gases. Equipartition of energy. Heat, heat transfer and heat conduction. Laws of thermodynamics, applications to engine cycles. Coulombs law and electrostatic fields. Gauss's law. Electric potential. Magnetic field. Amperes law. Faradays law.

Credits: (4 / 1 / 0) 4 Prerequisites: None ECTS:7

Abbreviated Title: Physics II Category: Faculty Core Course Teaching Language: English

Keywords: physics

Department offering the course: Faculty of Arts & Sciences

9. ENGL191 Communication in English – I

ENGL 191 is a first semester freshman academic English course. It is designed to help students improve the level of their English to B1 level, as specified in the Common European Framework of Reference for Languages. The course connects critical thinking with language skills and incorporates learning technologies such as GEMoodle. The purpose of the course is to consolidate students' knowledge and awareness of academic discourse, language structures and lexis. The main focus will be on the development of productive (writing, speaking) and receptive (reading and listening) skills in academic settings, and on the improvement of study skills in general.

Credits: (3 / 0 / 1) 3 Prerequisites: None
ECTS:5

Abbreviated Title: Communication in English I Category: University Core Course Teaching Language: English

Keywords: Main idea, scanning, skimming, writing (academic composition, paragraph)

Department offering the course: School of Foreign Language

10. ENGL192 Communication in English – II

This course is designed to further help students improve their English to B2 level, as specified in the Common European Framework of References for Languages. The course aims to reconsolidate and develop students' knowledge and awareness of academic discourse, language structures, and critical thinking. The course incorporates more technologies on MOODLE that will promote self study and Microsoft computer skills. The course will focus on reading, writing, listening, speaking and emphasizing documentation and presentation skills in academic settings.

Credits: (3 / 0 / 1) 3 Prerequisites: ENGL191
ECTS:5

Abbreviated Title: Communication in English II Category: University Core Course Teaching Language: English

Keywords: Common European Framework of References for Languages, critical thinking, report writing, autonomous learning.

Department offering the course: School of Foreign Language

11. ENGL201 Communications Skills

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.

Credits: (3 / 0 / 1) 3 Prerequisites: ENGL192
ECTS:4

Abbreviated Title: Communications Skills Category: Area Core Course Teaching Language: English

Keywords: English language teaching

Department offering the course: School of Foreign Language

12. HIST280 History of Turkish Reforms

The aim of this course is to teach students under what conditions the Republic of Turkey was established; to make students understand the principles of Ataturk's reforms; the phases of the Reforms; Ataturk as a military hero and a statesman; Ataturk's concept of nationalism that defies racism;
Ataturk's attempts to maintain global peace based on causes and effects; the relations between the Turkish Republic and the establishment of the Turkish Republic of Northern Cyprus; Turkish Cypriot years of national strife. This is a general education course.

Credits: (2 / 0 / 0) 2 Prerequisites: None ECTS:2

Abbreviated Title: History of Turkish Reforms Category: University Core Course Teaching Language: Turkish

Keywords: history, Turkish reforms.

Department offering the course: Centre of Atatürk Investigations

13. TUSL181 Introduction to Turkish Language

TUSL 181 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.
Credits: (2 / 0 / 0) 2 Prerequisites: None ECTS:2

Abbreviated Title: Turkish Category: University Core Course Teaching Language: English

Keywords: Turkish language teaching

Department offering the course: School of Foreign Language

14. IENG355 Ethics in Engineering

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.

Credits: (3 / 0 / 0) 3 Prerequisites: None ECTS:4

Abbreviated Title: Ethics Teaching Category: Area Core Course
Language: English
Keywords: ethics

Department offering the course: Industrial Engineering

15. IENG450 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.

Credits: (3 / 0 / 0) 3 Prerequisites: None ECTS:5

Abbreviated Title: Engineering Economy Teaching Category: University Elective Course
Language: English
Keywords: engineering management

Department offering the course: Industrial Engineering