EĞİTİM PLANI KISA DERS İÇERİKLERİ (İngilizce)

Zorunlu Dersler

1st Year					
	Code	***Course Name***	***Cls***	***Lab***	***Crd***
Fall	*CENG111*	Concepts in Computer Engineering An orientation course to provide counsel to the students about the Department and Computer Engineering in general. An introduction to the faculty and their activities. Visit to several Computer Centers in and outside the University. Basic computer literacy: terminology, system components and operation. Internet, HTML Coding and Java, Desktop Softwares, Windows-Unix-Dos Operating Systems, Library Usage.	3	0	3
	CENG113	Programming Basics Fundamentals of computer programming: sequence, decision, repetion, syntax, compilation, debugging and maintenance, procedures, parameters, arrays, object, top-down structured design, layout and style. The emphasis is on an engineering ``right-first-time'' approach to solving large problems using computers. Basic concepts of algorithmics and algorithmic terminologies.	3	2	4
	CENG115	Discrete Structures Basic mathematical notions of sets, relations, and functions, and operations involving the same; logic and its role, propositional logic, truth tables, issues of equivalence, limitations; predicate logic, its power and its limitations, relevance in the context of computer engineering; proof techniques; commonly occurring mathematical concepts such as graphs, trees; representational issues; relevance of these to computer engineering; recursion; counting; combinatorics; relevance of these ideas to computer engineering.	3	0	0
Spring	*CENG112*	Data Structures Basic concepts of data, data structures and data types: arrays, strings, linear structures, sequential searching and sorting techniques, stacks, queues, pointers, linked lists. Various forms of m-way search and B-trees. Prerequisites: CENG113	3	0	3
	CENG114	Probability & Statistics Elementary probability theory, conditional probability and independence, random variables, distribution functions, joint and conditional distributions, law of large numbers, central limit theorem, parameter estimation, confidence intervals, and hypothesis testing.	*3*	*0*	*3*

2nd Year					
Fall	*CENG211*	Programming Fundamentals Ideas from object-oriented programming, methods, classes, information hiding, and inheritance; fundamental algorithms, sorting and searching; user defined classes; concept of recursion, benefits and problems; exception handling; using APIs; simple graphics programming; concept of software design. Prerequisites: CENG113	3	0	3
	CENG213	Theory of Computation Abstract automata, especially finite state machines; push-down automata; and Turing machines. Formal languages, especially context-free languages. The relationship between automata and languages. Computability and solvability.	3	0	3
Spring	*CENG212*	Concepts of Programming Languages Syntax, semantics and pragmatics of programming languages. Data, storage and control. Binding of identifiers. Procedural abstraction. Definitions, sequences and concurrent processes. Types. Formal semantics. Study of key features of existing programming languages. Prerequisites: CENG211	3	0	3
	CENG214	Logic Design Introduction to Computer Architecture. Number Systems. Boolean Algebra. Logic Gates and Flip Flops. Combinational and Sequential Circuit Design. Registers, Counters. Bus Transfer. RAM, ROM units. Instruction Execution and Hardwired Control.	3	2	4
	CENG216	Numerical Computation Surveys and applications of numerical techniques related to matrix inversion, systems of linear equations and optimization, finite difference expressions, interpolation and approximation, numerical differentiation and integration. The problems of speed, accuracy and applicability of the topics are examined with related algorithms. The applications of these numerical methods and subjects on computers using efficient programming techniques and with necessary programming languages.	3	2	4

3rd Year					
Fall	*CENG311*	Computer Architecture Basic computer organization and design. Instruction fetch, decode and execution. CPU organization. Hardwired and microprogrammed control organization. Arithmetic algorithms and arithmetic processor design. Input-Output organization. Memory organization, virtual memories, caches, and their management. Machine language and assembly language. Instruction formats and addressing modes. Survey of computer architectures: Von Neumann, Parallel and RISC. Pipelining and other advanced techniques for performance improvements. Introduction to parallel computing, interconnection networks, and multiprocessors. Prerequisites: CENG214	3	2	4
	CENG313	Operating Systems Classification and structure of operating systems. Storage media, memory management and dynamic storage strategies. Scheduling algorithms. I/O and interrupt structures. Protection and security. Queueing and network control models. System software: Linkers, loaders, assemblers, translators and programming environments. Case studies of existing operating systems and implementation of operating system modules.	3	2	4
	CENG315	Information Management Relevance of information management in the context of computer engineering; introduction to database systems and the relational model; normal forms and their benefits; building databases, underlying methodology, database languages; issues associated with information retrieval; SQL, its use and power; information systems in the context of networks, intranets, extranets; special systems and applications; particular issues, access, security, and integrity; relevant legal and ethical issues.	3	0	3
Spring	*CENG312*	Computer Networks Computers and computer communication; problems of security, reliability; speeds, capacity measures, reliability measures; physical realities and the limitations; wireless possibilities; communications network architectures, computer network protocols; variants on the basic topologies; local and wide area networks; client server computing; data integrity and data security, problems and solutions; performance issues; network management; nature and special problems of mobile computing.	3	0	3
	CENG314	Embedded Computer Systems Nature of embedded systems, particular problems, special issues; role in computer engineering; embedded microcontrollers, embedded software; real time systems, problems of timing and scheduling; testing and performance issues, reliability; low power computing, energy sources, leakage; design methodologies, software tool support for development of such systems; problems of maintenance and upgrade; networked embedded systems; FPGA design issues.	3	0	3
	CENG316	Software Engineering Software engineering, role of software engineers; evaluation of software and principles thereof, software lifecycle models; notions of requirements, specification, design implementation; main techniques; important of maintenance; quality concerns at all stages of the software development process; concept of process; software process maturity models; software process improvement; aspects of software engineering, important benefits of and good practice in software re-use; verification and validation; the use of metrics; selection of and use of tools; the nature and structure of teams; human computer interface as a software engineering activity; related life cycles; standards; use of relevant libraries; importance of practical activity; group activity as an important skill for these engineers.	3	0	3

4th Year					
Fall	*CENG411*	Professional Issues in Computer Engineering Critical examination of ethical problems associated with computer engineering; discussion of these problems conducted within the framework of classical philosophical ethical theories; legal and quasi-legal (i.e., policy and regulative) issues; topics addressed include the process of ethical decision-making, privacy and confidentiality, computer crime, professional codes and responsibilities, professional practice, system security, impact of computers on society.	3	0	3
	CENG415	Senior Design Project & Seminar I	2	0	2
Spring	*CENG412*	Analysis and Design of Algorithms Elementary ideas and results on discrete probability; mathematical foundations needed to support measures of complexity and performance; basic concepts from counting; concepts of graphs and trees; basic strategies that underpin the design of algorithms; fundamental algorithms for counting, searching, sorting, manipulation of hash tables, symbol tables, queues, trees, and graphs; distributed algorithms for certain simple tasks; fundamentals of computability theory; relevance to security; relevance of design and analysis of algorithms to software design and implementation.	3	0	3
	CENG414	Project Management This course is designed to introduce the engineering students to economic and management concepts. Topics will include economic concepts such as; cash flow, interest rates, rate of return, demand supply relations, product pricing, taxes, inflation, and related subjects; and management analysis such as management layers, network analysis, project management via CPM/PERT networks, optimization concepts, linear programming, and decision analysis. The course also includes use of related software.	3	0	3
	CENG416	Senior Design Project & Seminar II	0	4	2

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Computer Networks					
	Code	***Course Name***	***Cls***	***Lab***	***Crd***
Fall	CENG421	Network Programming Unix systems: signals, threads, interprocess communication; TCP-UDP/IP; socket programming in Unix; windows sockets, network programming in Java; client/server model, web-based programming; remote procedure calls; network security issues.	3	0	3
Spring	CENG422	Network Design & Management LAN/WAN analysis and design; LAN standards, internetworking, recent technologies, LAN design procedures; WAN design, network services, WAN design procedures; LAN management, SNMP (simple network management protocol); design tools, network simulators.	3	0	3
Software Engineering					
Fall	CENG431	Building Software Systems Concepts of open source, shareware, freeware; issues of quality, conditions of use, availability; issues of software reuse; program libraries, software components; creation of additional libraries and other components; application program interfaces; use of separate compilations; use of software libraries and other software components; problems of building large systems; assessment of software including interfaces such as metrics and measures; criteria; simple principles of interface design; multimedia issues; special problems associated with color, sound, video and multimedia; advanced issues in object-oriented programming, modularity, storage management issues, parallelism; client server computing, different kinds of servers, the role of middleware; overview of the software support needed for client services and server services; illustrations of the use of object oriented techniques applied to the building of certain commonly used software tools; applets and servlets; simple design patterns; nature of the software life cycle and its different phases; concept of process; differences across various developments and the reasons for the differences.	3	0	3
Spring	CENG432	Distributed Information Management Types of parallelism in database systems, architecture of parallel and distributed database sytems; parallel query processing; data partitioning; parallel relational operators in the dataflow approach; dataflow database machines; parallel query optimization; dynamic load balancing in parallel and distributed database systems; next-generation parallel and distributed database systems; distributed and parallel knowledge base systems; object-oriented database management system, distributed transactions; atomic commit protocols; concurrency control in distributed transactions; distributed deadlocks; transactions with replicated data; object and transaction model integration, database languages and applications; active databases; data warehouses; data mining and knowledge discovery; multi-media information services; database support for workflow management systems.	3	0	3
Multicore Architectures & Parallel Programming					
Fall	CENG441	Introduction to Parallel Programming Introduction to the programming techniques to effectively utilize modern multicore computers. Identifying the parallelism, naming shared data, synchronizing threads, the latency and bandwidth associated with communication, analyzing & improving parallel performance, parallel programming tools, miscallenous lab works & exercises.	3	0	3
Spring	CENG442	Multicore Architectures and Operating Systems An evolutionary approach to the multicore architectures, integration of multicore architectures with operating systems, OS kernel design for multiprocessors and multithreding, OS support for threads, User level threads, Kernel level threads, An example: Solaris threads, Threads and libraries, Hardware support for multithreading in a uniprocessor and in a multiprocessor.	3	0	3

Embedded Systems					
Fall	CENG451	Advanced Digital System Design Finite state machine design and analysis; high-level hardware description languages, VHDL, automated synthesis in design; digital integrated circuit design and advanced design principles; electrical properties of digital circuits, synchronous and asynchronous circuits, computer arithmetic and interfacing to external circuitry, digital system testing and design for testability; implementation of embedded computing systems in terms of Application Specific Integrated Circuits; Design for reuse.	3	0	3
Spring	CENG452	Building Software for Embedded Systems Design and implementation of software for programmable embedded systems; software tools such as compilers, schedulers, code generators, and system-level design tools; data-flow and control models of computation and software synthesis for uniprocessor and multiprocessor architectures; synchronous/reactive languages and their mathematical properties; implementation of signal processing, communication and control algorithms using variety of technologies such as digital signal processors, microcontrollers, FPGAs, ASICs and real-time operating systems; real-time kernel design; software implemented fault-tolerance techniques.	3	0	3
Artificial Intelligence					
Fall	CENG461	Artificial Intelligence Declarative programming; problem solving; knowledge representation; reasoning; acting logically; uncertainty; learning; communicating.	3	0	3
Spring	CENG462	Soft Computing Artificial neural networks; evolutionary computation; fuzzy systems.	3	0	3
Security					
Fall	CENG471	Cryptography Basic terminology, history & background, Symmetrical cryptosystems, DES-AES, DES-AES likes, Asymmetrical cryptosystems, primality, hashing, factorization based (RSA)-ECC-Lattice cryptosystems, cryptographic protocols & applications, secrecy, authentication, integrity-authenticity, digital signatures, standards.	3	0	3
Spring	CENG472	Network Security Symmetrical encryption, Asymmetrical encryption, Authentication, Email security, Application security, Web services security, Network traffic analysis, Internet attacks, Firewalls, Intrusion detection systems.	3	0	3

Teknik Seçmeli Dersler

CENG381 Stochastic Processes (3-0) 3

Probability spaces, random variables, distribution and density functions, random vectors, sequences of random variables, convergence notions, the central limit theorem, the law of large numbers, stochastic processes, stationary notions, Poisson processes, Gaussian processes, transformations of stochastic processes, ergodicity, second order random processes, representation theorems, Markov processes, homogeneous Markov models and applications.

CENG382 Information Theory (3-0) 3

An introduction to Shannon's information theory and elementary binary coding schemes with and without noise. The concept of information, entropy, simple sources, Markov sources, continuous sources, information channels, average error, ambiguity, transformation, capacity, noiseless coding, Kraft-McMillan theorem, Shannon-Fano and Huffmann coding schemes, error-correcting codes, linear codes, cyclic codes. Data Compression.

CENG383 Real-Time Systems (3-0) 3

Specification and verification techniques for real-time systems with many interacting components. formal design of real-time systems using (a) programming languages with unambiguous semantics of time - related behavior and (b) scheduling algorithms. Real-time operating systems, concepts of programming languages for real-time systems.

CENG384 Microprocessors (3-0) 3

Elements of microprocessors and microcomputers, software and hardware for microprocessors; microcontrollers; embedded system design with microcontrollers, memory interface, analog-digital input/output interfaces and interrupt interface of typical microprocessors/controllers; programming with assembly and high level languages; real-time working, real-time operating systems; design of single and general purpose microprocessor/controllers using FPGAs; system control, analysis of feedback control systems, controller design; data acquisition, fundamentals of digital signal processing.

CENG385 Mathematical Logic (3-0) 3

Propositional logic: syntax, semantics, decision procedures; first-order logic: syntax, semantics, definability, formal system, completeness, undecidability, incompleteness; second-order logic; advanced topics: many-valued logic, modal logic, temporal logic, fuzzy logic.

CENG386 Fuzzy Logic Systems (3-0) 3

Fuzzy set theory, fuzzy relations, fuzzy rule base, approximate reasoning, fuzzy control, fuzzy logic system design.

CENG421 Network Programming (3-0) 3

Unix systems: signals, threads, interprocess communication; TCP-UDP/IP; socket programming in Unix; windows sockets, network programming in Java; client/server model, web-based programming; remote procedure calls; network security issues.

CENG422 Network Design & Management (3-0) 3

LAN/WAN analysis and design; LAN standards, internetworking, recent technologies, LAN design procedures; WAN design, network services, WAN design procedures; LAN management, SNMP (simple network management protocol); design tools, network simulators.

CENG431 Building Software Systems (3-0) 3

Concepts of open source, shareware, freeware; issues of quality, conditions of use, availability; issues of software reuse; program libraries, software components; creation of additional libraries and other components; application program interfaces; use of separate compilations; use of software libraries and other software components; problems of building large systems; assessment of software including interfaces such as metrics and measures; criteria; simple principles of interface design; multimedia issues; special problems associated with color, sound, video and multimedia; advanced issues in object-oriented programming, modularity, storage management issues, parallelism; client server computing, different kinds of servers, the role of middleware; overview of the software support needed for client services and server services; illustrations of the use of object oriented techniques applied to the building of certain commonly used software tools; applets and servlets; simple design patterns; nature of the software life cycle and its different phases; concept of process; differences across various developments and the reasons for the differences.

CENG432 Distributed Information Management (3-0) 3

Types of parallelism in database systems, architecture of parallel and distributed database sytems; parallel query processing; data partitioning; parallel relational operators in the dataflow approach; dataflow database machines; parallel query optimization; dynamic load balancing in parallel and distributed database systems; next-generation parallel and distributed database systems; distributed and parallel knowledge base systems; object-oriented database management system, distributed transactions; atomic commit protocols; concurrency control in distributed transactions; distributed deadlocks; transactions with replicated data; object and transaction model integration, database languages and applications; active databases; data warehouses; data mining and knowledge discovery; multi-media information services; database support for workflow management systems.

CENG441 Introduction to Parallel Programming (3-0) 3

Introduction to the programming techniques to effectively utilize modern multicore computers. Identifying the parallelism, naming shared data, synchronizing threads, the latency and bandwidth associated with communication, analyzing & improving parallel performance, parallel programming tools, miscallenous lab works & exercises.

CENG442 Multicore Architectures and Operating Systems (3-0) 3

An evolutionary approach to the multicore architectures, integration of multicore architectures with operating systems, OS kernel design for multiprocessors and multithreding, OS support for threads, User level threads, Kernel level threads, An example: Solaris threads, Threads and libraries, Hardware support for multithreading in a uniprocessor and in a multiprocessor.

CENG451 Advanced Digital System Design (3-0) 3

Finite state machine design and analysis; high-level hardware description languages, VHDL, automated synthesis in design; digital integrated circuit design and advanced design principles; electrical properties of digital circuits, synchronous and asynchronous circuits, computer arithmetic and interfacing to external circuitry, digital system testing and design for testability; implementation of embedded computing systems in terms of Application Specific Integrated Circuits; Design for reuse.

CENG452 Building Software for Embedded Systems (3-0) 3

Design and implementation of software for programmable embedded systems; software tools such as compilers, schedulers, code generators, and system-level design tools; data-flow and control models of computation and software synthesis for uniprocessor and multiprocessor architectures; synchronous/reactive languages and their mathematical properties; implementation of signal processing,

communication and control algorithms using variety of technologies such as digital signal processors, microcontrollers, FPGAs, ASICs and real-time operating systems; real-time kernel design; software implemented fault-tolerance techniques.

CENG461 Artificial Intelligence (3-0) 3

Declarative programming; problem solving; knowledge representation; reasoning; acting logically; uncertainty; learning; communicating

CENG462 Soft Computing (3-0) 3

Artificial neural networks; evolutionary computation; fuzzy systems

CENG471 Cryptography (3-0) 3

Basic terminology, history & background, Symmetrical cryptosystems, DES-AES, DES-AES likes, Asymmetrical cryptosystems, primality, hashing, factorization based (RSA)- ECC-Lattice cryptosystems, cryptographic protocols & applications, secrecy, authentication, integrity-authenticity, digital signatures, standards.

CENG472 Network Security (3-0) 3

Symmetrical encryption, Asymmetrical encryption, Authentication, Email security, Application security, Web services security, Network traffic analysis, Internet attacks, Firewalls, Intrusion detection systems.

CENG481 Theoretical Approaches in Computer Science (3-0) 3

Turning theoretical ideas into solution sets in computer science. Integration of mathematical approaches with general problem solving techniques and computer science applications. Topics will be from Algorithms, Complexity Theory, Game Theory, Probability Theory, Graph Theory, Automata Theory, Algebra, and Cryptography. Assignments involve both mathematical proofs and programming.

CENG482 Evolutionary Computation (3-0) 3

Evolution strategies, evolutionary programming, genetic algorithms, genetic programming, overview of selected evolutionary computation techniques.

CENG484 Data Mining (3-0) 3

Data mining in general, data warehousing, data preparation and data mining primitives, concept description, mining association rules in large databases, classification and prediction, cluster analysis, web mining, applications in data mining.