ISTINYE UNIVERSITY FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

COURSE DESCRIPTIONS

1. Semester

Differential and Integral Calculus (2+2), 6
Analytic geometry, functions and limits, derivatives, techniques and applications of differentiation, logarithmic and trigonometric functions. Definite and indefinite integrals, techniques of integration, with applications in sciences and engineering.

Computational Thinking (3+2), 7
Introduction to the central idea of computational thinking as it applies to a wide variety of human endeavors, including natural and physical sciences; computational mathematics with Sage, Matlab, and Mathematica; introduction to programming with Python.

Engineering Physics (3+1), 6
Vectors. Motion in one and two dimensions. Newton's laws and its applications. Work and energy. Conservation of mechanical energy. Momentum and motion of systems. Static equilibrium of rigid bodies. Rotation and angular momentum. Newton's law universal gravitation.

Computing Literacy (2+2), 5
Email and IM usage and etiquette; Computer security basics; Mobile and Cloud computing basics; Google apps and services: Docs, Sheets, Slides, Drive, Calendar, Keep, Scholar; Apple apps and services.

Engineering Design (3+0), 4
Introduction; The Design Process, Creative style; Brainstorming. Effective graphic and verbal communication of design ideas to groups and individuals, Student will learn how to research an engineering problem, where to find information and how to assess its validity, Students will be give an overview of key achievements in the history of engineering. There will also be stories with ethical implications.

Turkish Language-I (2+0),2
To teach the importance of language in human and social life; showing the classification of languages and teaching of Turkish among the world languages; to teach the characteristics of Turkısh in terms of phonology, morphology, syntax; to analyze spelling and writing rules of Turkish.

2. Semester

Linear Algebra With Applications (2+2), 6
Systems of linear equations, matrix algebra, determinants, vector spaces and subspaces, basis and dimension, linear transformations, eigenvalues and eigenvectors, diagonalization, and orthogonality; singular-value decomposition.

Computational Mathematics (3+2), 7
Introduction to the theoretical underpinnings of computer science and engineering. Topics include propositional predicate logic, set theory, functions and relations, counting, mathematical induction,

recursion, generating functions, graph theory and algorithms. Fundamentals of groups, rings, fields, number theory and cryptography. Computational tools such as Python, Sage, and Mathematica will be be used to illustrate properties the mathematical objects and structures.

Electronic Physics And Systems (3+1), 6
In this course the principles of electrical and electronical engineering and basic technology will be introduced. Application examples of the knowledge on engineering will be given. In addition, electric machinery, power electronics, and electrical driving circuits will be introduced according to the mechanical engineering requirements

Human Body (2+2), 4
The basic functions of human body. The circulatory, digestive, endocrine, immune and lymphatic systems. The muscular, skeletal and respiratory systems. Human brain, heart, kidneys, liver and lungs. Anatomy and functions of the eye. Properties of human vision. Anatomy and functions the ear. Properties of hearing and balance. Human genetics and physiology.

Computer Aided Design (2+2), 5
Introduction to computer aided technical drawing. Basic drawing functions and multi-view projection. Sectioning and conventions. General concepts in 3D modelling. Creating parts in 3D design and solid modeling. Transfering 3D parts to drafting detailing. Assembly modelling and assembling parts. Surface modelling.

Turkish Language-II (2+0), 2
To teach spelling, writing and punctuation rules, to teach basic elements of writing essays, to introduce Turkısh and World literary canons; to teach writing creative texts of literature especially story, poem and essay ; to teach writing scientific paper and texts; To analyse expression and punctuation disorders, to contribute lectures.

3. Semester

Problem Solving With Computers In C (3+2), 7
Fundamental building blocks for solving problems using computers. Topics include basic computer organization and programming constructs: memory CPU, binary arithmetic, variables, expressions, statements, conditionals, iteration, functions, parameters, recursion, primitive and composite data types, and basic operating system and debugging tool.

Digital Logic Design (3+2), 7
Assembly language programming and advanced computer organization; Digital logic design topics including gates, combinational circuits, flip-flops, and the design and analysis of sequential circuits.

Signals and Systems (3+2), 7
Two-port network parameters; small-signal models of nonlinear devices; transistor amplifier circuits; frequency response of amplifiers; non-ideal op-amps; modulation, bandwidth, signals; Fourier analysis.

General English I (2+0), 2
The English of the terms and concepts encountered in various branches of engineering are examined in depth, and for the proper use of these terms, Turkish-English bilingual translations are explained. English language training for students starts from simple forms and intended to develop over time.

Ataturk's Principles And History Of Turkish Revolution I (2+0), 2
The Collapse of the Ottoman Empire, Tanzimat and Reform Edict, I. and II. Constitutional Era, Tripoli and Balkan Wars, Worl War I, Mudros Armistice, War of Independence; Amasya Circular, National Congresses, Establishment of Turkish Grand National Assembly, Declaration of Republic

Manifest of Istinye I (0+1), 1

4. Semester

Problem Solving With Computers In C++ (3+2), 7
Intermediate building blocks for solving problems using computers. Topics include intermediate object-oriented programming, data structures, object- oriented design, algorithms for manipulating these data structures and their run-time analyses. Data structures introduced include stacks, queues, lists, trees, and sets.

Digital System Design (3+2), 7
Design of synchronous digital systems: timing diagrams, propagation delay, latches and flip-flops, shift registers and counters, Mealy/Moore finite state machines, Verilog, 2-phase clocking, timing analysis, CMOS implementation, S- RAM, RAM-based designs, ASM charts, state minimization.

Principals of Artificial Intelligence (3+2), 7
Introduction to the field of artificial intelligence, which seeks to understand and build intelligent computational systems. Topics include intelligent agents, problem solving and heuristic search, knowledge representation and reasoning, uncertainty, probabilistic reasoning, and applications of AI.

General English II (2+0), 2
The English terms and concepts encountered are examined in depth and Turkish-English bilingual translations are used in order to use the concepts correctly. To be able to master professional English language, the students are informed about grammatical structures of sentences, spelling and pronunciation.

Ataturk's Principles And History Of Turkish Revolution II (2+0), 2
Revolutions in Turkish politics, political parties and multi-party system attempts, revolutions in law, reorganization of public life, reforms in economics, Turkish foreign policy 1923-1938, Turkish domestic and international politics in post-Atatürk era.

Manifest of Istinye II (0+1), 1

5. Semester

Data Structures And Algorithms (3+2), 7
The study of data structures and their applications. Correctness proofs and techniques for the design of correct programs. Internal and external searching. Hashing and height balanced trees. Analysis of sorting algorithms. Memory management. Graph traversal techniques and their applications.

Advanced Digital System Design (3+2), 7
Introduction to computer-aided simulation and synthesis tools for VLSI. VLSI system design flow, role of CAD tools, layout synthesis, circuit simulation, logic simulation, logic synthesis, behavior synthesis and test synthesis.

Machine Learning (3+2), 7
Covers the most important techniques of machine learning (ML) and includes discussions of: wellposed learning problems; artificial neural networks; concept learning and general to specific ordering; decision tree learning; genetic algorithms; Bayesian learning; analytical learning; and others.

6. Semester

Microprocessor System Design (3+2), 7
This class is focused on the principles and practices of modern embedded systems design. In class, we will focus on computer architecture beyond the CPU, fundamentals of the hardware/software interface, techniques for sensing and controlling the physical world, and a few other topics. The labs and project require a substantial amount of time -- this is a lab-intensive class.

Computer Architecture (3+2), 7
Introduction to the architecture of computer systems. Topics include: central processing units, memory systems, channels and controllers, peripheral devices, interrupt systems, software versus hardware trade-offs.

Cryptographic Engineering (3+2), 7
An introduction to the basic concepts and techniques of cryptography and cryptanalysis. Topics include: The Shannon Theory, classical systems, the data encryption standard, the advanced encryption standard, public key systems, digital signatures, file security.

7. Semester

Capstone Project I (3+2), 7
Student groups design a significant computerbased project. Multiple groups may cooperate toward one large project. Each group works independently; interaction among groups is via interface specifications and informal meetings.

VHDL and FPGA System Design (3+2), 7
Introduction to VHDL basic elements. VHDL simulation concepts. VHDL concurrent statements with examples and applications. VHDL subprograms, packages, libraries and design units. Writing VHDL for synthesis. Writing VHDL for finite state machines. Design case studies involve popular FPGAs.

Manifest of Istinye III (0+1), 1

8. Semester

Capstone Project II (3+2), 7
Student groups design a significant computerbased project. Multiple groups may cooperate toward one large project. Each group works independently; interaction among groups is via interface specifications and informal meetings.

Human-Computer Interaction (3+2), 7
The study of human-computer interaction enables system architects to design useful, efficient, and enjoyable computer interfaces. This course teaches the theory, design guidelines, programming practices, and evaluation procedures behind effective human interaction with computers.

Manifest of Istinye IV (0+1), 1

DEPARTMENT ELECTIVE COURSE DESCRIPTIONS

Directed Research (2+2), 5
The students are involved in projects that are going on research centers. They are required to attend meetings, develop code, help to build devices, and give presentations as needed. The lecturer covers basic research techniques, search, writing papers in LaTeX, and working with data.

Engineering Ethics (2+2), 5
The origins of ethical thought; ethical principles and basic theories; personal, academic and professional ethics for engineers; environmental ethics; ethical implications of technology, computer ethics; ethics in research and experimentation.

Biomedical Imaging (2+2), 5
This course covers the physical principles of major in vivo bio-imaging modalities, i.e., ultrasound, computed tomography, emission computed tomography, positron emission tomography and magnetic resonance imaging. We will show how existing physical principles transcend into bio-imaging and establish an important link into life sciences, illustrating the contributions physics can make to life sciences.

Cyber-Physical Systems and Security (2+2), 5
Cyber-physical as a term explains much of the underlying theory and practice; it is the interplay of physics and computation. Our understanding of the physical world through the models of classical and quantum physics, together with our models of computation from analog to digital, helps us build a better understanding of the cyber-physical world. Insights from physics, methods of complex systems theory, and formal methods borrowed from various facets of mathematical and computational sciences will help us to build reliable, safe, and secure systems.

Advanced Cryptography (2+2), 5
This is a course on methods, algorithms, techniques, and tools of cryptography. We study algorithmic and mathematical aspects of cryptographic methods and protocols, such as secret-key cryptography, public-key cryptography, hash functions, and digital signatures. We show how these techniques are used to solve particular data and communication security problems. This course material is useful for computer science, electrical engineering, and mathematics students who are interested in learning how cryptographic algorithms and methods are embedded in information systems, providing confidentiality, integrity, non-repudiation, and authenticity of stored and transmitted digital data.

Theoretical Computer Science (2+2), 5
Formal languages; finite automata and regular expressions; properties of regular languages; pushdown automata and context-free grammars; properties of context-free languages; introduction to computability and unsolvability. Introduction to Turing machines and computational complexity.

Computer Graphics (2+2), 5
Overview of OpenGL graphics standard, OpenGL state machine, other 3D graphics libraries, 3D graphics pipeline, 3D transformations and clipping, color model, shading model, shadow algorithms, texturing, curves and curved surfaces, graphics hardware, interaction devices and techniques.

Mobile Application Development (2+2), 5
An introduction to programming mobile computing devices. Students will learn about and study the shift in software development from desktop to mobile device applications. Topics will include

software engineering and design practices, advances in programming practice, and support tools for mobile application development and testing. Students will develop and deploy mobile applications as part of their course work.

Hardware Software Interfaces (2+2), 5
Issues in interfacing computing systems and software to practical I/O interfaces. Rapid response, real-time events and management of tasks, threads, and scheduling required for efficient design of embedded software and systems is discussed. Techniques for highly constrained systems.

Parallel Computing (2+2), 5
Fundamentals of high-performance computing and parallel algorithm design for numerical computation. Topics include parallel architecture and clusters, parallel programming with messagepassing libraries and threads, program parallelization methodologies, parallel performance evaluation and optimization, parallel numerical algorithms and applications with different performance trade-offs.

Data Mining (2+2), 5
Advanced course which introduces data mining concepts, principles and algorithms. Topics include association analysis, classification, clustering, sequential pattern analysis, stream data mining, mining complex types of data, multi-relational data mining, spatiotemporal data mining, social network analysis, text mining, link analysis, data mining applications (bioinformatics, security, the Web, software engineering) and trends in data mining.

Database Systems (2+2), 5
Database system architectures, relational data model, relational algebra, relational calculus, SQL, QBE, query processing, integrity constraints (key constraints, referential integrity), database design, ER and object-oriented data model, functional dependencies, lossless join and dependency preserving decompositions, Boyce-Codd and Third Normal Forms.

Introduction to Robotics (2+2), 5
Dynamic modeling and control methods for robotic systems. LaGrangian method for deriving equations of motion, introduction to the Jacobian, and modeling and control of forces and contact dynamics at a robotic end effector. Laboratories encourage a problem-solving approach to control.

Biological and Artificial Vision (2+2), 5
Overview of computer vision problems and techniques for analyzing the content images and video. Topics include image formation, edge detection, image segmentation, pattern recognition, texture analysis, optical flow, stereo vision, shape representation and recovery techniques, issues in object recognition, and case studies of practical vision systems.

Neuromorphic Engineering (2+2), 5
Neuromorphic systems carry out robust and efficient neural computation using hardware implementations that operate in physical time. They are event- or data-driven, they employ low-power, massively parallel hybrid analog/digital VLSI circuits, and operate using the same physics of computation used by the nervous system. The simulation of neural systems using the artificial neural networks on silicon are accomplished using methods of neuromorphic engineering.