

KTU Department of Computer Engineering

Course Contents

(L P L:Lecture, Practice, Lab;Cr: Credit;ECTS: European Credit Transfer and Accumulation System)

1st Semester

BIL1003 Bilgisayar Mühendisliğine Giriş L:2 P:0 L:0 (Cr: 2) ECTS: 3 Turkish

Introduction to the department. History of the development of computers. Application and working areas of Computer Engineering. Computer Engineering education. Career opportunities after graduation. Student regulations. Student exchange programs such as Erasmus Programme and Mevlâna Exchange Programme. TÜBİTAK supports for students.

BIL1007 Bilgisayarın Temelleri L:3 P:0 L:0 (Cr: 3) ECTS: 6 Turkish

Advantages of digital systems, digital representation of data, number systems, representation of integer and fractional numbers, representation of negative numbers, fixed-point arithmetic, addition, subtraction, overflow, carry-lookahead addition, floating-point format, biased exponent, normalization, operations with floating-point numbers, logic gates, Boolean algebra, simplification of Boolean functions using algebraic methods and Karnaugh maps, latches, Set-Reset (S-R) latch, gated S-R latch enabled by a control (G) signal, Data (D) latch, simplified computer architecture, hardware and software, shared system resources, fundamentals of operating systems (OS).

BIL1005 Elektrik Devreleri L:3 P:0 L:0 (Cr: 3) ECTS: 6 Turkish

Units: DC current. Electric charge. Current and voltage. Resistance: Ohm's law, series and parallel connection of resistors, Kirchhoff's Current Law. Electrical work, power, and energy. Voltage sources and Kirchhoff's Voltage Law. Single-resistor circuits: maximum power theorem, voltage equivalent of a circuit (Thevenin) and current equivalent (Norton), superposition theorem. Chemical effect of current: electrolysis. Faraday's law, batteries, accumulators, and other energy sources. Capacitor: electric field, magnetic circuits, eddy (Foucault) currents, energy and forces in a magnetic field. Coils (inductors). Solution of first-order linear differential equations: natural, forced, and general solutions of RC and RL circuits. Alternating current (AC): generation of AC voltage, quantities related to AC, addition and subtraction of sinusoidal quantities. Steady-state behavior of RLC circuits under AC. Series and parallel resonance circuits. Power consumed in a general circuit, power compensation, circuit analysis using complex numbers, equivalent circuits, skin effect. Three-phase systems. Transformer.

YDI1001 English – I L:3 P:0 L:0 (Cr: 3) ECTS: 3 English

Reading passages and exercises, listening passages and exercises, translation studies, writing essays on a specific topic, conducting debates on a specific topic.



FIZ1009 Temel Fizik L:3 P:0 L:1 (Cr: 3.5) ECTS: 5 Turkish

Introduction (Unit Systems, Vectors, Derivatives, Integrals), Translational and Rotational Motion, Laws of Motion and Friction, Work, Power and Energy, Linear and Angular Momentum, Rotation of a Rigid Body About a Fixed Axis, Equilibrium, Harmonic Motion, Electric Charge and Electric Field, Gauss's Law, Electric Potential, Direct Current Circuits, Magnetic Field, Faraday's Law, Induction and Inductance, Alternating Current.

MAT1011 Matematik – I L:4 P:0 L:0 (Cr: 4) ECTS: 5 Turkish

Functions (polynomial, rational, algebraic, trigonometric, hyperbolic, exponential, logarithmic, and inverse trigonometric functions), limits, continuity, derivatives and their applications (Intermediate Value Theorem, L'Hôpital's Rule, Mean Value Theorem, optimization problems, sketching graphs of functions), and integration techniques.

TDB1001 Türk Dili – I L:2 P:0 L:0 (Cr: 2) ECTS: 2 Turkish

Language and Languages: The relationship between language and nation, the relationship between language and culture, languages of the world and the place of the Turkish language among world languages; language families in terms of their origins. The historical development of the Turkish written language: Old Turkish, Middle Turkish, Divanü Lügat-it Türk, Atabetü'l-Hakayık, Khwarezm Turkish, Old Anatolian Turkish (Old Turkey Turkish); the New Turkish Period, the Modern Turkish Period, Western (Southwestern Turkish), Turkey Turkish, Eastern (Northeastern Turkish), Karatay Turkish. Phonetics: sound and the formation of sound, major and minor vowel harmony, main sound changes in Turkish; phonetic features of Turkish, syllable structure of Turkish, sentence stress. Morphology: words in terms of form, roots, stems, affixes (derivational and inflectional suffixes); words in terms of meaning and function: nouns, adjectives, pronouns, verbs, verb conjugation, tense and aspect suffixes, verbals, prepositions/particles, derivatives from verbs and nouns; semantics: meaning of words, semantic scope of words; syntax: sentence types and sentence analysis.

2nd Semester

COM1000 Introduction to Computer Programming L:3 P:1 L:0 (Cr: 3.5) ECTS:6 English

General classification of programming languages. Introduction to algorithms. Flowcharts. Pseudocode. C programming environment. Structure of C program blocks. Loops. Decision mechanisms. Functions. Arrays. Pointers. Files.



BIL1000 Elektronik Devreler L:4 P:0 L:0 (Cr: 4) ECTS: 6 Turkish

Prerequisite: BIL1005-Elektrik Devreleri

Semiconductor Fundamentals and Diodes; Diode Applications (Rectifiers, Clipping Circuits); Diode Applications (Clamping Circuits, Voltage Multipliers); Special-Purpose Diodes (Zener Diodes, LEDs, Laser Diodes, Photodiodes); Bipolar Junction Transistors (BJTs and BJTs as Switches); BJT Amplifiers, Field-Effect Transistors (JFETs); Field-Effect Transistors (MOSFETs, Enhancement Mode, Depletion Mode); Logic Gates, Operational Amplifiers; Oscillators.

BIL1004 Olasılık ve İstatistik L:3 P:1 L:0 (Cr: 3.5) ECTS: 6 Turkish

Basic concepts, fundamental axioms, geometric probability; conditional probability, independence of events, Bayes' formula, random variables and their characteristics, distribution of a random variable, cumulative distribution function, probability (density) function, classification of distributions: discrete distributions, absolutely continuous distributions, expected value, variance, multivariate distribution functions, mixed distributions, percentile function; median, marginal distributions, conditional distributions, moments, moment-generating functions, covariance, correlation, maximum likelihood estimation (MLE), maximum a posteriori (MAP) estimation, regression, confidence intervals.

BIL1002 Bilişim Etiği L:2 P:0 L:0 (Cr: 2) ECTS: 2 Turkish

Introduction to ethics and information technologies; ethical values and concepts, the structure of ethical theories. Professional ethics and responsibility. Security and network ethics. Privacy and online environments, privacy and security. Intellectual property and ethical values. Methods of protecting copyrights and patents, copyright, professional responsibility, and license agreements. Security issues: hacking and cracking. Legal and jurisdictional issues in internet and information environments. The internet and cybercriminals. Electronic commerce. Awareness of entrepreneurship, innovation, and sustainable development, and information ethics.

MAT1008 Matematik – II L:4 P:0 L:0 (Cr: 4) ECTS: 5 Turkish

Riemann sums, definite integrals and their properties, the Fundamental Theorem of Calculus. Change of variables in definite integrals and areas between curves. Applications of definite integrals: volume calculation (disk, washer, and shell methods), arc length, and surface areas of solids of revolution. Improper integrals (Type I and Type II). Sequences and infinite series (concepts of convergence and divergence, geometric series, divergence test, integral test, comparison test, ratio test, and root test). Alternating series, absolute and conditional convergence, power series, Taylor and Maclaurin series. Functions of several variables, the concept of limits and continuity, and partial derivatives. Chain rule, directional derivatives, and



gradients. Extreme values, absolute maximum and absolute minimum, Lagrange multipliers (single constraint). Double integrals and their applications (area). Change of variables in multiple integrals, polar coordinates, double integrals in polar coordinates and their applications (mass and density, center of mass).

YDI1002 English – II L:3 P:0 L:0 (Cr: 3) ECTS: 3 English

The main objective of this course is to improve the English proficiency of students who have successfully completed the preparatory class. The course covers upper-intermediate level English programs.

TDB1000 Türk Dili – II L:2 P:0 L:0 (Cr: 2) ECTS: 2 Turkish

Spelling, punctuation, and composition (punctuation marks and other signs); spelling and writing rules (use of capital letters, writing of numbers, spelling of abbreviations, spelling of loanwords); composition (purpose of composition, methods of writing a composition), planning in composition (introduction, development, conclusion); features of expression, clarity, simplicity, coherence, and sincerity in expression; expression errors (use of synonymous words within a sentence), misuse of idioms; modes of expression (exposition, narration, concise expression, description, satire, portrait, argumentation, speech, poetic expression); types of oral expression (daily and impromptu speech, prepared speech, panel discussion, debate, forum); types of written expression (letter, telegram, congratulation, invitation, literary letter), business letters, official letters, petitions, reports, minutes, decisions, announcements, advertisements, essays, critiques, memoirs, travel writing, interviews, surveys, autobiography, biography, novel, short story, fairy tale, fable, theatre, tragedy, drama, screenplay).

3rd Semester

BIL2009 Ayrık Matematik L:3 P:0 L:0 (Cr: 3) ECTS: 5 Turkish

Sets. Relations. Lattices. Discrete and Continuous Probability. Models. Groups. Functions. Boolean algebra. Completeness and closure. Graphs. Dependency evaluation. Graph derivatives. Formal systems. Characterization. Forbidden substructures. Paths, cycles, and chains. Coverage. Application examples. Hamiltonian and Eulerian cycles. Minimum spanning trees. Coloring problem. Evaluation of maximum flow in graphs.

BIL2003 Elektronik Laboratuvarı L:1 P:0 L:1 (Cr: 1.5) ECTS: 3 Turkish

Prerequisite: BIL1000- Elektronik Devreler

Rectifiers, Clippers, Clampers, Binary Multiplication, Monostable Circuits / Shift Registers, Thevenin and Norton Transformations, Alternating Current (AC) Circuits, Resonant Circuits,



Transformers, Logic Gates, Schmitt Trigger Circuit, Operational Amplifiers, Coding and Error Detection Techniques, Implementation of Boolean Functions using Multiplexers, Memory, and Programmable Logic Arrays (PLA).

COM2005 Data Structures L:3 P:0 L:0 (Cr: 3) ECTS: 4 English

Prerequisite: COM1000- Introduction to Computer Programming

Fundamentals of C++, Object-Oriented Programming, Arrays, Linked Lists and Recursion, Analysis Tools, Stacks, Queues and Deques, List and Sequential ADTs, Trees, Heaps and Priority Queues, Hash Tables, Maps and Skip Lists, Search Trees, Sorting, Sets and Selection, Strings and Dynamic Programming, Graph Algorithms, Memory Management and B-Trees.

COM2003 Digital Design L:4 P:0 L:0 (Cr: 4) ECTS: 6 English

Electrical structure of logic gates, multi-output logic circuits, ROM memories, programmable devices (PLA, PAL); flip-flops; counters and similar sequential circuits, analysis of clocked sequential circuits, derivation of state graphs and state tables; reduction of state assignments in state tables; MSI integrated circuits in sequential circuit design; design of sequential circuits using programmable logic devices and ROM. Design of state machines using SM charts; analysis and design of pulse-mode asynchronous circuits; analysis of level-mode asynchronous sequential circuits; derivation and reduction of primitive flow tables in level-mode circuits; realization of flow tables through state assignments; hazards in level-mode circuits; asynchronous circuit design, interface between analog and digital systems.

COM2001 Object Oriented Programming L:3 P:1 L:0 (Cr: 3.5) ECTS:6 English

Prerequisite: COM1000- Introduction to Computer Programming

Fundamental principles of object-oriented programming, basics of programming in C++, control structures and various loop-based functions, parameter passing in functions, development of user-defined functions, creating dynamic, static, and template structures in functions, ANSI-ISO C++ data types, array and string structures, structured programming, object-oriented programming with classes, inheritance and composition in classes, relationships between classes and pointers, virtual and friend functions, operator/function overloading in classes, template-based programming, creating threads and DLLs in C++, object-oriented visual programming in graphical software platforms.

MAT2011 Diferansiyel Denklemler L:4 P:0 L:0 (Cr: 4) ECTS: 6 Turkish

Differential equations and basic concepts. Differential equations as mathematical models (ordinary and partial differential equations, order and degree of differential equations,



formulation of differential equations). General, particular, and singular solutions of differential equations. Separable, homogeneous, exact, and reducible-to-exact differential equations. Linear differential equations, Bernoulli differential equations, and their applications (population models, acceleration–velocity models, heat problems). Method of substitution. General solution theory of nth-order linear differential equations (linear independence of solutions, superposition principle for homogeneous equations, concepts of particular and general solutions). General solutions of nth-order homogeneous differential equations with constant coefficients. Nonhomogeneous equations with constant coefficients and their solution methods (method of undetermined coefficients, variation of parameters). Initial value and boundary value problems. Physical applications, mechanical vibrations, and electrical circuits. Homogeneous and nonhomogeneous differential equations with variable coefficients (Cauchy–Euler differential equation). Reduction of order method. Solutions of differential equations around ordinary points using series methods. Laplace and inverse Laplace transforms. Solutions of initial value problems with constant and variable coefficients, and differential equations involving the Dirac delta and shifting functions using the Laplace transform method.

4th Semester

BIL2008 Algoritmalar L:3 P:0 L:0 (Cr: 3) ECTS: 6 Turkish

Deterministic and non-deterministic algorithms. Algorithm complexity. Algorithm analysis. Types of algorithms. Polynomial and NP problems. Combinations. Combinatorial algorithms. Recursive approaches. Algorithms for computing series (finite and infinite) and continued fractions. Prime numbers, Euclid’s algorithm. Mappings. Sorting. Searching. Algorithm performance. Matrix techniques. Geometric algorithms. Data encryption, packing theory.

BIL2012 Sayısal Tasarım Laboratuvarı L:1 P:0 L:1 (Cr: 1.5) ECTS:3 Turkish

Prerequisite: COM2003- Digital Design

Multivibrators, Coding and Error Detection Techniques, Boolean Functions, Counters. Level-mode sequential circuits. Pulse-mode sequential circuits. Problems in logic circuits and their elimination. Edge-triggered D Flip-Flop. Sequential circuit design using ROM and PLDs. Sequential circuit design using MSI-type integrated circuits.

COM2004 Automata Theory L:3 P:0 L:0 (Cr: 3) ECTS: 4 English

Languages, Recursive Definitions, Regular Expressions, Finite Automata, Transition Graphs, Kleene’s Theorem, Finite Automata with Output, Regular Languages, Non-Regular Languages (Pumping Lemma, Myhill–Nerode Theorem), Decidability.

PUSHDOWN AUTOMATA THEORY: Context-Free Grammars (Trees, Ambiguity), Grammatical Forms (Regular Grammars, Chomsky Normal Form, Leftmost Derivations),



Pushdown Automata, CFG = PDA, Non-Context-Free Languages (Pumping Lemma for CFLs), Context-Free Languages (Closure Properties), CYK Algorithm.

TURING THEORY: Turing Machines (TM), Post Machines, Minsky's Theorem, Types of Turing Machines (Stay-Put Machine, Machine with Halt Option, k-Tape Turing Machine, Two-Way Infinite Tape Model, Non-Deterministic TM, Read-Only TM), TM Languages (TM Encoding/Decoding, Universal Turing Machine, Halting Problem).

COM2008 Engineering Mathematics L:3 P:0 L:0 (Cr: 3) ECTS: 6 English

Introduction to fundamental mathematical applications in computer engineering; Fourier series, discrete and fast Fourier transforms (DFT and FFT) and their engineering applications; correlation and convolution functions and their applications; matrix analysis; numerical methods in matrix analysis; determinants and their numerical computation; fundamental functions in N-dimensional vector spaces; general vector spaces and matrix rank; eigenvalue and eigenvector computation; numerical methods for eigenvector computation and their engineering applications; Principal Component Analysis (PCA) and its applications.

COM2002 Programming Languages L:3 P:0 L:0 (Cr: 3) ECTS: 5 English

Programming paradigms: imperative, object-oriented, functional, and logic programming. Program syntax: Backus–Naur Form (BNF), grammars, lexical and syntactic structures, other grammar forms. Syntax and semantics: operators, precedence, associativity, other ambiguities, parse trees. Language systems: traditional pipeline, interpreters, virtual machines, late binding, profiling, dynamic compilation, binding times. First look at Haskell: the Hugs system, types, classes. Types: primitive and structured types, sequences, arrays, composite types, subtypes, uses of types. Second look at Haskell: defining functions, list comprehensions. Polymorphism: overloading, coercion, parametric and subtype polymorphism. Third look at Haskell: higher-order functions, functional parsers. Scope: definitions, scope with blocks, scope with labeled fields, scope with primitive fields, dynamic scope. Fourth look at Haskell: interactive programs, type and class declarations. Memory allocation for variables: activation-specific variables, activation records, static allocation, dynamic stacks, handling nested functions, functions as parameters, long-lived functions. Memory management: a memory model, stacks, heaps, fragmentation, free list management. Object orientation: classes, prototypes, inheritance, encapsulation, polymorphism. Parameters: matching, parameter passing methods. Cost models: a cost model for lists, a cost model for function calls, a cost model for arrays.

COM2000 Microprocessors L:4 P:0 L:0 (Cr: 4) ECTS: 6 English

Prerequisite: BIL1007- Bilgisayarın Temelleri

Random Access Memory (RAM), memory decoding, error detection and correction, Read-Only Memory (ROM), programmable logic devices (PLD, PLA, PAL), register transfer, micro-



operations, common bus transfer, processing unit (PU), arithmetic logic unit (ALU), shifter unit, control word, microprogrammed control, PU control, microprogram examples, hardwired control, design example: binary multiplier, hardwired control for the multiplier, simple computer example, simple computer design, address space, addressing modes, stack organization, data transfer instructions, data manipulation instructions, floating-point operations, program control instructions, interrupts, Input/Output (I/O) interface, serial communication, transfer modes, priority interrupt, Direct Memory Access (DMA), multiprocessor systems.

5th Semester

COM3003 Operating Systems L:4 P:0 L:0 (Cr: 4) ECTS: 6 English

Processes and threads; scheduling and interprocess communication. Memory management: basic memory management techniques, virtual memory management, operating system policies for virtual memory, and segmented memory structure. File systems: files, directories, implementation of file systems, and examples of file systems. Input/Output (I/O): I/O software and hardware principles, layered I/O structure, disks, clocks, terminals, and graphical interface devices. Deadlock: resources, deadlock, detection and recovery, deadlock avoidance and prevention. Multimedia operating systems. Security. Distributed and network operating systems.

COM3005 Computer Architecture L:3 P:0 L:0 (Cr: 3) ECTS: 6 English

Computer systems: Microprocessor systems, developments in architecture. Cache systems: cache organizations, read and write mechanisms. Memory management: memory hierarchy, paging, replacement algorithms, virtual memory systems, segmentation. Serial and parallel I/O methods. Direct Memory Access (DMA). Interrupt-driven input/output. Secondary storage devices: magnetic disks, optical memory, magnetic tapes, magnetic recording techniques. CRT displays: cathode ray tube and LCD displays, CRT controllers, text and graphics memories. Pipelined processor design. Shared-memory multiprocessor systems: multiprocessor systems and programming, interconnection networks. Distributed-memory multiprocessor systems: message-passing multiprocessor systems.

COM3001 Database Management L:3 P:0 L:0 (Cr: 3) ECTS: 5 English

Database management, conceptual, logical, and physical databases, data models, hierarchical and network data models, relational data model, normalization, redundancies and methods for eliminating redundancies, functional dependencies, entities, entity-based data model, levels of relations, database design, query languages, physical databases, index organization, data collisions, key-based searches, data compression.



COM3009 Numerical Analysis L:3 P:0 L:0 (Cr: 3) ECTS: 5 English

Solution of nonlinear equations $f(x)=0$: fixed-point iteration, bisection method, chord (false position) method, Newton–Raphson method, secant method, Halley method, nonlinear systems. Solution of linear systems $AX=B$: forward and backward substitution, Gauss–Jordan elimination, inverse matrix, LU decomposition, Jacobi and Gauss–Seidel iteration, row-reduced form, linear programming– Simplex method. Maclaurin and Taylor series: Lagrange polynomial interpolation and approximation, Newton interpolation polynomial, Hermite polynomial interpolation, cubic splines, Padé approximation. Curve fitting: least squares polynomial, nonlinear curve fitting, logistic curves, FFT and trigonometric polynomials, conic fitting, radius of curvature. Numerical differentiation: Richardson extrapolation, derivation of numerical differentiation formulas. Numerical integration: Riemann sums, midpoint rule, trapezoidal rule, Simpson’s rule, Simpson’s 3/8 rule, Boole’s rule, Monte Carlo integration. Solution of differential equations: Euler method, Taylor series method, Runge–Kutta method, finite difference method, Frobenius series solution, Picard iteration. Eigenvalues and eigenvectors: power method, deflation technique, matrix diagonalization. Numerical optimization: golden section search, Fibonacci search, Newton’s method.

Technical Elective I

BIL3009 Java ile Programlama L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Java applications: introduction, simple programs, arithmetic, equality and relational operators. Java classes and objects: classes, objects, methods, local variables, primitive types, reference types, dialog boxes. Control statements: control structures, selection and multiple selection statements, iteration statements, logical operators. Methods: static methods, method declaration and invocation, argument promotion, passing by value, scope of declarations, method overloading. Arrays: array declaration and creation, array traversal, multidimensional arrays. Classes and objects: member access control, constructors, composition, ordering, garbage collection, final local variables. Inheritance: base classes and subclasses, protected members, constructors in subclasses, Object class. Polymorphism: polymorphic behavior, abstract classes and methods, final methods and classes, creating and using interfaces. GUI components: Swing components, JTextField, JLabel, JButton, JComboBox, JList, mouse event handling, adapter classes, keyboard event handling, layout managers, JTextArea. Graphics and Java 2D: graphics objects, color control, font control, drawing shapes, Java 2D API. Exception handling: simple exceptions, exception hierarchy, finally block, stack unwinding, exception chaining, defining new exception types. Files and streams: data hierarchy, File class, sequential access text files, object serialization, random access files. Multithreading: life cycle of a thread, thread priorities, creating and running threads, thread synchronization, multithreading with GUIs.



BIL3007 Yazılım Mühendisliği L:3 P:0 L:0 (Cr: 3) ECTS: 4 English

Software process: Process models, linear sequential model, prototyping model, RAD model, evolutionary software process models, component-based development, formal methods model. Systems engineering: Computer-based systems, system modeling, product engineering. Requirements engineering: Requirements analysis, requirements elicitation, analysis principles, software prototyping, specification. Analysis modeling: Analysis modeling elements, data modeling, functional modeling, behavioral modeling, mechanics of structured analysis. Design engineering: Design process, design principles, design concepts, effective modular design. Architectural design: Software architecture, data design, architectural styles. Component-level design: Interface design models, task analysis and modeling, design activities. Software testing techniques: Testing fundamentals, white-box testing, basis path testing, control structure testing, black-box testing. Software testing strategies: Verification and validation, unit testing, integration testing, validation testing, system testing, debugging. Project management concepts: Management spectrum, software team, software scope, problem decomposition, process decomposition. Software metrics: Project domain, project metrics, software measurement, metrics for software quality. Software project estimation: Software scope, human and environmental resources, decomposition techniques, empirical estimation models. Project planning and tracking: Fundamental principles, selection of software engineering tasks, scheduling, plan tracking, defect tracking.

BIL3017 Donanım Tanımlama Dilleri L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Embedded systems technologies. Features of the VHDL hardware description language, development and testing of models for combinational and sequential circuits. Logic-level and high-level synthesis. Synthesis of combinational and sequential circuits. Programmable logic and storage devices. Design of arithmetic–logic circuits and testing on an FPGA training board.

Social Elective I

HUK3009 Temel Hukuk L:2 P:0 L:0 (Cr: 2) ECTS:4 Turkish

Social order and law; differences between legal rules and other rules of social order; the purpose of law; sources of law; the making and application of legal rules; the distinction between public law and private law; branches of private law; branches of public law; the concept and types of rights; acquisition and loss of rights; legal events; legal transactions; protection of rights and the right to sue; the concept of personality; the beginning and end of legal personality; protection of personality; property and inheritance rights.



BIL3013 Girişimcilik-I L:2 P:0 L:0 (Cr: 2) ECTS: 4 Turkish

Assessment of entrepreneurial traits, idea development and creativity exercises, the concept and components of a business plan (market research, marketing plan, production plan, management plan, financial plan).

BIL3019 Mesleki İngilizce L:2 P:0 L:0 (Cr: 2) ECTS:4 Turkish

The course content aims to develop the skills required for a foreign language in an academic environment and to teach commonly used professional terminology and language structures.

IKT3015 Mühendislik Ekonomisi L:2 P:0 L:0 (Cr: 2) ECTS:4 Turkish

Introduction to Engineering Economics, Costs in Engineering Economics, Supply and Demand, Cash Flow Concept, Time Value of Money – Equal Series Payments, Time Value of Money – Gradient Cash Flows, Evaluation Methods – Present Worth, Evaluation Methods – Annual Equivalent, Evaluation Methods – Future Worth, Selection of Alternatives, Payback Period, Nominal and Effective Interest Rates.

6th Semester

BIL3008 Bilgisayar Grafikleri-I L:3 P:0 L:0 (Cr: 3) ECTS: 5 Turkish

Linear algebra fundamentals for computer graphics such as vector product, scalar product, deriving surface equations, and their application areas; lighting using the Phong shading model; modeling reflection, transparency, and refraction in 3D objects; back-face culling methods; texture mapping using barycentric coordinates; interactive computer graphics; Bézier curves and their applications; Bézier surfaces and their applications; three-dimensional transformations: rotation, translation, scaling; implementation of the Phong shading model in DirectX 12; texture mapping in DirectX 12; reflection implementation in DirectX 12; introduction to 3D modeling in MAYA; tank game development with DirectX 12.

COM3004 Computer Networks L:4 P:0 L:0 (Cr: 4) ECTS: 6 English

Evolution of computer networks, network programming and applications. Data transmission: communication media, electromagnetic media, copper cables, fiber optic cables, asynchronous communication, and long-distance communication. Packet transmission: packets, frames, and error detection. Local area network (LAN) technologies and network topologies: multiple access protocols, hardware addressing, and frame type determination. LAN cabling, physical topology, and interface hardware. Expansion of LANs: fiber modems, repeaters, bridges, and switches. Long-distance digital communication technologies. Wide area network (WAN) technologies and routing algorithms. Connection-oriented network usage and ATM. Network



characteristics: ownership, services, performance, protocols, and layered structure. Internetworking technologies: concepts, architectures, protocols, and congestion control algorithms. IP: Internet Protocol addressing. Address binding protocols. IP datagrams and datagram forwarding. IP encapsulation. Future IP. Error detection mechanisms. TCP: reliable transport service, simple transport protocol. Internet routing, network applications.

BIL3006 Sinyaller ve Sistemler L:3 P:0 L:0 (Cr: 3) ECTS: 6 Turkish

Classification of signals and fundamental properties of signals. Some MATLAB examples. Time-domain models of Linear Time-Invariant (LTI) systems: continuous-time systems. Fundamental properties of systems. Causal LTI systems defined by differential equations. Block diagrams of systems. Solution of differential equations. Impulse response and convolution integral. State-variable analysis of LTI systems. Discrete-time systems. Difference equations. Unit sample response and discrete convolution. Frequency-domain models of LTI systems: Fourier series representation of continuous-time and discrete-time periodic signals. Continuous-time and discrete-time Fourier transforms. Discrete Fourier transform (DFT). Time and frequency characteristics of signals and systems. Frequency-domain analysis of systems. Laplace Transform and s-domain models of LTI systems: definition of bilateral and unilateral Laplace transforms. Inverse Laplace transform and contour integration. Impulse response and convolution. s-domain analysis of LTI differential systems. Pole-zero plots. Stability analysis. z-Transform and z-domain analysis of LTI systems: z-transform and inverse z-transform. Region of convergence in the z-transform. z-domain analysis of discrete LTI systems. LTI systems with random inputs: introduction to random processes. Definition of random variables, stochastic processes, first- and second-order statistics, moments, correlation and covariance, stationary processes, ergodicity. System response.

COM3000 System Programming L:3 P:0 L:0 (Cr: 3) ECTS: 5 English

Prerequisite: COM1000-Introduction to Computer Programming or COM2001-Object Oriented Programming

Unix systems: Unix versions, layers, system login, command execution. Unix file systems: working directory, file hierarchy, system paths, standard directories, file types, file handling, file permissions, renaming files, file systems. Shell operators: standard files, file descriptors, I/O redirection, pipes, processes, filters, communication. Regular expressions (RE): commands using RE, the egrep command, metacharacters. Window system: X Window System, X server, window managers, desktop environments. Shell environments: command-line parsing, text-based completion, aliases, command-line editing, command history. Shell programming: shell variables, integer arithmetic, variable substitution, command-line arguments, command substitution, control structures, function definition and invocation, login scripts, shell scripts. Program development tools: creation of source files, separate compilation, execution and testing, gcc and make commands. System programming: files, directories, processes, buffered I/O, standard I/O, standard streams, system call interface. File operations: basic file I/O, file



descriptors, creating and opening files, reading and writing files, file seeking, kernel operations, file control, device files. Process operations: creating processes, executing programs, exit status, orphan processes, pipe system call, signals.

Technical Elective II

BIL3012 Görüntü İşleme L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Image generation systems and standards; 2D and 3D image generation, digital image formats; geometric relationships between the image and the real-world coordinate system; image analysis: preprocessing operations, spatial filters; first- and second-order derivative-based edge detection operators and their applications; image segmentation; thresholding-, edge-, and region-based methods; discrete transforms in image processing (Fourier, cosine, Walsh–Hadamard, wavelet transforms) and their applications; model-based object detection using the Hough transform; mathematical morphology; extraction and analysis of feature parameters of objects in binary images; pattern classification and recognition; image enhancement; image restoration, spatial and spectral filtering techniques; geometric transformations; lossless compression methods for image data; lossy image data compression methods, JPEG, MPEG, H.263 image compression principles.

BIL3002 Web Programlama L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

HTML and CSS. Creating HTML Forms. PHP Language: Variables and Constants. PHP Language: Operators, Decision Structures. PHP Language: Loops, Function Definition. PHP with MySQL. PHP with XML. PHP with RSS. JavaScript and DOM. Creating HTML Forms with Ajax. Database operations with Ajax. XML with Ajax. RSS with Ajax.

BIL3004 Optimizasyon L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Systems of linear inequalities, linear programming, the Simplex method, nonlinear programming, classical solutions, unbounded solutions, artificial initial solution, finding local extrema in nonlinear programming, convex and concave functions, multidimensional optimization problems, Lagrange method, numerical optimization methods, approximation methods, steepest descent method, hill climbing method, applications such as finding the shortest path, dynamic programming, assignment methods, genetic algorithms and ant colony algorithms, game theory, equilibrium theorem.



Social Elective II

ISL3026 Yönetim ve Organizasyon L:2 P:0 L:0 (Cr: 2) ECTS:4 Turkish

Management, management and decision-making, management and planning, management by objectives, classical organization theory, neo-classical organization theory, systems approach, contingency approach, total quality management, customer satisfaction, quality control circles, quality assurance systems, standardization.

HUK3028 Bilişim Hukuku D:2 U:0 L:0 (K: 2) AKTS: 4 Turkish

Individual and Institutional Responsibility, Violation of Personal Rights on the Internet – Actors of the Internet, Access Blocking, Protective and Compensation Lawsuits, Liability in Social Media, Cybercrimes and Information Technology-Related Crimes, Crimes Committed Through Press and Broadcasting, Personal Data, Intellectual Property Rights, Advertising Liability, Limits of the Right to Inform, Internet News Sites, Liability Arising from Mass Communication Media, Landmark High Court Decisions.

BIL3010 Girişimcilik – II L:2 P:0 L:0 (Cr: 2) ECTS: 4 Turkish

Workshops on market research, marketing plan, production plan, management plan, and financial plan aimed at reinforcing the components of a business plan. Key considerations in writing and presenting a business plan.

BIL3016 İş Hayatında İngilizce L:2 P:0 L:0 (Cr: 2) ECTS: 4 Turkish

By reading texts from various topics in Computer Engineering, students improve their reading and comprehension skills. Through the use of abbreviations and symbols, mathematical expressions, computer engineering terminology, résumé writing samples, job advertisements and application form examples, telephone conversations, application notes and obtaining technical information, specification preparation, letter writing examples (general letters, business letters, commercial letters), and speaking practices, students' reading, comprehension, and writing skills are enhanced.

7th Semester

BIL4001 Mühendislik Tasarımı L:2 P:2 L:0 (Cr: 3) ECTS: 8 Turkish

Prerequisite: To Successfully Complete the Courses of the First Four Semesters.

By developing a project from start to finish, students gain practical experience in this field and build confidence for projects they will undertake in the future. They have the opportunity to apply the knowledge and skills they have acquired in previous courses. In this way, they not



only reinforce their theoretical knowledge but also develop the habit of applying it to real-life situations. Additionally, by taking an active role in the project development process and in teamwork, they improve their collaboration, responsibility, and communication skills. Thus, they gain valuable experience both individually and as part of a team.

BIL4019 **Mesleki Deneyim – I** **L:0 P:2 L:0 (Cr: 0)** **ECTS: 4**

An individual who gains a solid foundation in the legal, professional, and ethical framework related to their field of interest can confidently apply this knowledge in their professional life. At the same time, by developing problem-solving skills, they can effectively use this ability in various areas related to their profession. In professional settings, they also acquire the ability to resolve both work-related issues and interpersonal problems by utilizing their organizational skills. Thus, they become well-equipped both professionally and socially.

AITB4001 Atatürk İlkeleri ve İnkılap Tarihi – I **L:2 P:0 L:0 (Cr: 2)** **ECTS: 2** **Turkish**

Historical terms, concepts, introduction to sources and methods, the French and Industrial Revolutions, the Dissolution of the Ottoman Empire (19th century). The Tanzimat and Islahat Edicts, the First and Second Constitutional Periods, the Italo-Turkish (Tripoli) War and the Balkan Wars, World War I, the Armistice of Mudros, Wilson’s Principles, the Paris Conference, Mustafa Kemal’s arrival in Samsun and the situation in Anatolia, the Amasya Circular, National Congresses, the Opening of the Ottoman Parliament, the Establishment of the Grand National Assembly of Turkey (TBMM) and internal revolts, the Constitution of 1921 (Teşkilat-ı Esasi Law), the establishment of the regular army, the First Battle of İnönü, the Kütahya–Eskişehir Battles, the Battle of Sakarya and the Great Offensive, treaties during the War of Independence, the abolition of the Sultanate, the Treaty of Lausanne, and the Proclamation of the Republic.

Technical Elective III, IV, V

BIL4013 **Yapay Zeka** **L:3 P:0 L:0 (Cr: 3)** **ECTS: 4** **Turkish**

Problems of Artificial Intelligence. Intelligence tests. The Turing Test. The Chinese Room test. Problem-solving methods. State space. Search techniques. Heuristic problem solving. Games. Alpha-beta and minimax algorithms. Data modeling: semantic networks, frame model, scene model. Knowledge base. Rules. Expert systems. Natural language processing. Parsers. Production systems. Computer vision. Recognition of handwriting and printed characters. Knowledge base architecture. Learning. Artificial neural networks and learning. Object recognition using neural networks. Speech analysis and synthesis, speech recognition.



BIL4023 Derleyici Tasarımı L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Lexical analysis: lexical tokens, regular expressions, finite automata, lexical analyzer generators. Parsing: context-free grammars, predictive parsing, LR parsing, parser generators. Abstract syntax: semantic actions, abstract syntax trees, visitors. Semantic analysis: symbol tables, type checking. Activation records: stack frames, frames in the MiniJava compiler. Intermediate code translation: intermediate representation trees, translation to trees, declarations. Basic blocks and control flow: trace trees, conditional branch extraction. Instruction selection: instruction selection algorithms, CISC machines, instruction selection for the MiniJava compiler. Liveness analysis: solving data flow equations, liveness in the MiniJava compiler. Register allocation: graph coloring via simplification, coalescing, precolored nodes, graph coloring, register allocation for trees. Code generation: integrating all modules.

BIL4005 Bilgisayar Ağ Programlama L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Client–server interaction. Socket interface. Client and server examples. Naming with DNS: DNS namespace, resource records, and name servers. Definition and transmission of electronic mail. File transfer and remote file access. World Wide Web pages and browsing: client-side and server-side. Locating documents on the web. Dynamic document technologies. Active web technologies. Remote procedure calls and middleware. Network management. Network security: traditional encryption techniques, symmetric and asymmetric algorithms, and digital signatures. Multimedia: audio, video, data compression, video on demand, and multicast on the backbone. Initialization and bootstrapping.

BIL4003 Robot Teknolojisi L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Definition of robots, their applications and types. Robot computer hardware and interfaces. Mechanical, electrical, pneumatic, and hydraulic actuators for robot joints. Robot sensors, control structures, and algorithms. Open-loop control and closed-loop control. Effects of friction and gravity, important considerations in the frequency domain. Sensor systems: potentiometers, synchros, resolvers, optical sensors, and encoders. Robot calibration. Drive systems: stepper motors, brushless DC motors, and direct-drive actuators. Motor driver circuits, servo amplifiers, linear and pulse-width modulated amplifiers, and the effect of feedback in servo amplifiers. Position measurement and motion control. Robot kinematics and dynamics. Robot software, robot programming languages, software requirements, and transformation matrices. Vision in robotics: image perception, edge detection, and computer vision interfaces.

BIL4011 Windows Programlama D:3 U:0 L:0 (K: 3) AKTS: 4 Turkish

Fundamental Techniques. Windows Graphics System Architecture. GDI/DirectDraw Internal Data Structures. Graphics Pipeline. Coordinate Space and Transformations. Pixels. Lines,



Curves, and Areas. Bitmap Fundamentals. Advanced Bitmap Graphics. Image Processing Using Windows Bitmaps. Palettes and Fonts. Text and Metafiles. Printing. DirectDraw and Direct3D.

BIL4015 Yapay Sinir Ağları L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Artificial neural systems: neural computation, history of the development of artificial neural systems (ANS). Fundamental concepts and models of ANS: biological neurons, ANS models, neural processing, learning and adaptation, neural network learning rules. Single-layer neural classifiers. Multilayer feedforward networks. Single-layer feedback networks. Associative memories. Competitive and self-organizing networks. Applications of neural algorithms and systems. Implementation of neural networks.

BIL4017 Sayısal İşaret İşleme L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Discrete-time signals, sampling, signal reconstruction, discrete-time systems, convolution, difference equations, Discrete-Time Fourier Transform (DTFT), Discrete-Time Fourier Series (DTFS), Fast Fourier Transform (FFT), system transfer function in the frequency domain, Z-transform, system transfer function in the Z-domain, FIR and IIR filter structures.

Computer Lab Electives I

BIL4021 Bilgisayar Organizasyon Laboratuvarı L:1 P:0 L:1 (Cr: 1.5) ECTS: 4 Turkish

Assembly language programs, development using an Integrated Development Environment (IDE), binary multiplication, microprocessor-based Analog-to-Digital Converter (ADC), integer square root calculation using a microprocessor, busy-wait operation and time-critical tasks, control of a stepper motor in microcomputers, serial input/output, interrupt-driven input/output, smart traffic intersection.

BIL4021 Bilgisayar Grafikleri Laboratuvarı L:1 P:0 L:1 (Cr: 1.5) ECTS: 4 Turkish

OpenGL Applications, WebGL Applications, Surface Filling Techniques, 3D Modeling with MAYA, Animation with MAYA, Texture Mapping with Inverse Perspective Transformation, Tank Game Development with DirectX, Rough Surface Generation.



8st Semester

BIL4000 Bitirme Projesi L:2 P:2 L:0 (Cr: 3) ECTS: 8 Turkish

Prerequisite: BIL4001-Mühendislik Tasarımı, To Successfully Complete the Courses of the First Four Semesters.

By developing a project from start to finish, students gain hands-on experience in this field and build confidence for future projects. They have the opportunity to apply the knowledge and skills acquired in previous courses. In this way, they not only reinforce their theoretical knowledge but also develop the habit of applying it to real-life situations. In addition, by taking an active role in the project development process and in teamwork, they improve their collaboration, responsibility, and communication skills. Thus, they gain valuable experience both individually and as part of a team.

BIL4014 Mesleki Deneyim – II L:0 P:2 L:0 (Cr: 0) ECTS: 4

An individual who acquires a solid foundation in the legal, professional, and ethical framework related to their field of interest can confidently apply this knowledge in their professional life. At the same time, by developing problem-solving skills, they can effectively use this ability in various areas related to their profession. In professional contexts, they gain the ability to resolve both work-related and interpersonal issues by leveraging their organizational skills. Thus, they become well-equipped both professionally and socially.

AITB1000 Atatürk İlkeleri ve İnkılap Tarihi – II L:2 P:0 L:0 (Cr: 2) ECTS: 2 Turkish

Reforms in the political sphere, political parties and attempts to transition to a multi-party political system, reforms in the field of law, regulation of social life, innovations in the economic sphere, Turkish foreign policy during the period 1923–1938, Turkish foreign policy after Atatürk, the Principles of the Turkish Revolution (Republicanism, Populism, Secularism, Reformism, Statism, Nationalism), and Complementary Principles.

Technical Elective VI, VII, VIII

BIL4016 Paralel Bilgisayarlar L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Classification of parallel computer systems, levels of parallelism, parallel operations. Petri nets: definition and coordination of parallel organizations among parallel processes. Concept of parallel processing. Network structures. Basic parallelism: SISD computers and multiprocessor CPUs. Pipeline computers; MISD computers, linear and nonlinear; superscalar and superpipelined computers. Asynchronous parallelism. Structure of MIMD systems. Synchronization and communication in MIMD systems. MIMD programming languages and coarse-grained parallel algorithms. System software for complex problems. Synchronous parallelism. Structure of SIMD systems. Communication in SIMD systems. SIMD



programming languages and MasPar algorithms. Non-procedural parallel programming languages. State of parallelism: automatic parallelization and vectorization. Evaluation of parallel systems.

BIL4010 Tıbbi Görüntüleme Sistemleri L:3 P:0 L:0 (Cr: 3) ECTS: 4 Turkish

Planar X-Ray Imaging: X-ray projection radiography, subtraction angiography. X-Ray Computed Tomography: imaging principles and geometry, considerations in measurement, imaging characteristics, post-measurement data processing in computed tomography. Magnetic Resonance Imaging (MRI): magnetic resonance phenomena, response measurement and interpretation, basic MRI settings, localization and reconstruction of image data, image quality and distortion effects, post-measurement data processing in MRI. Nuclear Imaging: planar gamma imaging, single-photon emission tomography (SPECT), positron emission tomography (PET). Ultrasonography: two-dimensional echo imaging, flow imaging, three-dimensional ultrasonography. Other methods: optical and infrared imaging, electron microscopy, electrical impedance tomography.

BIL4008 Veri Madenciliği D:3 U:0 L:0 (K: 3) AKTS: 4 Turkish

Fundamental Concepts, Data Preparation, Data Reduction, Distribution-Based Clustering, Decision Trees, Ensemble Learning, Cluster Analysis, Association Rules, Web and Text Mining, Graph Mining, Temporal and Spatial Data Mining, Visualization Methods.

BIL4006 Bulanık Mantık D:3 U:0 L:0 (K: 3) AKTS: 4 Turkish

Fuzzy Set Theory, Fuzzy Logic, Properties of Fuzzy Sets and Fuzzy Logic. Fuzzy Operations. Fuzzy Relations and the Extension Principle. Approximate and Fuzzy Reasoning. Fuzzy Rules. Fuzzification, Defuzzification, and Fuzzy Logic-Based Controllers. Fuzzy Control Applications. Introduction to Other Applications. Implementing Computer-Aided Application Examples.

BIL4012 Mantıksal Programlama D:3 U:0 L:0 (K: 3) AKTS: 4 Turkish

Fundamentals of logical programming, first-order predicate logic, atoms and variables, lists, operators. Backtracking control, recursion, head and tail structures, cut operation, search techniques, Lisp programming, expert system examples.

BIL4004 Ağ ve Veri Güvenliği D:3 U:0 L:0 (K: 3) AKTS: 4 Turkish

Objectives of ensuring data security and techniques used for securing data, integer and modular arithmetic, operations performed in modular arithmetic, linear and quadratic congruence systems, traditional symmetric encryption methods, algebraic structures, Galois fields, modern symmetric encryption systems, DES, AES, modern symmetric encryption systems, asymmetric



key systems, integrity, authentication and message authentication, cryptographic hash functions, digital signatures, key distribution management.

Computer Lab Electives II

BIL4018 Bilgisayar Ağları Laboratuvarı L:1 P:0 L:1 (Cr: 1.5) ECTS: 4 Turkish

Various computer networks and internet applications. Network and socket programming. Static, dynamic, and active web programming. Parallel and distributed systems and programming in these systems.

BIL4020 Bilgisayar Sistemleri Laboratuvarı L:1 P:0 L:1 (Cr: 1.5) ECTS:4 Turkish

Grammar-Based Evaluation Methods, Process Monitoring in Operating System Environments, Client–Server Architectures, Bison Parser Generator, Interprocess Communication, Process-Based Multitasking and Synchronization in Windows Operating Systems, Data Compression Methods.

