

Üsküdar University
Faculty of Engineering and Natural Sciences

Department of Computer Engineering

**Compulsory English
Preparatory Class**

Course Contents

Course Contents

Year One

1st Term

COME101-Introduction to Computer Engineering

3 (2+0+2) ECTS: 4

Main objective is to give a brief for the practical use of computers and information technologies to acquire, manage, and use information that will be vital to the personal and professional lives will be presented. Basic computer hardware and software concepts, computer networks, effective use of internet, Microsoft Office programs and their use in the respective fields, web page design and web site publishing preliminaries will be carried out. The course will also provide the necessary information about computer engineering like computer data representation, storage and data manipulation, operating systems and networks, algorithms, programming languages, software engineering, database structures, artificial intelligence, theory of computation.

MATH101-Calculus I

4 (3+2+0) ECTS: 6

Foundations, coordinates and vectors, functions, limits, continuity, derivative, tangent lines, the mean value theorem, graphing, extreme values, optimization problems, linearization and differentials, integration, Riemann sums and definite integrals, the fundamental theorem of calculus, natural logarithm, exponential functions, inverse trigonometric functions, L'Hospital's rule, methods of integration, applications of integrals.

PHYS101-Physics I

4 (3+0+2) ECTS:6

Measurement and vectors, kinematics, Newton's laws, circular motion, gravitation, work and energy, conservation of energy, momentum, statics, rotational Motion, simple harmonic motion, wave motion, heat, the first law of thermodynamics, kinetic theory of gases, the second law of thermodynamics, entropy (Related experiments).

CHEM101-General Chemistry I

4 (3+0+2) ECTS:6

Chemical foundations, atoms, molecules and ions, modern atomic theory, chemical compounds and their nomenclature, stoichiometry of chemical reactions, chemical calculations, reactions in solutions, precipitation, acid-base neutralization and oxidation-reduction (redox) reactions, gases, thermochemistry, periodic table and its properties, properties of solutions, chemical reaction kinetics and principles of chemical equilibrium. Laboratory experiments accompany the lectures.

ING 10X-English I

3 (3+0+0) ECTS: 3

Reading texts and exercises. Listening exercises. Translation exercises. Writing essay. Speaking exercises, conversations.

TURK101-Turkish Language I

2 (2+0+0) ECTS: 3

Definition of "language", social role and importance, language-culture relationships, Turkish language and its place and relationships amongst the global languages, the history and development of Turkish language, current position and the hinterland of Turkish language. Phonetics and classification, characteristics of Turkish phonetics and the rules related to phonetics. Spelling rules and applications, punctuations marks and applications, general rules about essay writing, planning of essay writing, words and verbs, adverbs and prepositions with applications.

RCUL-University Culture**1 (0+2+0) ECTS: 1**

In this course, it is intended to make students gain a higher education culture by participating seminars and conferences organized by universities and writing reports about these academic activities.

RPSC109-Positive Psychology and Communication Skills**3 (3+0+0) ECTS: 5**

The course includes subjects like the general framework of the basic concepts of communication sciences, solutions and recommendations to strengthen communication skills, interpersonal communication, group communication, organizational communication, mass communication, public communication, international communication and intercultural communication.

Year One**2nd Term****COME102-Introduction to Algorithms and Programming****3 (2+0+2) ECTS: 4**

Basic computer literacy: terminology, system components and operation. Fundamentals of computer programming: sequence, decision, repetition, syntax, compilation, debugging and maintenance, procedures, parameters, arrays, searching, sorting, top-down structured design, and style. Recursion, pointers and dynamic memory allocation; strings and string processing; advanced file processing; programmer-defined types; Introduction to Object Oriented Programming; classes and data abstraction: behaviour/state (data) model, member scope and access, constructors/destructors, object assignment.

COME104-Discrete Mathematics**3 (3+0+0) ECTS: 4**

The Foundations: Logic and Proofs, The Foundations: Logic and Proofs, Basic Structures: Sets, Functions, Sequences, and Sums, Basic Structures: Sets, Functions, Sequences, and Sums, The Fundamentals: Algorithms, the Integers, and Matrices, The Fundamentals: Algorithms, the Integers, and Matrices, Induction and Recursion, Counting, Advanced Counting Techniques, Relations, Graphs, Trees, Boolean Algebra, Modeling and Computation

MATH102-Calculus II**4 (3+2+0) ECTS: 6**

Sequences and series, Taylor and Maclaurin series, lengths of plane curves, polar coordinates and complex numbers, lines, planes and quadric surfaces in space, functions of several variables, limits and continuity, partial derivatives, differentiability, the chain rule, directional derivatives, extreme values, multiple integrals, integrals in polar, cylindrical and spherical coordinates, line integrals and surface integrals.

PHYS102-Physics II**4 (3+0+2) ECTS: 6**

Electric charge and matter, electric field, electric flux and Gauss's law, potential, capacitors, current in materials, DC circuits, magnetic field and magnetic force, Ampere's and Faraday's laws, inductance, electromagnetic waves, geometrical optics, interference, diffraction and polarization, the particle and wave nature of EM radiation (Related experiments).

ING10X-English II**3 (3+0+0) ECTS: 3**

Reading texts about profession, grammar exercises, word activities, translation activities, listening and speaking exercises.

TURK102-Turkish Language–II**2 (2+0+0) ECTS: 3**

Components of a sentence, analysis and applications of the sentence, reading and investigating of the literature and philosophy examples from the world and rhetoric applications. Arts of written essay and applications, expression and grammar defaults and their corrections, the rules to prepare scientific articles.

RCUL-University Culture**1 (0+2+0) ECTS: 1**

In this course, it is intended to make students gain a higher education culture by participating seminars and conferences organized by universities and writing reports about these academic activities.

Year Two**3rd Term****COME201-Object Oriented Programming I****3 (2+0+2) ECTS: 4**

Object-oriented programming principles and techniques using C++, Topics include classes, operator overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, class structure, constructor-destructor techniques, interfaces.

COME203-Logic Circuits**4 (3+0+2) ECTS: 6**

Realization of Boolean functions, logic gates. Multivibrators. Coding and debugging techniques. Boolean functions with a single-chip implementation. Flip-flops. Clock mode sequential circuits. Level mode sequential circuits. Counters. MSI integrated circuits. MSI chips, integrated circuit design. Logic circuits, race and hazard.

COME205-Data Structures**3 (2+0+2) ECTS: 5**

Basic data structures. Stacks and queues. The pointer concept and utilization of dynamic memory. Linked lists. Recursive calls. Tree structures. Algorithms related to basic data structures. Searching, sorting and linking methods which include basic data structures.

MATH201-Linear Algebra and Engineering Applications**3 (2+0+2) ECTS: 5**

Matrices, row equivalence, invertibility, systems of linear equations, determinants, Cramer's rule, vector spaces, linear dependence and independence, bases, inner product spaces, Gramm-Schmidt orthogonalization process, orthogonal projections, Fourier series, eigenvalues, eigenvectors, exponential matrix, diagonalization and its applications, linear transformations and their matrices. Examples for each subject of this course are performed in Matlab.

MAT203-Differential Equations**3 (2+2+0) ECTS: 5**

Differential equations and basic concepts. Differential equations as mathematical models. Differential equations of general, special and unique solutions. Existence and uniqueness theorems. Separable, homogeneous, complete and fully convertible into ordinary differential equations. Of linear differential equations, Bernoulli's differential equation and its applications. Change of variables. General solution of n-th order linear differential equations. n-th order homogeneous differential equations with constant coefficients, the general solutions. Non-homogeneous equations with constant coefficients and solution methods. Initial and boundary value problems. Homogeneous and non-homogeneous differential equations with variable coefficients. Power series solutions of differential equations around ordinary points. Laplace and inverse Laplace transforms. Fixed and variable coefficient initial value problems. Systems of differential equations.

Conversion of higher-order system of first order differential equations. Solutions of non-homogeneous diff. equations with constant coefficients. Application of Laplace transformation of differential equations systems. Methods for the numerical solution of differential equations.

ING211-Professional English I

3 (3+0+0) ECTS:3

Teaching English terms and terminologies in order to facilitate follow-up of the literature related to their course.

ATA101-Principles of Atatürk and History of Reforms-I

2 (2+0+0) ECTS: 3

In this course the meaning and the importance of the Turkish Revolution, the conditions which led to the Turkish Revolution, the environment and the developments, the National War of Independence under the leadership of Mustafa Kemal Pasha, the founding of the new Turkish State that is totally independent that rests upon national sovereignty, Atatürk as a genius soldier, as a great statesman, as a reformer and as a perfect organizer are presented.

Year Two

4th Term

COME202-Object Oriented Programming II

3 (2+0+2) ECTS: 4

Introduction to Java programming language and object oriented programming: objects, classes, and program control. Association and composition, data encapsulation, abstract classes, polymorphism, reloading functions, overloading functions, exception handling, threads, Building programs with files, graphics and networking. Internet applications.

COME204-Computer Architecture

3 (3+0+0) ECTS: 5

Computer systems: Microprocessor systems architecture developments. Cache systems: Cache organization, retrieval, and writing mechanisms. Memory management: Memory hierarchy, paging, replacement algorithms, virtual memory systems, Slicer. Serial and parallel I / O methods. Direct memory access (DMA). Shared input / output. Secondary registers: magnetic disk, optical storage, magnetic tape, magnetic recording techniques. Demonstrators CRT: Cathode ray tube and LCD displays CRT controllers, text and graphics memory. Shared-memory multi-processor systems-pipe processor design: multi-processor systems and programming, linking networks. Common non-memory multiprocessor systems: Message transmission multi-processor systems.

COME202-Signals and Systems

3 (2+2+0) ECTS: 6

Introduction, Time-domain representations of linear time-invariant systems, Fourier representations signals and linear time-invariant systems, applications of Fourier representations to mixed signal classes, application to communication systems, representing signals by using continuous time complex essentials: The Laplace transform, representing signals by using discrete time complex exponentials: the z-transform, application to filters and equalizers, application to linear feedback systems, epilogue.

COME208-Electronic Circuits

4 (3+0+2) ECTS: 6

Semiconductor structures, diodes, transistors. Transfer function concept. Rectifier circuits. RC filter circuits, time and frequency domains properties. Series and parallel circuits of the regulator. Operational applications: collection circuit, digital-to-analog converter, analog-to-digital converter, integral and derivative circuits. The use of electromagnetic waves in communication. Modulation types. Amplitude and frequency modulation.

COME210-Probability and Statistics**3 (3+0+0) ECTS: 5**

Introduction to Statistics, Descriptive Statistics, Probability, Random Variables and Expectation, Discrete Probability Distributions, Continuous Probability Distributions, Distributions of Sampling Statistics, Parameter Estimation, Hypothesis Testing, Simple Linear Regression and Correlation, Analysis of Variance

COME282 -Summer Practice I

The purpose of the internship, get to know the working environment of the computer industry and universities to apply the information obtained in such a practical working environment.

ATA102-Principles of Atatürk and History of Revolutions-II**2 (2+0+0) ECTS: 3**

The struggle of the Turkish Nation to go above the level of the contemporary nations with all its institutions and values, Principles and Revolutions of Ataturk, Ataturk's School of thought, Turkey's national and international politics during Ataturk's leadership, Second World War and Turkey and the transition period to the multi political party era in Turkey.

Year Three**5th Term****COME301-Database Management Systems****3 (2+0+2) ECTS: 5**

Introduction to database management systems, file structure, organization and processing, sequential files, direct files, sort/merge, indexed and hash files, relational data model, logical database design, entity-relationship data model, data description and query languages.

COME303-Microprocessors**3 (2+0+2) ECTS: 5**

Central processing unit (CPU): The CPU registers, arithmetic and logic unit, status flags, micro command execution, microprogramming, and the control unit, the CPU legs. Memory: ROM, RAM, PROM, EPROM and E2PROM memories. Connection of the CPU and memory decoders. Parallel Input / Output: Programmed I / O, interrupted I / O, direct memory access I / O. Serial Input / Output. Programming of microcomputers: the source and the purpose programs. Assembly language and assembler directives. Memory addressing methods. CPU command set. Real CPUs. Microcomputer system design. Applications.

COME305-Computer Networks**3 (3+0+0) ECTS: 4**

Local and wide area network architectures, protocols, services and applications; Physical data transmission, the elements of reliable and unreliable communications protocols; Transfer of information between machines with similar and different characteristics; How communications services fit in with the hardware and operation system.

COME307-Operating Systems**3 (2+0+2) ECTS: 4**

Introduction to operating systems concepts, process management, memory management, virtual memory, input-output and device management, file management and file systems, job scheduling, deadlocks, interrupt structures, case studies of operating systems.

RPRE104-Entrepreneurship and Project Culture**2 (2+0+0) ECTS: 3****COMEXXX-Departmental Elective I****3 (3+0+0) ECTS: 5**

Year Three

6th Term

COME316-Computer Graphics

3 (3+0+0) ECTS: 6

Theory and practice of 3D computer graphics, Topics covered include graphics systems and models; geometric representations and transformations; graphics programming; input and interaction; viewing and projections; compositing and blending; illumination and color models; shading; texture mapping; animation; rendering and implementation; hierarchical and object-oriented modeling; scene graphs; 3D reconstruction and modeling.

MATH302-Numerical Analysis

3 (3+0+0) ECTS: 5

Field and space of real numbers, distance and norms in mathematical spaces, matrices, equations with real coefficients; the matrix inversion problem, eigenvalues and eigenvectors; recurrence relations, mathematical induction, and recursive algorithms; error analysis, evaluation and estimation; iterative methods in computational numeric analysis; finding roots of polynomials; numerical integration and differentiation; solving systems of linear algebraic equations, linear differential equations; the idea and concept of computer algebra systems and symbolic computation; computer handling of polynomials and rational functions; Square-free decomposition of polynomials; the extended Euclidean algorithm; Rational functions and partial fractions.

COMEXXX-Departmental Elective II

3 (3+0+0) ECTS: 5

COMEXXX-Departmental Elective III

3 (3+0+0) ECTS: 5

XXXXXXX-Social Elective I

3 (3+0+0) ECTS: 5

COME382-Summer Training II

The purpose of the internship, get to know the working environment of the computer industry and universities to apply the information obtained in such a practical working environment.

Year Four

7th Term

COME491-Graduation Project

2 (2+0+0) ECTS: 8

Computer Engineering within the scope of computer software, hardware and all matters related to science education.

COME401-Data Mining

3 (3+0+0) ECTS: 6

Introduction to data mining and data warehousing, introduction to relational data model and query languages, data warehousing and OLAP technology, data preparation, association rule mining, data mining and data confidentiality, classification, prediction, clustering, mining complex types of data.

COMEXXX-Departmental Elective IV

3 (3+0+0) ECTS: 5

XXXXXXX-Field Elective I

3 (3+0+0) ECTS: 5

XXXXXXX-Social Elective II

3 (3+0+0) ECTS: 5

Year Four

8th Term

COME492-Graduation Thesis

2 (0+4+0) ECTS: 9

Computer Engineering within the scope of computer software, hardware and all matters related to science education.

ING212-Professional English II

3 (2+2+0) ECTS: 4

Teaching English terms and terminologies in order to facilitate follow-up of the literature related to their course.

COMEXXX-Departmental Elective V

3 (3+0+0) ECTS: 5

COMEXXX-Departmental Elective VI

3 (3+0+0) ECTS: 5

XXXXXX-Field Elective II

3 (3+0+0) ECTS: 5

XXXXXX-Elective (Second Foreign Language)

2 (2+0+0) ECTS: 3

ELECTIVE COURSES POOL

COME309-Web Programming

3 (3+0+0) ECTS: 5

.Net framework, Operational models of the Internet applications. The basic logic of Asp.net, Asp.net application. Asp.net objects. Asp.net objects with central regulation, Web form elements, database concepts, Ado.net and the database, Ado.net and dataset, introduction to the use of Asp.net, XML.

COME311-Data Security

3 (3+0+0) ECTS: 5

Conventional encryption techniques and algorithms: DES, Block Encryption, Blowfish, RCS, CAST-128, Confidentiality: key distribution, random number generation. Public-key encryption. Number Theory, Message authentication and Hash functions, Hash and Mac algorithms, Digital signatures and authentication protocols. Verification applications. Elliptic curves and cryptography. Chaotic encryption. Discrete logarithms. Information theory. Error correction codes.

COME304-Visual Programming

3 (3+0+0) ECTS: 5

Visual programming environment, basic components and design phase, component properties and events, variables, control statements and loops, object-oriented programming, the use of advanced components, database applications, Internet applications, preparing setup projects, graphics commands, game programming.

COME306-Digital Signal Processing

3 (3+0+0) ECTS: 5

Introduction of digital signal processing and its applications. For digital systems operating in real-time analog-to-digital input / output interface principles. Discrete transformations. Discrete Fourier transform, fast fourier transform, inverse fast Fourier transform, and other discrete transformations. Z-Transform and signal processing applications. Relationship extraction and convolution functions. Digital learning and learning algorithms for voice recognition, Digital filter design principles. Digital filter design with finite impulse response, FIR filter design by windowing, frequency sampling-based FIR filter design, recursive digital filters, design. Adaptive digital filters.

COME308-Mobile Programming**3 (3+0+0) ECTS: 5**

Mobile Devices and Technologies, file and directory Read / Write operations, XML files, XML Web Services and ADO.NET. Visual Studio 2008, Working with emulators and devices, SQL Server Compact Edition Environment, Graphics Programming, .NET Compact Framework, developing interface for Mobile Applications, Sending SMS and email, developing high performance applications, Testing and debugging, Sample applications.

COME310-Real Time Systems**3 (3+0+0) ECTS: 5**

The goal of this course is to familiarize students with the issues and technologies involved in designing real-time and hardware-resource constrained systems. Design engineers are often called upon to make decisions about general purpose computing solutions vs. specialized hardware solutions, this course will give students the tools to intelligently make the necessary tradeoffs and understand the business consequences of their choices.

COME312-User Interface Design**3 (3+0+0) ECTS: 5**

The basics of user interfaces, human skills and limits. Usability principles. User and task analysis. The design phase, prototyping and evaluation. The color and design. The new user interface technologies.

COME314-Introduction to Control Systems**3 (3+0+0) ECTS: 5**

Introduction to Control Systems, Mathematical Modeling, Difference and differential equations in discrete and continuous time domain, SISO and MIMO systems, Linear and nonlinear systems, Linearization, Linear Time Invariant systems, I/O representation, Transfer functions, Block diagrams, Open-loop Systems, Closed loop systems, Time-domain analysis, Frequency-domain analysis, Bode diagrams.

COME403-Software Engineering**3 (3+0+0) ECTS: 5**

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 of modeling elements, data modeling, functional modeling, behavioral modeling, structural analysis, mechanics. Design Engineering: Design process, design principles, design concepts, impressive 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: test principles, white-box testing, the basic road test, control structure testing, black box testing. Software testing strategies: the verification and validation, unit testing, integration testing, provisioning, testing, system testing, debugging. Project management concepts: range management, software suite, software, content, problem decomposition, process decomposition. Software metrics: The project domain, project metrics, software measurement, software quality metrics. Software project estimation: Software scope of the humanitarian and environmental resources, decomposition techniques, empirical prediction models. Project planning and tracking: Basic principles, selection of software engineering tasks, time diagram, plan tracking, bug tracking.

COME405-Artificial Intelligence**3 (3+0+0) ECTS: 5**

The course objective is to introduce the students to the "Artificial Intelligence" area. In particular, the course will start from problems system modeling using neural networks. Later in the Term,

various controllers will be discussed. Using the controllers, the students will optimize the parameters using optimization algorithms. Upon successful completion of the course, the student must be able to: model a real time system to control and use optimization algorithms for any parameter.

COME407-Image Processing

3 (3+0+0) ECTS: 5

Image production mechanisms and Standards; 2-D, 3-D image production, digital image formats, geometric relationships between the image and world platform; Image Analysis: Preliminary functions, spatial filters, edge detection based on the first-second order derivative operators and its applications; Image segmentation; Thresholding-Edge Field-based methods, image processing discrete transforms (Fourier, Cosine, Walsh-Hadamard, Wavelet transforms) and their applications; model-based object detection with Hough transform, mathematical morphology; feature parameter production and analysis of the objects used in 2D images, pattern classification and recognition, improving the quality of the image, the image restoration, spatial and spectral filtering techniques, geometric transformations, lossless image data compression techniques, lossy image data compression methods, JPEG, MPEG, H. 263 video compression principles.

COME409-Automata Theory

3 (3+0+0) ECTS: 5

Basic concepts: the alphabet, language, concepts, basic methods of proof. Recursive identification. Regular expressions. Finite automata models. Examples of applications of finite automata: the communication protocol design, lexical analysis. Kleene theory. Non-deterministic finite automata models. Finite Automata with Output. Uniform and non-uniform languages, "pumping lemma". Context free grammars, parsing trees, push down automata models. Turing theory.

COME402-Artificial Neural Networks

3 (3+0+0) ECTS: 5

Introduction to neural networks, feed-forward networks, multi-layer perceptrons, multi-layer samples for the networks, back propagation networks (Hopfield Network), back propagation network examples and supervised, unsupervised learning, SOM (Self Organizing Networks)

COME404-Fuzzy Control

3 (3+0+0) ECTS: 5

Introduction to fuzzy logic. Classical sets and fuzzy sets. Classical relations and fuzzy relations. Membership function features: fuzzyfication, defuzzyfication. Fuzzy logic systems. Membership function development. Fuzzy systems automation. Fuzzy system simulation. Rule-based reduction methods. Fuzzy logic and decision-making methods. Fuzzy classification and pattern recognition, fuzzy arithmetic, fuzzy control systems. Current fuzzy logic issues.

COME406-Parallel Computing

3 (3+0+0) ECTS: 5

Classification of parallel computer systems, level of parallelism, parallel operations. Petri nets, describing organization and co-ordination between parallel processes. Parallel processing concepts. Network structures. Basic Parallelism; SISD computers, CPUs and multi-tasking. Pipeline computers; MISD computers, linear and non-linear, and super-pipelined superscalar computers. Asynchronous Parallelism. Structure of MIMD systems. MIMD systems, synchronization and communication. MIMD parallel algorithms, programming languages, and coarse grain. System software for complex problems. Synchronous Parallelism. Structure of SIMD systems. Communication in SIMD systems. Maspar SIMD programming languages and algorithms. Non-procedural programming languages in parallel. Condition of parallelism, automatic parallelization and vectorization. Evaluation of parallel systems.

COME408-Network Security**3 (3+0+0) ECTS: 5**

Techniques and types of access control, authentication, authorization, password setting, the password authentication, biometric, Access from a single point, Kerberos, RADIUS, TACACS, unauthorized access detection, intrusion detection, attack types, the ISO model, protocols, TCP, IP, ICMP, packet sniffing, Smurf attack, SYN flood attack, DOS attacks. DNS poisoning, firewall, VPN, IPsec, NAT, PAT, Secure HTTP, SSL, SET.

COME410-System Programming**3 (3+0+0) ECTS: 5**

Unix systems: Unix versions, layers, the system input, command execution. Unix file systems: the root directory, the file hierarchy, the system routes the standard directories, file types, file processing, file permissions, file name substitution, file systems. Shell operators: Standard files, file descriptors, I/O routing, pipes, processes, filters, communication. Regular expressions (RE): RE, which makes using the commands egrep command, the meta-characters. Window system: X windows, the X server, window managers, desktop environments. Shell environment: Command line parsing, based on the text 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: the creation of source files, separate compilation, running, and testing, gcc and make commands. System programming: files, directories, processes, hide I/O, standard I/O, standard channels, system call interface. File operations: Basic file I/O, file descriptors, Creating and opening files, reading and writing files, file research, core processes, file control, device files. Process Operations: Creating Processes, programs run, output status, orphan processes, pipe system call signals.

COME412-Embedded Systems**3 (3+0+0) ECTS: 5**

Embedded Systems Introduction, C programming, embedded system design, Arduino intro, basic circuit diagrams, instruction sets, registers and mem access, digital I/O, timers, debugging, pulse width modulation (PWM), CPU bus, com protocols (UART, SPI, I2C), analog input, power management, program optimization, interrupts, embedded algorithms, feedback control, embedded operating systems, peripherals, sensors, embedded systems applications, embedded systems applications.

COME414-Optimization Techniques**3 (3+0+0) ECTS: 5**

Introduction to optimization, graphical optimization, Unconstrained Optimization, Constrained Optimization, Global Optimization, Linear optimization, nonlinear optimization, Optimization and Functions of a Complex Variable and Numerical Analysis, Optimization in Operation Research, PERT and CPM.

COME416-Compiler Design**3 (3+0+0) ECTS: 5**

Compilers and translators; vocabulary and syntax analysis, bottom-up and top-down parsing techniques, semantic analysis, symbol tables, error detection, code generation and optimization;