

BSc Degree in Computer Engineering

1st year, 1st semester
Mathematical Analysis I
Algebra
Introduction to Programming
Digital Systems
Technology Fundamentals
1st year, 2nd semester
Mathematical Analysis II
Logic and Computing
Introduction to Digital Electronics
Object Oriented Programming
Internet Technology I
2nd ano, 1st semester
Probabilities and Statistics
Data Structures and Algorithms
Introduction to Telecommunications
Computer Architecture I
Databases I
2nd ano, 2nd semestre
Operating Systems
Data Networks I
Databases II
Microprocessors
Internet Technology II
3rd ano, 1st semestre
Software Analysis and Architecture
Data Networks II
Computer Architecture II
Computer Networks – Management and Security
Distributed Systems
3rd ano, 2nd semestre
Entrepreneurship
IT Systems on Organizations
Data and Computer Network Project
Information Systems Project
Final ICT Project

Mathematical Analysis I

Preliminaries. Real functions of a real variable: definitions; function classes; properties. Limits and continuity: definitions; theorems. Differential calculus: definition of derivative and geometric interpretation; differentiability and continuity; derivation rules; Bolzano's, Weierstrass's, Rolle's, Lagrange's and Cauchy's theorems; Cauchy's and L'Hôpital's rules; derivative applications; increments and differentials. Integral calculus: antiderivatives; techniques of integration; definite integral; applications: areas and volumes; improper integrals.

Algebra

Complex numbers. Matrices and systems of linear equations. Vector spaces: subspaces, linear spanning; linear independence; basis and dimension; applications. Determinants and their application to the solution of linear systems and computation of the inverse of a square matrix. Analytic geometry: dot, vectorial and mixed product of vectors; applications; representation of straight lines and planes in the Euclidean space; application to distances. Eigenvalues and eigenvectors of square matrices: application to matrix diagonalization.

Introduction to Programming

Introduction to computers and languages; Data manipulation: data types, constants, variables, operators and expressions; Control of execution flow: if, switch, do, while and for; Top-down problem decomposition: division of programs, functions and parameters, recursion; Pointers: address, value and dynamic memory; Composite data types: arrays, strings and structs; basic I/O: files, streams and devices.

Digital Systems

Essential concepts of digital logic: numerical coding systems; binary arithmetic; Basic logic gates; Project of combinatory circuits based on logic gates; Function tables, operation characteristics, and pin-out of integrated circuits based on combinatory logic, such as: adders, comparators, multiplexers, demultiplexers, decoders, priority coders, etc; Logic families of integrated circuits; Synchronous and asynchronous memory cells; Synthesis and analysis of sequential circuits; Design and analysis of counters and shift registers.

Technology Fundamentals

Digital Image Processing; Computing and Internet History; Computer Systems Concepts: devices and services, back-office and front-office, e-Commerce and e-Business, SCM (Supply Chain Management), ERP (Enterprise Resource Planning) and CRM (Customer Relationship Management); ICT (Information and Communication Technology) Professional Skills; Information and Knowledge Management: research and interpersonal communication; 3D CAD (Computer-Aided Design) practice: solid primitives, CSG (constructive solid geometry), B-Rep (boundary representation) and scenario rendering.

Mathematical Analysis II

Numerical and function series: definitions; tests for convergence; power series; Taylor and Maclaurin series; applications of power series. Real functions of several real variables: definitions; limits and continuity; partial derivatives; differentiability; increments and differentials; directional derivatives; extreme values and saddle points; optimization problems with constraints. Multiple integrals: definition and properties of double and triple integrals; geometric interpretation of double integral; double integrals in polar coordinates; triple integrals in cylindrical and spherical coordinates; applications of double and triple integrals.

Logic and Computing

Propositional Logic. Graphs and digraphs. Adjacency and incidence matrices. Connected graphs and strongly and weakly connected digraphs. Eulerian and hamiltonian paths. Trees and their applications. Minimum cost spanning tree: Kruskal and Prim algorithms. Shortest Path problem: Dijkstra and Floyd-Marshall algorithms. Error and stability. Iterative methods for linear systems of equations. Nonlinear equations and systems of equations. Polynomial interpolation. Numerical integration. Numerical methods for ordinary differential equations.

Introduction to Digital Electronics

Electric circuits concepts (units, Joule's Law, Ohm's Law). Introduction to Digital Systems Projects with programming logic devices. Hardware design environments Structural specifications of hardware. Behaviour description of hardware. Programming logic devices: PAL, PLD and FPGA. VHDL and Verilog. MaxPlus II design environment.

Object Oriented Programming

Object Oriented Programming: abstraction, encapsulation, inheritance, static and dynamic members; Class Hierarchy: Abstract classes, Polymorphism, dynamic objects, casting; Basic data structures; Generic programming.

Internet Technology I

XHTML (Extensible HyperText Markup Language) e DHTML (Dynamic HyperText Markup Language): W3C standards, syntax, structure and practice; CSS (Cascading Style Sheets) fundamentals: external stylesheets, embedded style and inline styles; CSS styling practice: box model, color schemes, classes and objects modeling, block metrics, etc.; DOM (Document Object Model): class hierarchy, specification levels; JavaScript programming: syntax, dynamic interfaces, forms validating, object motion, event triggered actions, etc.

BSc Degree in Computer Engineering, 2nd year, 1st semester

Probabilities and Statistics

Probability. Discrete and Continuous Random Variables. Probability Distributions: Discrete Uniform, Binomial, Poisson, Continuous Uniform, Normal and Exponential; Normal approximation to the Binomial and Poisson distributions. Sampling Distributions. Estimation using a single sample of the mean, variance and proportion. Hypothesis testing using a single sample about the mean, variance and proportion, Hypothesis Tests using the p-value. Simple Linear Regression and Correlation.

Data Structures and Algorithms

Algorithm Analysis; Dynamic data structures. Sorting and searching; Abstract data types : stacks, queues, trees. Binary search trees. Hash tables. Priority queues. Graphs; Algorithm design techniques: divide-and-conquer, greedy algorithms, backtracking.

Introduction to Telecommunications

Introduction to telecommunications: Network Models. Signal theory: Signal representation by Fourier. Continuous-Time signal analysis: the Fourier Transform. Energy and Power; Frequency response of linear systems: filters; dB and derived units; Analog to Digital conversion: Pulse Code Modulation; Transmission Media; Wireless Systems; Modulation systems with continuous carrier; Principles of digital data transmission; Multiplexing; Using Telephone and Cable Networks for Data Transmission.

Computer Architecture I

General knowledge of Computer Architecture; Central Processing Unit Organization (Data Processing Unit; Control Unit; implementation forms; performance analysis); Programming language Assembly (to develop routines); Memory Organization (technologies; hierarchy; cache); Interfaces and Peripherals Organization (types, characteristics; interfaces).

Databases I

Objectives and functions of Database Management Systems (DBMS). Hierarchical model. Network model. Relational model. Relationships. Instances and schemes. Data dictionary . Keys. Primary key, foreign key and indices. Integrity and rules. Functional dependencies and normalization. First normal form (1FN), second normal form (2FN), third normal form (3FN) and Boyce-Codd normal form. Entity-relationship method. Extended entity-relationship method. SQL. SQL's DDL commands. SQL's DML commands.

BSc Degree in Computer Engineering, 2nd year, 2nd semester

Operating Systems

Manage computational resources; Operating Systems Introduction; Operating Systems Nucleus; Processes and Threads Management; Process Synchronization and Deadlocks; Interprocess Communications; Memory Mechanisms and Memory Management; File System; Security and Protection; Practical Content: Unix commands, shell, unix and windows programming; Unix and Windows Server system installation and configuration.

Data Networks I

Application Layer (Principles of functioning of the network applications; Layer Protocols; Email, DNS, FTP, HTTP); Transport Layer (Introduction to the UDP and the TCP; Mechanisms used to prevent congestion); Network Layer (Virtual circuits networks; Packages commutation networks; The Internet Protocol - IP; Unicast routing protocols: intra-domain and inter-domain; Multicast IP; Multicast routing: intra-domain and Inter-domain; NAPT and PAT).

Databases II

Transactions and concurrence control. Savepoints and transactions recovery. Isolation. Locking. Deadlocks. Physical aspects of a database. Files and tablespaces. Datablocks, extents and segments. Indexes. Clusters. Database management and administration. Installation and maintenance of a SGBD. User management. Fault tolerance. Security and privileges. Distributed databases. Remote and distributed transactions.

Microprocessors

Fundamental concepts of: processor architecture, programming languages, instructions, and addressing modes; Basic programming structures; Implementation of mechanisms related to several data communication processes; Control and operation modes between the processor and the outside world. Control and operation modes of the following peripherals: SPI, I2C, USART, CAN, ADC and DAC.

Internet Technology II

XML (Extensible Markup Language) fundamentals: standards, syntax and correctness; XSL (Extensible Stylesheet Language): XSLT (XSL Transformations), XSL-FO (XSL Formatting Objects), XPath (XML Path Language); XML-Schema: validation and correctness of XML documents; XML-DOM and XML usage: Xlink (XML Linking Language), Xpointer and XInclude; COM (Component Object Model) / ADO (ActiveX Data Objects) / Recordset Objects; ASP (Active Server Pages): WEB interfaces to remote databases;

BSc Degree in Computer Engineering, 3rd year, 1st semester

Software Analysis and Architecture

Classical Structured Analysis; UML – Unified Modeling Language; System Requirements; Software Testing; Design Patterns; RUP- Rational Unified Process.

Data Networks II

Link layer (The services provided by the link layer); Error detection and correction techniques; Multiple Access protocols; Link layer addressing; Ethernet; Interconnections: Hubs and Switches; The IEEE protocols: 802.1D, 802.1w, 802.1t, 802.1s, 802.1q, 802.1ad; Multiprotocol label switching (MPLS); Local networks and physical media.

Computer Architecture II

Microprocessor architecture and microcomputer system hardware; Instruction Set: machine language architecture; Assembly language programming; Arithmetic for Computers; Programming Arithmetic Coprocessor; Memory Hierarchy; Input/Output Data Systems; Multiprocessors.

Computer Networks – Management and Security

Introduction to data computer network management; Network management system – generic architecture; OSI management model and standards; Internet management model; Simple Network Management Protocol: SNMP, SNMPv2, and SNMPv3; Remote monitoring: RMON 1 and 2; Managements platforms and tools; Computer network security and applications; principals of cryptography; Authentication, Integrity; Key distribution and certification; Firewalls; Intrusion detection systems; Data backup and recovery techniques and tools.

Distributed Systems

Berkley Sockets; JAVA Remote Methods Invocation; Remote Procedures Calls; Common Object Request Broker Architecture; Simple Object Access Protocol; Web Services Description Language; Universal Description, Discovery and Integration; SOAP Services; Java and XML-SOAP; Programming web-services using SOAP; The VoiceXML; JAVA Server Pages.

BSc Degree in Computer Engineering, 3rd year, 2nd semester

Entrepreneurship

Entrepreneurship and Innovation; Ideas, Contexts and Driving Forces; Competitive Strategy; Financing Sources; Decision Making; Business Planning; Enterprise Management: enterprise creation, business functions, industrial and commercial law, labor law; Benchmarking; Quality Management System.

IT Systems on Organizations

IT Systems on Organizations: Value Channel – Processes to be Supported; IT Systems history; Solutions Map; Information Contents and Flow; Market Solutions; IT Department Organization; IT Strategy; IT Security; IT Investments; Risk Analysis; Aligning Cobit, ITIL and Security Standards; Legislation.

Data and Computer Network Project

Internet Traffic Engineering: traffic characterization, traffic components, measurement, modeling, analysis, and simulation; QoS: principals of QoS, integrated Services, RSVP, differentiated services; MPLS; VoIP: architecture, voice codification, signalization protocols, transition scenarios; Data and computer network planning and projects.

Information Systems Project

The Rational Unified Process (RUP); UML advanced (Web applications Modeling; Design Patterns); Quality management in Software Development Process; Software Testing (unit, integration, system, and regression tests); Project and development of a Information System according RUP; Software inspection and revision.

Final ICT Project

Market of ICT Solutions; ICT Project Life Cycle; ICT Project Charter Elements; ICT Project Planning: designing, cost estimation and analysis, document revising and assessing; Work Breakdown Structure (WBS) Methodologies; Team Management for ICT Projects: setting roles, responsibilities and leadership; Research Techniques; Technical Communication: writing, editing, illustrating and presenting ICT Projects; ICT Project Development.