

Software Lab	Credit Type	Theoretical	Practical
	Number of Credits	---	2
	Number of Hours	---	68
Pre-requisite: <i>Simultaneous with Data Storage and Retrieval</i>			
Aims to optimal usage of applied software packages(database, word, excel,)			
System Design and Analysis	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>Business Systems Programming</i>			
<p>Concept of system life period, management of life period and dividing responsibilities, methods and tools of systems analysis, feasibility study, comparison of manual and automatic systems, economic aspects of system, general needs and specifications of system, different methods of system analysis, selection and evaluation of hardware and software, making programs and database, system implementation, system study and evaluation, CPM & PERT project control, application of the above concepts in designing a real system including: study of data circulation in system, input and output data, files design and necessary programming and system documentation.</p>			
Principles of Management	Credit Type	Theoretical	Practical
	Number of Credits	1	---
	Number of Hours	17	---
Pre-requisite: <i>After 30 credits</i>			
Supervisor Tasks, Organization Tasks, Planning Tasks, Control Operations Tasks, Human Resources Management Tasks, Direct and Motivate Tasks.			
Principles of Network Systems	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>Simultaneous with Introduction to Operating Systems</i>			
<p>Structure of networks, network architectures, reference model of ISO, networks of ARPA, SNA, DECNET and general.</p> <p>Network topology, connectivity analysis, delay analysis, design of network with local access.</p> <p>Design of physical layer, fundamentals of theory for data transfer, transfer telephone systems and multiplexing, survey on terminal, transfer errors.</p> <p>Data relation layer, primary protocols for data relation, sliding window protocol, protocols analysis.</p> <p>Primary layer of network, point-point networks, routing algorithms, density.</p> <p>Secondary layer, satellite and radio networks, broadcasting satellite packages, radio packages.</p>			
Documentation	Credit Type	Theoretical	Practical
	Number of Credits	1	---
	Number of Hours	17	---

Pre-requisite: <i>Simultaneous with System Design and Analysis</i>			
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Different methods of Presentation of Scientific and Technical Topics, softwares used in documentation such as word and graphical softwares, automation in documentation such as image record and data specification(screen capture, document generation)

Introduction to Operating Systems	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>Data Structures</i>			

Fundamentals of operating systems: memory management, processor management, file and i/o management. Particular topics include threads, CPU scheduling, process synchronization and deadlock, paging, segmentation and virtual memory, protection and security, and distributed systems. Client-server architecture is handled in the context of distributed systems. Particular systems are treated in the context of examples.

Principles of Compiler	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>Data Structures</i>			

Languages and grammar, dynamic program, method of description of syntax and meaning of the word analyzer, word analyzer including: method of analysis of LR and LL(1) languages with simple precedence and operations precedence, symbols table organization and memory allocation at the time of implementation, internal representation of program, interpreter programs, coding, practical points in compilers design, study of design of a simple compiler, method of effective use of common compilers, error displaying messages.

Special Topics I	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>After second semester</i>			

Depend on head of department view.

Computer Programming I	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>Simultaneous with General Mathematics</i>			

Introducing organization and main parts of computer, machine language and assembly, numeric and non-numeric data representation, algorithms and sub-algorithms and flowchart, basic concepts such as frequency, selection, repetition and branching, familiarity with a structured language and programming including: constants and variables, computational and logical phrases, different types of instructions, different types of conditional operations loops, vectors and matrices, subprograms, input and output instructions, common algorithms such as methods of search and arrangement, practical examples of

programming.

Computer Workshop	Credit Type	Theoretical	Practical
	Number of Credits	---	2
	Number of Hours	---	102
Pre-requisite: <i>Simultaneous with Computer Programming I</i>			

Familiarity with accessory systems such as card reader, printers, magnetic tape, disc and console, manner of work with terminal, familiarity with compilers and editors, familiarity with JCL language, familiarity with computer organization of a center, familiarity with prepared software packages such as database, spreadsheet, lotus, familiarity with the important programs of system such as sort, merge, creation and copy of files etc., familiarity with usage manner of an operating system of microcomputer

Computer Programming II	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>Computer Programming I</i>			

Correct programming, programs documentation, structured programming, modular programming, familiarity with C programming language and its comparison with the first language, troubleshooting and programs testing, assurance of programs accuracy, non-numeric algorithms including: fields processing and etc., return programming, program efficiency, elementary familiarity with compilers and other translator programs, effective use of system software facilities, implementation of large programming projects in group form.

Technical Language for Computer Science	Credit Type	Theoretical	Practical
	Number of Credits	2	---
	Number of Hours	34	---
Pre-requisite: <i>Foreign Language</i>			

Introduction to basic concepts and grammar relevant to computer science, used vocabularies in software, hardware, internet, information networks.

Familiarity with common messages in operating systems and softwares installation and programming languages and abbreviation in email and chat and search engines.

Texts translation relevant to computer.

Computer Logic Circuits	Credit Type	Theoretical	Practical
	Number of Credits	2	---
	Number of Hours	34	---
Pre-requisite: <i>General Physics, Simultaneous with Physics Lab</i>			

Number representation system and coding, Boolean algebra and the relevant laws, different types of logic gates, logical functions and their simplification including Carnot's diagram methods and tabulation method, methods for simplifying multi-output combinational functions, design of combinational circuits including comparators, encoder, code transformers, adder, subtractors, selectors and data distributors, design of special combinational circuits by use of PLA, ROM, MUX and PLA, ordinal circuits including flip flaps, counters, shift registers, familiarity with synchronous and asynchronous ordinal circuits, method of design and analysis of synchronous ordinal circuits, familiarity with logical ICs technology and their selection parameters.

Computer Logic Circuits Lab

Pre-requisite: *Simultaneous with Computer Logic Circuits*

Credit Type	Theoretical	Practical
Number of Credits	---	1
Number of Hours	---	51

Laboratory should be presented in appropriation with the course on "Logical Circuits".

Machine Language and Structure

Pre-requisite: *Computer Programming I*

Credit Type	Theoretical	Practical
Number of Credits	3	---
Number of Hours	51	---

Familiarity with different units of computer, constants, different types of instructions, data representation, extraction and implementation of commands and their scheduling, representation of instructions in assembler language, program counter, index constants, indirect addressing, absolute and relative addressing, macroinstruction and modality of their implementation, input and output operations, interrupt and its control, sub-procedures and co-procedures, reverse and reentry routines, general specifications of assemblers and openers, error display messages, programs tracking, (programming practices for this course should be selected so that their implementation in common high level languages are impossible or are relatively more difficult than assembly language)

Data Structures

Pre-requisite: *Computer Programming II*

Credit Type	Theoretical	Practical
Number of Credits	3	---
Number of Hours	51	---

Arrays, vectors, matrices, private matrices, arrays display, stacks, queues and rows, bond lists: graphic, cyclical, double bond, multi-bond, method of display and application of bond lists, trees and their mensuration, method of representation and application of trees: decision making trees, search trees, tree of the game and etc, graphs and their representation, dynamic memory allocation and the relevant issues, searching and sorting and combining algorithms

Business Systems Programming

Pre-requisite: *Simultaneous with Computer Programming II*

Credit Type	Theoretical	Practical
Number of Credits	3	---
Number of Hours	51	---

Introduction of commercial systems, specifications of commercial systems, concepts of data processing, full survey on programming in COBOL language, full familiarity with specifications of COBOL language including: tables, sorting, merging, searching, organization of ordered, indexed ordered and direct files and their implementation in COBOL, design and implementation and execution of a project in the great commercial systems is compulsory.

Database	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>Data Storage and Retrieval</i>			

Survey of change and evolution of data storage and retrieval technology, reminding storage and retrieval in non-bank policy, definition of database, data, existence, relation between existences, operating medium, different types of communications, data engineering, data abstraction, difference of bank policy with non-bank policy, bank medium components including application of data, software and hardware, database system architecture including: external, conceptual, internal and physical levels, database management system, method of achieving database in different levels, data models including relational, hierarchical and network models mentioning to the other models, detailed study of model, relational computations, study of a specified sample of relational model, normalizing in relational model, safety, confidentiality, protection, non-defectiveness and comprehensiveness of database, very large database and special machines of database.

The student should perform a theoretical project and a practical project in appropriate to the objective of design and implementation of a base.

Data Storage and Retrieval	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: <i>Computer Programming II</i>			

Definition of storage and retrieval, study of types of extra-machine memories (disc, tape and ...) regarding calculation of real rate of transfer and principal parameters, basic concepts of file, blocking techniques, calculation of factor of block and wasted memory in them, buffering and the relevant techniques and efficiency of each one, study of different structures of file and different operation on each of them, evaluation criteria of different structures (the rate of consumed memory, operation time), analytical description of each of the unordered, ordered, indexed, ordered-indexed, multi-index, direct and multi-loop structures, external sorting and merging, study and implementation of one of the advanced access methods.

General Mathematics	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---
Pre-requisite: ---			

Functions, Limits and Continuity, Derivation and it's applications, Polar Coordinates, Integral

Statistics and Probabilities	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	51	---

Pre-requisite: <i>General Mathematics</i>	Number of Credits	3	---
	Number of Hours	51	---

This course comprises two sections: Preliminary Statistics and Probability Section.

General Physics	Credit Type	Theoretical	Practical
	Number of Credits	2	---
	Number of Hours	34	---
Pre-requisite: ---			

Vectors: Equilibrium of a particle: introduction, Newton's First Law, neutral equilibrium (stable and unstable), Newton's Third Law, particle equilibrium, rigid body equilibrium friction: moment of force, second condition of equilibrium, center of gravity, couple. **Motion on one dimension:** motion, average and instantaneous velocity, mean and instantaneous acceleration, acceleration integral average velocity, motion on a uniform acceleration, free fall, motion with variable acceleration, relative velocity, gravity tension of two substances. **Motion on two dimensions (plane):** motion on the plane, average and instantaneous velocity, average and instantaneous acceleration, components of acceleration, circular motion, centripetal force, circular motion perpendicular on the horizon, satellite motion, the effect of earth rotation on acceleration and gravity. **Work and energy:** introduction, work, kinetic energy, gravity potential energy, elastic potential energy, gravity potential, elastic potential energy, conservative and losing ranges, internal work, internal potential energy, power and velocity. **Impulse:** impulse, linear momentum conservation law, rubber and non-rubber percussions, return, principles of rocket motion, relative changes of mass and velocity, mass and energy, relative conversion of force, mass in length and width. **Rotation:** introduction, angular velocity, angular acceleration, rotation with variable angular acceleration, rotation with fixed angular acceleration, relation between linear and angular accelerations and velocities, angular acceleration moment (moment of inertia), computation of moment of inertia, kinetic energy of work and power, angular momentum. **Temperature:** thermal equilibrium, measurement of heat and different scales, ideal gas temperature scale, zero principle. **Heat:** quantity of heat, specific heat and heat energy, heat conduction, mechanical equivalent of heat and gas, first law of thermodynamics, application of first law. **Kinetic theory of gases:** ideal gas, computation of pressure, kinetic change of heat, specific heat, ideal gas, equal distribution of heat energy, mean free-path, distribution of molecular velocity, thermodynamic change and transformations, van der Waals state equation. **Entropy:** reversible and unidirectional process, Carnot's cycle, second law of thermodynamics, thermal engines return, reversible and unidirectional entropy

General Physics Lab	Credit Type	Theoretical	Practical
	Number of Credits	---	1
	Number of Hours	---	51
Pre-requisite: <i>Simultaneous with General Physics</i>			

Laboratory should be presented in appropriation with the General Physics course.

Artificial Intelligence	Credit Type	Theoretical	Practical
	Number of Credits	2	1
	Number of Hours	32	32
Pre-requisite: <i>Algorithm Design</i>			

What is AI ? introduction to artificial intelligence.

Agents: structure and operation, intelligent agents, environments.

Problem solving: problem solving via search, problem formulation, some example for search, search types.

Informed search methods: best-first, heuristic function, limited space search and another optimal methods.

Knowledge based agents: agents with logical reasoning, logic, predicated logic, reasoning.

First order logic: deduction in this type, deduction rules, forward-backward chaining deduction.

Planning: problem solving with planning, simple views for planning, knowledge engineering for planning.

Uncertainty: mechanism and probabilities

Representation of some application in expert systems, natural language processing, machine and robotic

Computer Simulation	Credit Type	Theoretical	Practical
	Number of Credits	2	1
	Number of Hours	32	32
Pre-requisite: <i>Software Engineering</i>			

Definition of simulation, comparison of simulation with other methods, system definition and its sections and simulation models, sections of simulation models, continuous, discrete and complex systems, models characteristics, discrete models simulation, Monte-Carlo simulation, representation of numeral samples of queue,... systems, methods of computer simulation such as events scheduling, activities processing, statistical concepts in simulation, uniform production of random numbers, independency and uniformity tests, production of random variables with different distributions, execution of a practical project of simulation via programming language and analysis the results.

Complete introduction to one of the programming languages such as GPSS, SLAMII, CSMP, DYNAMO, SIMMAN, SIMSCIPT, ACSL

Computer Graphics I	Credit Type	Theoretical	Practical
	Number of Credits	2	1
	Number of Hours	32	32
Pre-requisite: ---			

Introduction to graphical systems: raster scan, random scan, color and DVTS systems.

Graphical standards: GKS, Phigs, Phigs+

Base outputs: vector, circle, oval, curve types, characters and texts

Different algorithms about filling surfaces, Nicholl-Lee-Nicholl, Cohen & Sutherland, Liang & Barsky, optical pen, mouse, Bezier, Octree, CSG, fractal, transform, rotation, reflection, 3D view, deletion algorithms, Z-buffer, surface shading, Guraud and Phong algorithms, introduction to Ray Tracing

Internet Engineering

Credit Type	Theoretical	Practical
Number of Credits	2	1
Number of Hours	32	32

Pre-requisite: ---

Network concepts, LAN, MAN, WAN, international and universal networks and network communications, foundation of connection and information and software and hardware of wide networks, NP, IP, SP, internet structure, addressing patterns, access methods to internet, routing (by hardware or software), countless service, view of hyper text tools (Netscape, IE,...), network programming, socket programming, introduction to HTML, CGI programming, architecture and pattern and methods of intranet and extranet production, internet services verifying, remote access via wide network services, environment of production of secure hyper text pages, search engines in internet, VRML, Firewalls, future of wide networks.

Special Topics

Credit Type	Theoretical	Practical
Number of Credits	2	1
Number of Hours	32	32

Pre-requisite: *After second semester*

Will be presented according to relevant department.

Web Page Design

Credit Type	Theoretical	Practical
Number of Credits	2	1
Number of Hours	32	32

Pre-requisite: *Internet Engineering*

First Section:

Introduction to Home page, comparison of home page with another methods of presentation of information, standards, importance of information selection, use of menu, form, image, font, data update, link between pages, get information from users,

Second Section:

HTML application and its structure, instructions for HEAD, BODY, COMMENT, lists, menus, tables, graphic files, images, image maps, form, table design, familiarity with front page, familiarity with some important web servers, web server roles, NCSA, introduction to java and java script and its capabilities

Programming Languages Design and Implementation	Credit Type	Theoretical	Practical
	Number of Credits	2	1
	Number of Hours	32	32
Pre-requisite: <i>System Programming, Algorithm Design</i>			

Generalities of programming languages, Programming languages processors and method of their producing including use of compilers and interpreters Data, data determination and implementation in high level programming languages, Controlling mechanisms of order, repetition and selection in programming languages and their implementation, Data abstraction, Special points concerning languages with special application

Database Development	Credit Type	Theoretical	Practical
	Number of Credits	2	1
	Number of Hours	32	32
Pre-requisite: ---			

Preliminary concepts, user interface description, program management, instructions and functions, database and its management, program for create and update and sort and indexing on data base, search, use of RQBE, database relations, windows, environment configuration, reporting, label, macro, debugging, create form for insert and update, menu builder, project manager, programming concepts(constants, variables, operators), introduction to instructions, events management and Event-Driven interface

Object-Oriented System Design	Credit Type	Theoretical	Practical
	Number of Credits	2	1
	Number of Hours	32	32
Pre-requisite: ---			

Concepts of this course is by C++ and one project must be presented.

Introduction to C++, IO in C++, constructor and destructor functions, encapsulation, inheritance, structure class, union, in-line functions, object allocation, object transferring into functions, friend functions, recursive functions, arrays, pointers and reference pointers, overload functions, binary and logical and relational operators, multiple inheritance, IO systems, IO manipulators, extractor, inserters, random access, IO control, customize, derived classes, virtual classes, polymorphism and its application.

Machine Language and Assembly	Credit Type	Theoretical	Practical
	Number of Credits	1	1
	Number of Hours	16	32
Pre-requisite: ---			

Machine Structure: mention to role of different units of computer and programming levels, representation and application of register types, concept of instruction pattern in machine language, concise verifying of constant and unsteady patterns on different machines, different types of instructions, different phases of instruction implementation.

Numeral Systems: negative digits presentation, second complement system properties, presentation of

BCD digits, presentation of floating points digits.

Assembly Language: display methods(implicit, none distance, direct, indirect, indexing, base, movement in content of program counter, paging), instructions for registers, instructions for machine memory(work with words and characters and bits), junction instructions and loop control, logical instructions, call procedures and arguments transition, recursive procedures, macros, loop and conditional blocks, debugging of program, dump, use of assembly instructions in high level languages(pascal or c), connecting of high level languages and assembly language.

Technical English for Computer Software

Pre-requisite: ---

Credit Type	Theoretical	Practical
Number of Credits	3	---
Number of Hours	48	---

Introduction to basic concepts and grammar relevant to computer science, used vocabularies in software, hardware, internet, information networks.

Familiarity with common messages in operating systems and softwares installation and programming languages and abbreviation in email and chat and search engines.

Texts translation relevant to computer.

Algorithm Design

Pre-requisite: ---

Credit Type	Theoretical	Practical
Number of Credits	2	1
Number of Hours	32	32

Review in important points in data structure course and more details about: mathematical induction and recursive methods, algorithms complexity and their analysis. O , Θ , Ω , o symbols and different types of problem solving: for each method, some important problems must be selected and be discussed about their proves and analysis, divide and conquer(max and min in array, multiplication of two digits of n bits, strassen in matrix multiply, games tournament, quick sort), dynamic programming(matrix multiplication, knapsack problem, optimal triangulation for polygon, longest suborder, place characters in paragraph), greedy(scheduling, change, huffman code), methods based on complete search and techniques of space restriction for search, game tree and α - β pruning(tic-tac-tac, puzzle), detection methods for hard problems solving(Bottleneck traveling salesman problem), graph algorithms consist of : search methods in graphs(depth, shallow), undirected graphs(Djkstra, minimal surjective tree, connected members, full connected and other problems), directed graphs(Floyd, Topological sort, twice connected members,...), max flow problems and other problems.

In this course, concepts is presented by one structured programming language.

Presentation of Scientific and Technical Topics

Pre-requisite: ---

Credit Type	Theoretical	Practical
Number of Credits	2	---
Number of Hours	32	---

Different types of scientific and technical subjects (letters, reports, pamphlets, manual and etc.),

common points in all scientific and technical writings: specifying the objective of writing and its eventual readers, organizing the subjects, abstract of essay together with report, the role of a good introduction, dividing the subjects into parts and chapters, discussion and conclusion, preparing source and reference index, attachments, preparing the pictures and diagrams and tables. Important points in translation of scientific and technical subjects, writing style, marking and its importance, preparing final format of writing by typing machine or computer, foot-article, notes and other lateral subjects, an introduction to research methods, presenting subjects orally, effective use of audio-visual devices, the rules and process of drawing up graduation diploma including the main parts of thesis and details of each part, preparing and presenting a scientific essay (as assignment)

System Programming

Pre-requisite: <i>Machine Language and Assembly</i>	Credit Type	Theoretical	Practical
	Number of Credits	2	1
	Number of Hours	32	32

Executive files structure, viruses operation, programs trace, loaders, relocation, position independent code, call operating system functions, heap memory allocation, TSR programs, application of interrupts, disk partitioning and work with them by operating system functions and BIOS, file table structure, forms of file storage, work with ports, display text and picture on monitors with high resolution, familiarity with device drivers, familiarity with addressing in protected cases, virtual on 80X86 processors.

In this course, concepts is presented by assembly programming language.

Software Engineering

Pre-requisite: ---	Credit Type	Theoretical	Practical
	Number of Credits	3	---
	Number of Hours	48	---

design and implementation of software systems. Requirements specification: data and process modeling. Software design methodologies. Software quality assurance: testing and verification. Software development processes

Software Engineering Lab

Pre-requisite: <i>Simultaneous with Software Engineering</i>	Credit Type	Theoretical	Practical
	Number of Credits	---	1
	Number of Hours	---	48

Practical or theoretical study in one of desirable aspects of the student in the field of computer software, which its result is design and implementation and documentation of a software product. Attempt should be made that subject matter of study could remove a problem or a real and practical shortage in industries of the country or in the university.

Computer Architecture

Pre-requisite: <i>Machine Language and Assembly, logical circuits</i>	Credit Type	Theoretical	Practical
	Number of Credits	2	---
	Number of Hours	32	---

Computer architecture definition, mention to computer history and its generations, introduction to main units in computer, instruction set design, mechanism of instruction implementation with hardware description language like RTL, different methods of control unit design by wired method, control unit structure, data buses control and data routing, ALU unit design and specify the latencies, micro-procedure control unit design, memory organizations, hierarchy or memory, static and dynamic memories, introduction to cache and virtual memory, computational algorithms, add, sub, mul, divide, floating point algorithms, accessibility methods to IO devices(interrupt,...), DMA, BUS sharing and mention to difference between CISC, RISC.

Computer Architecture Lab

Pre-requisite: *Simultaneous with Computer Architecture*

Credit Type	Theoretical	Practical
Number of Credits	---	1
Number of Hours	---	48

Laboratory will be presented according to the course of Computer Architecture.

Engineering Statistics and Probability

Pre-requisite: ---

Credit Type	Theoretical	Practical
Number of Credits	2	---
Number of Hours	32	---

An introduction to theory of sets, samples and their table display together with average, exponent, middle and variance of conversion and composition, probabilities and the relevant theorems, random variables, intermediate and average and variance of distributions, Poisson's two-phrase distributions, geometric difference, normal distribution, distribution of several random variable, random sampling and random numbers, sampling from small society, estimation of statistical parameters, assurance intervals, test 2 presumptive test of decision-making, analysis and variance, regression, correlation, nonparametric methods test, fitting straight line on data, torque generating functions, theorem of huge digits, central limit theorem, independent random variables, conditional probability, general probability theorem

Engineering Mathematics

Pre-requisite: *Differential Equations*

Credit Type	Theoretical	Practical
Number of Credits	2	---
Number of Hours	32	---

The course introduces partial differentiation, complex analysis, complex integral, laplace transform; Integral, series and transform of Fourier; Z transform;

Differential Equations

Pre-requisite: ---

Credit Type	Theoretical	Practical
Number of Credits	2	---
Number of Hours	32	---

Nature of differential equations and their solution, family of graphs and vertical routes, physical patterns, separable equation, 1nd order linear differential equation, 2nd order linear equation, homogenous equation with fixed constants, method of indefinite constants, method of changing parameters, application of 2nd order equations in physics and mechanics, solution of differential equation with series, Bessel and Gamma functions, Legendre polynomial, an introduction to differential equations set, Laplace transform and its application in solving differential equations

Discrete Mathematics

Pre-requisite: ---

Credit Type	Theoretical	Practical
Number of Credits	2	---
Number of Hours	32	---

Introduction: mathematical logic, algebra of expressions, well-structured formula, a review of theory of sets, proving methods.

Relations and functions: dual relations, compatibility and equivalence relations, relations representation matrix, relations graph, functions, surjective functions, one to one functions, recursive relations, solving recursive functions, generating function.

Algebraic structures: semi-groups and monoids, grammars and languages, Polish marking, groups, homomorphism, isomorphism, lattices, boolean algebra, Carnot's table, grammar, grammar as an example of monoids

Combinational analysis: pigeon hole principle, an introduction to combinational algorithms, recursive functions and their application.

Graph theory: directed graphs, undirected graphs, Eulerian path and Hamiltonian path, optimal paths, algorithm finding of optimal paths, connected graphs, matrix of relation and related theorems, graph applications in activities analysis.

Trees: minimal surjective trees, mensuration of tree, application of trees, algebraic expressions and representation of their trees.