



The description of the areas of knowledge is part of the CONAIC Application for provisional membership in the Seoul Accord sent in February 2017, Section VII. Curricular models higher level Computer Science and Computing, 7.4 Catalogue of knowledge areas:

7.4 Catalogue of knowledge areas

The areas of knowledge are eight, as in previous profiles, because this taxonomy continues delineating quite accurately the contents and preserves the thematic differences, but their thematic contents were updated, now including advances in information science and computing, which they have been derived from research and applications scientists and scholars from these areas until today.

Then, eight major areas of knowledge in computer science and computer are defined, namely:

1. Social Environment
2. Maths
3. Computer architecture
4. Networks
5. Software base
6. Programming and software ing.
7. Treatment of information
8. Man-machine interaction

7.4.1 Social Environment

It includes knowledge, standards, experiences and motivations that make possible the successful integration of computer units and staff in organizations and in society in general. It includes subjects of administration, economics, accounting, law, sociology and psychology are included

1.1 Problematic Global, National and Regional

1.2 Organizations

1.3 Managing Information Technology

1.4 Legal Ethics and Regulations

1.1 Problematic Global, National and Regional

Objective: To analyze the impact of information technology in the social environment, in situations of global economy and digital convergence technology; the effect on collaborative and remote work, the internet and trivialization of information, the digital divide and the impact on quality models on the competitiveness of organizations.

1.1.1 Location of the global economy and convergence of digital technology

ES1 Megatrends, globalization and convergence. Analysis of the situation overall global economic and information technology (IT). Relevant statistics. Historical-statistical analysis of the main variables of IT trends. Analysis of the globalization of IT and technology interdependencies. Main advantages and disadvantages of globalization of IT.

1.1.2 Effects of collaborative work and distance.

ES2 organizational Socialization, interaction distance and distance communication processes. Organizational psychology. Conflict resolution. Incorporating IT in teaching and learning processes. Distance communication processes. Blended learning. Collaborative work and learning communities. Meaningful learning and relationship between members of groups. Integration of collaborative working groups for the design and implementation of computer systems. Expectations of results by the method of learning. Collaborative work at a distance. Using IT to expand the scope of collaborative work. Evaluation of results per heading among others. Application of classroom and distance collaborative work in organizations. Organizations are learning.

1.1.3 The internet and socialization of information.

ES3 Social changes ES3 for Internet use. Overview of the computer world on the Internet. Analysis of the global statistical information on the quality and reliability of information on the Internet.

ES4 the digital gap (digital). Analysis of statistical information on the use of IT in the world, socio-economic sectors. Consequences of exclusion and inclusion in access to information. Generational digital gap. Aspects of the digital divide. Identification of technological backwardness by major countries. Training and content. Electronic learning and development. Social influence and main impacts of the digital divide. Key strategies to follow in terms of public policies to narrow the digital divide. Current public policies in Mexico in IT.

1.1.4 Impact of quality models in organizations.

ES5 Quality Models (CMM, ISO, ITIL, MOPROSOFT, 6SIGMA, among others) from the organizational approach. Competitiveness of Mexican companies through quality models. International and national standards. His definition, purpose and scope. The choice of the ideal model, according to company type. Structural and operational implications organizations, as quality model. Expectations of productivity and competitiveness of Mexican companies with the implementation of systems of quality management, depending on the model. Complexity and limitations of systems of quality management in Mexican companies, quality models in IT. Software development. Objectives, scope, constraints and administrative costs in Mexican companies.

1.2 Organizations

Objective: To provide a set of knowledge and aspects of regulations concerning organizations in general, with the dual aim of adapting IT organizations, and having conceptual basis for the development and implementation in organizations computer systems related aspects administrative and accounting, financial, production and dissemination.

1.2.1 Theory of organizations.

SS6 Types and basic principles of organizations. Public agencies and private organizations. Organizations in different economic sectors. Types of companies. Management theories. Functional administrative areas. Typical basic structure and operation. Areas of responsibility. Typical organizational structure. Computing Unit in the organization.

SS7 Procedures administrative. Processes, procedures, methods, techniques, tools, technologies and tools. The administrative process. Information flows. Effectiveness, efficiency, productivity and quality. Methodology for the design of processes and procedures; redistribution of functions, integration manuals. Analysis and simplification of processes and procedures. Diagramming and definition of business processes; continuous improvement. Redesign and reengineering business

processes. Process management roles. Fundamental information flows. Material, financial and technical resources and general services.

SS8 Human resources. The staff. Positions and functions. Wage and salary structures. Features. Social Security. Payment systems. Motivation induction. Training: importance and necessity. Organization chart. Relations. Payrolls. Planning and control of places. Outsourcing of professional services.

SS9 Competitiveness in the digital age. The advent of telecommunications and computing and its impact on organizations. Organizational agility. E-commerce. Business intelligence. Competitiveness strategies. Innovation and technological development as tools of competitiveness.

ES10 Evaluation of information technology projects. Planning, programming, budgeting and project control. Techniques and tools. Technical, economic and financial analysis. Total cost of ownership. Return on investment. Cash flows. Feasibility. Uncertainty evaluation. Models project evaluation. Risk management.

1.2.2 Financial management topics.

ES11 Basic Accounting Principles. Objective of the accounts of an organization. General Accounting. Accounts: classification and catalogs. Journal entries. Operations log. Specific accounts. Banks and bank reconciliations. Accounts inventories, sales, and operating expenses. Analysis and interpretation of financial statements - including funds-flow, financial ratios and key financial indicators, analyzing flows following information in the various hierarchical levels of the organization.

ES12 Cost Accounting. Catalogs accounts. Raw material. Wages and salaries. Overhead and production. Production expenses. Industrial costs. Making decisions regarding costs. Manufacturing costs, development, adaptation and procurement costs.

ES13 Financial planning. The financial function. Treasury functions. Owners and workers. Working capital: assets and liabilities. National and international financial systems. Banking and insurance organizations. Stock organizations, alternative financing and investment. International financing. Financial feasibility studies and financing and investment alternatives.

ES14 Budgets. Budget purposes: forecasting, planning, control, investment, integration, operation, management, control. Estimates of revenue and expenditure. Budgets for areas of responsibility for programs and activities. Common Criteria for budgetary integration. Techniques and tools for budgeting.

ES15 Tax issues in organizations. Revenue Act of the Federation. Revenue in the organization. Tax implications: contributions, profit sharing, statements. Social Security. Investments. Expenses and fiscal stimulus. VAT mechanisms. The fiscal area in the organization and its relationship with the computer unit. Information systems and generation of fiscal indicators.

1.2.3 Topics of economic management.

ES16 basics of microeconomics. Object of economic science. Economic schools and economic systems. Sectors of the economy. Factors of production. Information. The market and Pricing determination. Offer and demand. Elasticity. Price controls. Production and costs. Economies of scale and diminishing returns. Topics of economic information systems and generation of indicators to support decision-making.

SS17 Basics of macroeconomics. Income levels. Consumption, savings and investment. Balance

of payments, national accounts, domestic debt and external debt indicators (GDP, GNP, etc.). Banking: Central, public, private, commercial, development. Fiscal policy. Bank credit and interest rates. Capital markets. Inflation and unemployment. Economic situation of Mexico.

ES18 Business Economics. The company and production structure. The company and the service structure. Making economic decisions. Risk and uncertainty. Costs, expenses and investments. Capital. Market: supply and demand. National and international markets. Export. Business incubators. Companies of goods and services, information systems and generation of indicators. Panorama of Mexico's economic situation and prospects and trends.

1.2 Managing Information Technology

Objective: To study the administration of computer or information technology units from the perspective of organizations. Will apply and the general concepts of these computer units, are part of a larger organization or independent companies.

1.3.1 The IT function

ES19 computer units in organizations. Mission and vision. Function and objectives. Location in the organization. Reorganization of the computing unit. IT functions centralized, distributed, independent, computer units as unit standards, integration and consistency. Purchasing functions, maintenance, integration solutions, development, training and technical advice. Administration computer. Formal and informal links of the computer unit with the other organs. Computer for personal computing units. Incorporation of the organization to the globalization of technology for both internal processes and activities and their relationships with their environment, advantages, disadvantages and criteria for setting limits. The importance of cost-benefit. Creating internal computer units or outsourcing services (recruitment outsourcing, hosting or housing).

ES20 Business and IT projects. Types of services companies. Guiding principles for the development of national technology principles: adaptation, adaptation, autonomy, independence. Small Business: Figure-technical partners; the figure of owner-managers. Offer resources and external services (outsourcing). Attracting needs. Definition of products and services for the market. Customized products. Products for final consumption.

ES21 Tenders Companies in real time. Computer applications and information retrieval in fixed and mobile media. Intercom and communication systems in fixed and mobile media. Update substantive information in databases in real time. Systems automatic generation of statistics and graphs on substantive for managerial decision making variables. Information and interaction with users, customers and suppliers web systems. The functions of front office and back office. Trade online through internet. Verification systems and safety certification business processes online (SS certification, Symantec or Versing, etc.).

ES22 Administration computer units. Planning unit. Requirements analysis and definition of the services of the unit. Determination of volumes of information to manage. Hardware and software selection, procurement, purchase, rent, licenses. Operating standards. Controls. Security. Evaluation of plans, programs, budgets and performance. Preparing reports for different hierarchical levels of the organization.

ES23 Real computer. Making plans automation and software development tailored to organizations. Feasibility studies for purchase or lease, under license computer equipment (hardware and software). Contracts and licenses. Equipment maintenance. Insurance special hardware to software, for the particular organizational information. Backup and data backup. Inventory of hardware and software. Administrative services.

ES24 IT Project Management. Life cycle of a project and the life cycle of an IT project. Work packages and cargo allocation. Network diagrams and Gantt. PERT and CPM networks. Critical route. Probable time. Resource allocation and costing.

ES25 Management Innovation and Technology. Life cycle of technology. The innovation process. Creativity, invention and technological development. Commercialization and deployment of innovation. Innovation strategies. Areas R & D + i (research, development and innovation) in enterprises.

ES26 Promoting sustainable development. Computer units as sources of information to promote and guide the sustainable development of organizations and their environment. The information and communications integration in support of substantive projects of organizations. Preventive information

ES27 Control and monitoring of business processes. Monitoring and control of automated processes. Generation and interpretation of statistics. Integrated ERP systems (Oracle, SAP, NetSuite, INFOR, etc.). Management information systems. Data mining and data warehouse. Databases oriented decision making. Nesting procedures users.

1.3.2 Human Resources.

ES28 Administration IT staff. Personnel management: recruitment, selection, training, induction, supervision, updating and motivation. Internal departments. Decentralization of functions, equipment and personnel. Formal training in professional and technical levels. Recruitment and retention of qualified personnel. Wage and salary policies. Stimuli. Penalties for computer crimes. Certification.

ES29 Update IT staff. Activities for continuous updating in the organization. Importance and necessity of updating the form of formal training, training, training. Specific policies to upgrade. Investment update. Industry profiles and certifications.

1.3.3 Audit computing units.

ES30 Computer audit. Concept and general methodologies for audit. Means and tools to audit. Types of audit. Collection and analysis of information. Assessment of the definition of the computer unit and its mission. Evaluation systems. Equipment and systems. Performance. Access, protection, insurance. Risks isolated PC environments. Organizational networks: design and access. Contracts and licenses. Audit firms. Opinion. Corrective measures and deadlines for implementation. Data mining applications.

1.3 Legal Ethics and Regulations

Objective: To provide knowledge of legal regulations and national and international policies for proper location of the goods and computer services in their social environment. Provide a framework of concepts and ethical values for professional work and use of goods and services.

1.4.1 Legal frameworks.

ES31 legal considerations. The man and the law. Laws and their application. Individuals and corporations. The state and the constitution. Contracts. Laws concerning income and expenses. Organic laws of the federal government, the public service. Concession regime.

Forms of acquisition of property by the state: purchase, expropriation, nationalization, confiscation.

Concessions. Types of commercial companies and protection of personal data.

ES32 Commercial law. The trader. The company. Commercial society. LLCs. Anonymous society. Cooperative Society. Securities and credit operations. Bankruptcy and receivership.

ES33 Policy computer. Regulatory standards of computer activity: national and international. Specific legislation. Cybercrime. Diagnosis and national development plans. Bodies of the federal public administration responsible for the definition, implementation and regulation policies. Assessment of IT policies and analysis of results. Public tenders. Computer technology, regulation, adaptation, autonomy, independence.

ES34 Human rights. Right to confidentiality of information. Information privacy. Bases of public and private data. Public and private networks. Technology as an economic asset and obligations. Regulation of IT services. The computer "power" and the power of information: uses and abuses. Ethics.

1.4.2 The information age.

ES35 Ethics. Concepts of ethics as a philosophical discipline from ICT, freedom and responsibility, ethical and moral issues, relations with other sciences, ethics vs. morality, moral principles, values: areas of personal and social decision.

ES36 Authorship information sciences. Authorship and creation software. Copyright: registration royalties. "Piracy" software. Contracts and software licenses; license categories: organizational, academic, individual. Ethics.

EN37 Impact of technology. Technological culture. Process automation. Changes in forms of production and operation. Staff Administration. Changing roles and tasks of staff. Acceptance and resistance. Education, training and training. Robotization. Dangerous tasks for the human and technological elements replacement or protection. The Information and Communication Technologies (ICT) and its relation to climate change and sustainable development. Awareness about technological waste.

ES38 social impact of computing. General computer literacy. Computer technology at different levels of education. Benefits and risks. Possibilities of stratification and separation from society. Generational differences. Applications to various areas of knowledge and different human activities. Tools and end-user environments.

Administrative and paperwork simplification. Communication optimization. Sociology of computing. ICT and the family. New ways of working. ICT for economic and social development. New risks.

7.4.2 Mathematics

Mathematics provide excellent training base and essential support for the development of skills of abstraction and expression of formalisms, in addition to providing essential expertise for computing and computing.

2.1 Basic Math

2.2 Applied Mathematics

2.3 Discrete Mathematics

2.4 Mathematical Theory of Computing

2.1 Basic Math

Objective: To provide knowledge of classical mathematical discipline that are the formal basis for all subsequent developments.

2.1.1 Calculation

MA1 differential and integral in one variable. Integers, rational and real. Functions. Graphs. Limit and continuity. Differentiability and continuity. The derivative. Bypass techniques. The indefinite integral and the definite integral. Integration methods. Improper integrals. Sequences and series of functions. Applications.

MA2 differential and integral in several variables. Real functions of a vector. Vectors. Functions and operations functions. Function graphs. Limit and continuity. The derivative of functions of several variables. Differentiability concept. Directional derivative. The integral of functions of several variables. Real functions of a vector. Vector functions of a vector. Parametric curves and surfaces parameterized. The integral over a path. The integral over a surface.

MA3 Differential Equations. Ordinary differential equations of first order homogeneous and inhomogeneous. Homogeneous ordinary differential equations and inhomogeneous higher order. Fundamental set of solutions and Wronskian. Systems of differential equations. Approximation methods for solutions. Application problems. Theorem of existence and uniqueness of differential equations. Solution in power series (Frobenius method). Solution by the Laplace transform method (include functions such as the unit step, sawtooth function, among others). Introduction to partial differential equations (equations of type: hyperbolic, parabolic and elliptical) Applications.

MA4 Fourier series. Periodic functions. Orthogonality properties. Fourier trigonometric series. Dirichlet conditions and convergence properties. Complex form of the Fourier series. Integration and differentiation of the Fourier series.

MA5 Fourier Transforms. Fourier integral. Properties of Fourier transforms. Fourier transforms derived. Convolution theorem. Transformed unobtrusive and fast Fourier transform. Analysis of discrete data and algorithmically practical for calculating transformed.

2.1.2 Algebra

MA6 Linear. Vector spaces over a field. Linear independence. Systems of linear equations. Matrices and linear transformations. Triangulation and diagonalization. Applications. Multilinear. Determinants. Eigenvalues and eigenvectors. Scalar product. Domestic product. Product Hermitian. Rule. Orthogonal vectors. Projections. Orthogonal and orthonormal bases. Unitary and orthogonal diagonalization.

MA7 Classic. Sets. Relations. Functions. Equality and composition of functions. Types of functions. Investable functions. Cardinality of a set. Finite and infinite sets. Equivalence relations. Partitions. Order relations. Natural numbers. Induction principle. Integer numbers. Algorithms division and greatest common divisor. Combinational calculation: ordinations with repetition, combinations and permutations. Prime numbers. Fundamental Theorem of Algebra. Congruences. Equations and systems of equations n module. Complex numbers: operations and properties. Polar representation. Roots of complex numbers.

MA8 Moderna. Group Theory: binary operations in a set. Semigroups and monoids. Group definition and examples. Finite Abelian groups. Subgroups. Operations groups. Groups of permutations, cycles, transpositions, parity, and the alternating group. Automorphisms. Ring theory. Homomorphisms. Rings of polynomials.

2.1.3 Geometry.

MA9 Vectors, lines, planes and curves. Vectors in R^2 and R^3 . Vector algebra. Geometric

interpretation. Scalar product. Vector product, scalar triple product. Polar coordinates. Curves and surfaces. Intersection of loci. Lines and planes. Straight. The plane. Families of straight, families of planes. Circles and spheres. Conic in the plane.

MA10 geometric transformations. The quadratic equation in two and three variables. Translations in R^2 and R^3 . Rotations in R^2 , and R^3 . Tangentes and normal. Curves and surfaces. Traces. Normal vectors and tangent planes to surfaces in R^3 . Spherical and cylindrical coordinates.

2.2 Applied Mathematics

Objective: To promote the exercise of formal skills as a training element, and provide specific knowledge of instrumental importance for further development.

2.2.1 Probability and Statistics.

MA11 Probability. Definition of probability, probability space and sample space. Basic theorems of probability. Calculation of probabilities. Conditional probability. Independent events. Random variables and probability functions and density. Expected value. Variance. Generating functions of moments and probability generating function. Discrete Distributions: Bernoulli, geometric, binomial, hypergeometric and Poisson distributions Continuous uniform ... Normal, exponential, uniform, gamma, t-student, chi square and F. The central limit theorem.

Descriptive statistics MA12. Populations and samples. Frequencies. Histograms. Statistical parameters: mean, median, quartiles, mode, range, variance, standard deviation. Measures tendency and dispersion. Coefficient of variation. Hypothesis testing. Descriptive statistics using specialized computer programs.

MA13 distributions. Discrete: binomial, hypergeometric and Poisson. Least Squares. Independence and convolution. Continuous distributions. Normal. The central limit theorem. Densities. Hopes, moments and variance. Conditional distribution. Joint distributions and independence. Convolutions.

MA14 Random vectors and transformations. Random vectors, joint distribution function, independence, conditional distributions. Distribution theory: Method distribution function, transformations, method of generating moments. Covariance and correlation.

MA15 statistical inference. Point estimation: estimators, properties of estimators, methods to propose estimators, the best estimate. Interval estimation: Basics of confidence intervals, propose methods intervals, intervals relative to normal (mean, variance, equal means, variance). Hypothesis Testing: Function power, type I error and significance level, and most powerful test uniformly most powerful. Related to Normal tests. Statistics descriptive using specialized software. Inferential statistics using specialized computer programs.

MA16 Stochastic processes. Classification and types of stochastic processes. Function average, variance function, autocovariance function. Markov processes discrete time: Basics, Introduction, classification of states, stationary distribution. Markov processes continuous time: Structure of a Markov process, Markov queuing theory, birth and death processes. Markovian processes decision: Fundamental Algorithms.

MA17 multivariate data analysis. Regression Analysis: Simple model assumptions, properties and model validation. The general model, assumptions, properties and model validation. Variance analysis. Multivariate analysis: Descriptive statistics multivariate analysis, cluster analysis, decision trees, principal components, factor analysis, multidimensional scaling, correlation analysis, discriminant and logistic regression function and poisson.

Stochastic modeling MA18. Simulation: Simulation Nature, benefits and limitations of simulation, simulation planning. Generation and use of random variables. Simulation languages general purpose, specific purpose and spreadsheets. Some simulation languages: GPSS, SAS and ARENA. Time series: time series and stochastic processes, elements of the time series, important results and decomposition of time series autocorrelation function (ACF), partial autocorrelation function (PACF), periodogram, white noise processes. Processes AR, MA, ARMA and ARIMA. Bayesian statistics: Distributions a priori and a posteriori, combined families. Bayesian nonparametric statistical inference: point estimation and region, hypothesis testing. Decision theory and statistical inference. Formal representation and decision troubleshooting. Monte Carlo methods for Bayesian computation. Computational implementation.

2.2.2. Numerical calculation

Numerical methods MA19. Floating Point and approaches. Theory of errors. Solving systems of linear equations. Solving algebraic equations. . Interpolation and polynomial approximation, Derivation and Numerical Integration.

2.2.3 Simulation.

MA20 Basics. Concept and use of simulation. Random variables and stochastic processes. Main probability distributions. Generating continuous uniform numbers. Generation of random variables and stochastic processes. Validity and reliability of the simulation.

MA21 Special programming techniques and languages. The Monte Carlo method. Simulation systems such as waiting lines, inventory, manufacturing, ERs, financial risks, and so on. Verification and validation procedures. Analysis of results. Languages: R, Arena, Promodel, SIMUL8, Stella, iThink, @ Risk.

2.2.4 Systems and Control.

MA22 elements for process control. System Performance. Identification processes, modeling and control. State. Feedback. Analytical modeling approach. Transformed Z. The modeling process. Methods of proportionality, likeness, approach and adjustment. Dynamic methods. Simulation. Direct Digital Control. Adaptive Control. Numerical control.

2.2.5 Operations Research.

MA23 Linear Programming. Models for maximization and minimization. Model formulation. Graphical method. Types of solutions. Region of feasible solutions. Basic feasible and infeasible solutions. Cycles. Simplex method. Artificial variable: Method of the two phases. Duality. Dual simplex method. Economic interpretation. Complementary theorem Clearances. Sensitivity Analysis. Tools available. The transportation problem.

MA24 nonlinear programming, integer and dynamic. Nonlinear programming and maximum and minimum problems. Quadratic programming, convex, separable. Integer programming: formulation of models, methods and enumeration cuts. Dynamic Programming Concepts such as: as recursive function, stages, states, decisions, policies and principle of optimality methods based on group theory and applications.

MA25 Network Analysis. Elements of graph theory in the formulation of network problems. Minimum weight tree. Properties trees. Solution algorithms. Sensitivity analysis. Shortest route. Maximum flow. Minimum cost flow between origin and destination. To offset circuit. Simplex method

to restricted networks. Activity networks.

2.3 Discrete Mathematics

Objective: To provide a body of formal knowledge, essentially linked with philosophy and computational discipline. Provide techniques for problem-solving approach and counting and enumeration.

2.3.1 Logic and sets.

MA26 propositional logic. Textual substitution and the concept of equality. Boolean expressions. Equality and equivalence. Satisfiability, validity and duality. Theorems denial, in equivalence, false, disjunction, conjunction and implication. Other methods of proof: modus ponens; modus tollens; antecedent assumption; proof by exhaustion; proof by contradiction; demonstration by contrapositive. Applications, relationnel logic.

MA27 predicate logic. Quantification. Syntax and interpretation of quantification. Manipulation rules. Ranges. Universal quantification. Existential quantification. Predicate and programming: pre- and post; invariants. Calculation, validity and test systems predicates. Verification by checking models of binary decision diagrams.

MA28 sets. Set theory. Description sets and membership. Predicate for membership. Predicate logic and membership. Operations on sets. Theorems concerning joint operations. Union and intersection of indexed family. The axiom of choice. Paradoxes and ill-defined sets. Principle of Induction. Relationships: ordered pairs and Cartesian products. Operations relations: inverse of a relationship, composition of relations. Order relations on a set: sets totally ordered, partially ordered sets.

2.3.2. Combinatorial

MA29 Combinatorial Analysis. Induction and recursion. Ordinations, permutations and combinations. Binomial theorem. Binomial Coefficients. Inclusion-exclusion principle. Theory counting. Generating functions. Recurrence relations, enumerative theory of Polya.

2.3.3 Relations and graphs.

MA30 Relations. Binary relations and operations on them (intersection, union, sum, sum ring fusion subtraction. reflective properties, symmetric, transitive and antisymmetric binary relationships. symmetric, reflexive and transitive Locks. Partial Orders. Finite partially ordered sets (lattices). One to one relationship between equivalence relations and partitions into equivalence classes.

MA31 Charts. Charts simple, regular, connected, complete, balanced, and symmetrical. Isomorphism between graphs. Incidence and adjacency matrices, matrix accessibility. Subgraphs. Degree of a vertex. Trajectories and connectedness. Charts flat, planar and dual. Cycles. Euler tour (Charts Eulerian). Hamiltonian cycles (Charts Hamiltonian). Matings. Coloring of edges and vertices. Chromatic numbers.

MA32 trees. Definition. Cutting edges. Vertex cutting (or points of articulation). Connectedness, eccentricity of a tree, a tree centers. Depth. Tours. Balanced, binary, strictly binary

trees.Applications. Mathematical foundations of trees as data structures, paths trees (subtrees and levels).

2.4 Mathematical Theory of Computing

Objective: To provide formal knowledge that support the theoretical and conceptual model of computers and computational task in its broadest sense. Providing elements for enriching understanding of computational discipline.

2.4.1 Automata and formal languages.

MA33 finite state machines. Basic definitions: states, symbols, transitions. Theorems of equivalence between languages produced by grammars and languages recognized by automata. Nesting automata: finite automata stack, Turing machine; equivalence of automata.

MA34 recognition languages. Structural relationships between automata and grammars. Generation languages: derivation trees. The problem of recognition. Parsing schemes: ascending and descending parsing. Parsing algorithms for context-free languages.

MA35 Formal languages. Strings, languages and operations. Formal grammars: definitions, operations, types of languages, ambiguity, equivalence, Chomsky hierarchy. Theorems on regular grammars and context-free grammars. Canonical derivations, recursive and recursively enumerable languages, undecidable problem in language theory and its philosophical and conceptual importance.

2.4.2. Formal systems

MA36 Turing machines. Concept of computability. Concept of procedures, effective procedure and algorithm. Turing machines: models of computability, undecidable problem (The Halting Problem). Limits of computability. Relations between Turing machines and recursive function theory. Formal equivalences.

MA37 Recursive functions. Computable functions and algorithms. Primitive recursive functions. Recursive primitive predicates. Post systems. Productions, canonical systems. Lambda calculus.

2.4.3 Computability.

MA38 Complexity. Complexity and computability. Complexity of algorithms. Boundedness theorem. Complexity classes. Polynomial computability.

Classes P and NP. NP algorithms. NP-complete problems. Satisfiability problem. Demonstrable intractable problems. Complexity of first-order theories.

MA39 Decidability. Gödel numbering. Recursively enumerable sets. Rice's Theorem. Post correspondence problem. Insoluble problems. Church-Turing thesis.

7.4.3 COMPUTER ARCHITECTURE

Study of theory, techniques, technologies and methods to understand the operation of digital systems and computers, as well as the physical principles that support them in order to formulate some of its specifications and know how to integrate various equipment for private purposes.

3.1 Physics
3.2 Digital Systems
3.3 Types and Computer Settings
3.4 Facilities and Equipment
3.5 New Technological paradigms

3.1 Physics

Objective: To understand the principles of operation of electronic circuits in general, and digital circuits in particular, to analyze common applications and make it possible to have particular designs.

3.1.1 Issues of mechanics, optics and modern physics.

Mechanical AC1. Need of physics as a science to model, understand and predict the behavior of natural phenomena. Quantities and units. Force. Systems in static equilibrium. Dynamic. Work. Energy. Power. Kinematics. Kinetic energy and potential energy. Energy conservation. Movement quantity conservation. Gravitational force. Newton's laws. Law of universal gravitation. Gravitational field.

AC2 Optics. Wave motion. Electromagnetic theory: photons and light. Light propagation. Geometrical Optics: lenses, diaphragms, mirrors, optical systems. Optical reflection. Optical refraction. Optical interference. Optical diffraction. Quantum theory of light. Laser radiation.

AC3 Modern physics. Relativistic physics: Galilean relativity, Lorentz-Fitzgerald equations, relativistic mass and energy. Quantum Theory: a black body radiation, Planck's quantum hypothesis, the photoelectric effect, wave-particle duality, Bohr's model, the hypothesis of De Broglie. Quantum mechanics:

The wave function, the Heisenberg uncertainty principle, philosophical implications, Pauli Exclusion Principle. Nuclear physics: atomic and subatomic particles. Nuclear fission and fusion. Elementary particles, quarks. Unified theories.

3.1.2 Electricity and Magnetism.

AC4 Electricity. Electric charge. Coulomb's law. Electric field. Lines of force. Electric potential. Electrostatics. Basics of electricity and electronics. Electrodynamics. Conductors and insulators. Electric current. Electrical power. Resistance. Ohm's law. Conductivity. Simple electrical circuits.

AC5 Magnetism. Magnetic induction. Forces on current-carrying conductors. Concept magnetization. Magnets. Magnetic field. Magnetic properties of materials. Ferromagnetism. Ferrites. Superconductivity: history and superconducting materials, magnetic induction. Maxwell equations.

AC6 Electrical circuits. V-i characteristics of passive and active components. Kirchhoff's laws. Current and voltage measurement. Relations between current and voltage. Analysis of resistive circuits. Answers to variables in general and in particular sinusoidal excitations. Transient and steady state response. Impedance. Resistance, capacitance and inductance. RC circuits, RL and RLC.

3.1.3 Electronics.

AC7 principles of electronics. Basic electronic components. Semiconductors. Transistors and diodes. Manufacture. Diode arrays: circuits. Configurations with diodes in series, parallel and series-parallel. Basic AND, OR and NOT. Operational amplifiers. Applications of diodes and

transistors. Flip-flops. Analog systems.

AC8 electronic circuits. Analytical representation of signals. Oscillators. Amplifiers. Switches. Basic circuits: inverter, adder, divider, inclusive. Modulators and demodulators. Integrated circuits. Flip-flops integrated. Linear integrated circuits: operational amplifiers, regulators (filters and power supplies), digital (comparators, converters).

AC9 integrated circuit technologies. Principles and stages of integration. Integrated circuits of small, medium and large scale. Floodgates DTL, TTL and ECL. Technology TTL, MOS and CMOS. Static and dynamic circuits. Microelectronics. CCD devices. Performance, economy of scale, interconnections pins.

AC10 special purpose devices. A/D and D/A. Conversion. Conversion methods with feedback and without feedback. Modulators and demodulators. Multiplexers. UARTs (Universal Asynchronous Receiver_Transmitter).

3.2 Digital Systems

Objective: To provide theoretical and practical elements to analyze and understand the basic subsystems of computers, and for their specification and design.

3.2.1 Logical Design

AC11 Number Systems and Codes. Representation of numbers: binary, octal, hexadecimal, decimal, BCD, ASCII and UNICODE. Conversion. Operations. Fixed point arithmetic and floating point. Errors in the different representations.

AC12 combinational circuits. Boolean algebra: definitions, basic theorems. Logic functions. Simplification of logic functions. Karnaugh maps. Minimization. Methods of analysis and synthesis. Floodgates. Adders. Code converters. Decoders. Multiplexers. Technology: CMOS, I²L, ASIC.

AC13 Sequential Circuits. Multivibrators (flip-flops): Astable, monostable, bistable. State diagrams. Minimization techniques. Records and data transfer. Bistable design records. Data transfer. Counters. Design of asynchronous counters. Design of synchronous counters. Integrated counters. Synchronized sequential circuits.

3.2.2 Basic subsystems

AC14 functional units. Study of the parties and the main components of a computer subsystems. CPU: arithmetic and logic unit, control unit, registers. Arithmetic processor. Controllers. Input / output. Buses. Memory.

AC15 Memories. Storage: encryption, compression, integrity (control codes, parity). Central organization memories: partitions, addressing. Access cycles. Bus operations. Caches, memory read-write, read-only. Virtual memory. Materials and storage technologies.

AC16 Storage Devices (Peripherals External storage devices). Drums, magnetic tapes and disks, optical disks, compact disks, diskettes. Features: access times, speeds, storage capacities, bloqaeaje, reliability, lifetime. Synchronous and asynchronous processes for care peripherals. Interrupt handling. Care programs peripherals (peripheral control) drivers.

AC17 peripheral input-output devices. Readers paper tape, punched cards: features, speed, failures. Matrix printers, inkjet, laser technology, color: characteristics. Monitors: sizes, resolutions,

colors. Scanners (digitizers). Video-cameras. Speakers. Keyboards. Mouse. Styluses. Peripheral Attention: interruptions. The USB 1.0 and 2.0 interface. IEEE 1394 Firewire interface.

3.3 Types and Computer Settings

Objective: To study different architectures existing systems throughout its historical evolution and analyze new trends.

3.3.1 Architectures and forms processing

AC18 History and evolution. 2 First generation machine language. Second generation: assembly language, first programming languages (FORTRAN, COBOL), compilers and operating systems, multiprogramming, batch processing or batch. Third generation: multiprogramming, multiprocessing, shared time, CPU and terminals, algorithmic programming languages evolve (Algol, Pascal, PL / I). Mainframes. Fourth generation: compaction of the components. Fifth generation. Microprogramming. Minicomputers. Microprocessors.

AC19 classical von Neumann architecture. Functional description of a computer: CPU, memory, input-output devices. Coding and internal representation of information storage. Arithmetic unit: integer, fixed-point and floating point. Control unit: program counter. Logic Special instruction decoders, feathering. Machine language: opcodes, addressing. Buses for communication with peripherals. Ports. Interruptions input-output. Measurement units internal times and total times.

AC20 alternative architectures. Stack machines under vector multiprocessor, hypercube. CISC and RISC concepts. SIMD and MIMD concepts. Architectures sequential and parallel architectures. Clusters. Mirror configuration. Comparing architectures, efficiency, and application of alternative architectures. Measurement units. MIPS and transactions per second. Commercial products. Core devices and intelligent peripherals. Supercomputers. Special Architectures. Oriented individual processing machines. Hardware designs based languages: Lisp, Algol, Prolog machines.

AC21 Microprocessors. Functional Description: control unit, arithmetic unit, special registers, memories, stacks, ports, canals, watches. Instructions, interrupts, drivers. O series and parallel. Special ports for keyboard, display screen for, for converters A / D and D / A.

AC22 computer equipment configurations. Central processing unit and peripherals. Card readers and paper tapes. Printers. Magnetic and optical disks and tapes. Terminals. Other peripherals: mouse, scanners, speakers. Intelligent and non-intelligent peripherals.

AC23 Forms processing. Single processors, multiprogramming, batch or batch, timeshare, real time. Different programming paradigms and their relationship to architectures. Conversational processing. Personal computing. Multiprocessing. Multiprocessor configurations: distributed processing, messages, events. Distribution of tasks: communications, synchronization and cooperation. Parallel processing.

AC24 Client-server model. Servers. Work stations. Personal computers. Characterization by means of software. Agents. Functional specificity. Communication: cooperation, synchronization, messages, events.

AC25 Assembly Language. Processor models. Operators. Bit level manipulation. Flags. Labels and mnemonics. Reading records. Operations. Interruptions. The data stack. Memory addresses. Memory transfer. Indiciamiento memory. Macros. Depuration. Estructurado. Conjunto assembler instructions, data types, assembled, linked, loading and execution.

3.3.2 Special purpose systems

AC26 specialized configurations. Design as a particular purpose. Implementation in large scale integrated circuits (VLSI). Specialized processors, specialized software. Using special purpose tools for VLSI design. Hardware-software combinations. Examples: systems for industrial process control, for filtering and signal analysis, radiology, for alarms, for medical prosthesis, for manufacturing, others.

AC27. Card design and printed circuit boards. Design of printed circuit boards and cards. Emulators systems. Floodgates arrangements Field Programmable (FPGA).

3.4 Facilities and Equipment

Objective: To provide knowledge and guidelines necessary for the proper determination of environments that meet standards and physical requirements, comfort and safety.

3.4.1 Facilities

AC28 Edilicias. Location of the building or room equipment (computers, servers, personal computers room, other). False floor, control temperature and humidity, special air conditioning. Insulation and protection.

AC29 Power. Electrical infrastructure: capacity, balancing phases, physical land leased lines. Uninterruptible power systems.

AC30 Telecommunications. Standards EIA / TIA 569, 2840, 3012 and 606. Size of wiring closets. Labeling and documentation of telecommunications infrastructure.

3.4.2 Management and maintenance.

AC31 Initial Setup. Consistency, functionality and integration of operating environments: users, categories, access rights. Definition of initial parameters. Operating policies. Furniture: Special furniture for different teams. Functionality and hygiene considerations.

AC32 Maintenance. Evaluation of new technologies. Upgrade. Expansion for growth: parameters, statistics. Logbooks use. Equipment replacement. ITIL standard.

3.4.3 Security.

AC33 Preventive measures and safety procedures. External backups of information. Teams backed mirror. Backup computer centers. Security vaults. ISO and BS 17799 and ISO 27001.

AC34 Sinister.Burglary: prevention rules and security mechanisms and monitoring of facilities against theft; alarms. Access: access rules with computer rooms; ways and means of access control. Fire detectors Fire and smoke; extinguidores. Power interruption equipment and uninterruptible power generating plants.

AC35 Insurance. Special insurance protection equipment (hardware), software and information. Value of information. Policies. Relevant legislation.

3.5 New Technological Paradigms

Objective: To provide theoretical and practical elements for integrating applications with digital systems using different purpose development environments.

3.5.1 Cloud Computing (Computing or Cloud Computing).

AC36 architecture and cloud computing models. Service models and deployment and their classifications (public, private and hybrid clouds). Semantic Web. New technological models: Software as a service, virtualization and storage web. Web architecture. Hardware and software. The multicompartidos services (multi-tenancy). Sensors, RFID chips (Radio Frequency Chips identifiers are replacing bar codes) chips NFC, Bluetooth technologies and naturally WiFi wireless technologies, WiMax or LTE. Virtual servers.

AC37 Data protection and user privacy. Data and applications on clouds machines, computer servers belonging to Internet giants, Google, Microsoft, IBM, Dell, Oracle, Amazon.

New technologies AC38. Web in real time. Geolocation (GPS). Augmented reality. Internet of things. New mobile technologies. Semantic technologies. Computers dumb or smart fools. Portable supercomputers. Expansion of VoIP technology.

AC39. Emerging issues of computer architectures.

7.4.4. NETWORKS

Study of fusion domains traditionally considered hardware and software and ways to distribute and share computing resources, processes and information, considering their safety and integrity.

4.1 Transmission and Data Communication.

4.2 Models.

4.3 Protocols.

4.4 Network Intercommunication.

4.5 Security and Integrity of Information.

4.6 Distributed Systems

4.1 Transmission and Data Communications

Objective: To study the theory and know the operating elements required for transmission and reception of information.

4.1.1 Information Theory.

RE1 Theoretical concepts. Transmission and communication of information. Measures of information. Entropies and generalized entropies. Spectral entropies. Bandwidth, power spectral density and bandwidth estimation. Channel capacity and transmission speed. Coding, distributed coding, channel coding and joint source, space-time coding and MIMO systems. Noise. Types of noise interference. Characterization noise. Shannon sampling theorem and Nyquist sampling criterion. Channels. Mistakes. Spread spectrum techniques.

RE2 codes. Information coding. Redundancy. Protection. Control codes (parity bit checksum). Codes BCD (Binary Coded Decimal). Hamming code. Algebraic codes. Codes ASCII (American Standard Code for Information Interchange) and EBCDIC (Extended Binary Coded Decimal Interchange Code). Text compression. Unicode, encoding audio and video.

RE3 errors. Detection and correction. Algorithms: parity, checksums, cyclic redundancy check

(Cyclic Redundancy Check). Special methods.

4.1.2 Signals.

RE4 Types and links. Analog and digital data. Analog signals. Digital signals. Digitizing signals. Scanning errors. Baseband and baseband transmission. Digital and analog filters. Digital and analog modulation. M-ary modulations.

4.1.3 Transmission of voice, images and data.

RE5 Communications. Bandwidth and frequency spectrum. Speed channel and transmission capacity. Dedicated and non-dedicated circuits. VCs. Circuit switching. Packet switching.

RE6 transmission modes. Synchronisation codes. Manchester code. Synchronous and asynchronous transmission. Message formats. Partition channel. Multi-channeling (frequency division. Multichanneling time division. Multicasting (multicast). Methods serial and parallel transmission. Broadcasting (broadcast).

RE7 Media and physical elements. Coaxial cable. Twisted pair cable. Optical fiber. Analog and digital microwave. Types of satellites. Satellite spaces. Satellite microwave. Digital public networks. Telephone networks. PBX (Private Branch Exchange). Extensive networks through PBX.

RE8 communication devices. Physical layer devices. Repeaters. Concentrators and distributors (hubs). Data switches, switches. Puentes. Routers. Dampers (Gateways) (Gateways).

RE9 communications services. Interactive video. Teleconference. Videoconference. ITU standard H.320. High-speed networks. Frame Relay for full transmission. ATM (Asynchronous Transfer Mode). ISDN (Integrated Services Digital Network) or ISDN (Integrated Services Digital Network) networks. Video on demand, near video on demand, audio on demand. MPLS, VPN.

Telecommunications RE10. Uses and applications of the electromagnetic spectrum. Digital multi-channeling. Signal processing and digital communications. Microwave links. Systems and digital microwave radio. Satellite communications. Mobile radio communication. Transmission systems optical fiber. Signal processing systems. Design of RF backbones. Design of fiber optic backbone networks.

4.2 Models

Objective: To study the theoretical elements, characteristics and properties of the different models of computer networks and network components, in order to design and implement specific applications.

4.2.1 Topologies.

RE11 The ISO/OSI model. Organization ISO (International Organization for Standardization). Organization OSI (Open Systems Interconnection). Reference Model. Level 1: Physical layer. Level 2: data link layer. Level 3: Network Layer. Level 4: Transport Layer. Level 5: Session layer. Level 6: Presentation Layer. Level 7: Application Layer. TCP / IP.

RE12 Architecture. Evolution of networks of voice and data transmission. Role of networks. Link layers and levels. OSI model. LAN (Local Area Network), MAN (Metropolitan Area Network), WAN (Wide Area Network). PAN (Personal Area Network). CAN (Campus Area Network). Wireless

technologies: WMAN, WLAN, WPAN. Open systems. Connectivity and interoperability. Network management, monitoring, sizing, safety, error handling. Networks of networks.

RE13 Standards and organizations. DoD (Department of Defense). IEEE (Institute of Electrical and Electronic Engineers). ITU (International Telecommunications Union). The OSI reference model (Open Systems Interconnection). SNA (Systems Network Architecture). DNA (DEC Network Architecture). BNA (Burroughs Network Architecture). EIA / TIA, NIC, IETF.

RE14 Local networks (LAN). Elements of a LAN (network card, cabling, software). Client-server scheme. Servers and hosts. Physical Topologies. Polling Protocol. Media access protocols. Protocol CSMA / CD (Carrier Sense Multiple Access / Collision Detect). Token Passing Protocol. IEEE 802.3 Ethernet. IEEE 802.4: IEEE 802.5 Token Bus.: *Token Ring*. Fast Ethernet standard. Standard FDDI / CDDI (Fiber-Distributed Data Interface / Copper). LAN switching networks (LAN switching). Virtual LANs. Network operating systems. Wifi 802.11, Bluetooth 802.15. Zigbee. Gigabit Ethernet. HomeRF, RFID, structured cabling. LAN design.

RE15 wide networks (WAN). Devices DTE (Data Terminal Equipment) and DCE (Data Communications Equipment). Layers 2, 3 and 4 of OSI. Transmission media (cable, microwave, satellite, radio). Connection-oriented protocols: X.25, Frame Relay, ATM. Connectionless protocols: TCP / IP, SNA. Point-to-point and point-multipoint. Interconnectivity software. Network applications: shared queries. File Transfer. Virtual Terminal. Email. Digital links, satellite networks. Cost of networks. IEEE 802.x Cost of wide area networks. MPLS, VPN.

RE16 Metropolitan Area Networks and Internet Access Subscriber. DQDB, xDSL, cable modems 802.14, WiMAX 802.16, 802.20, 802.22. Broadband. Links subscriber's costs.

4.3 Protocols

Objective: To study and analyze the conventions used for communication between the constituent parts of computer networks and communications.

4.3.1 Protocols for communication.

RE17 low level protocols. Notion of protocol. OSI protocol hierarchy. Physical layer protocols: RS-232, RS-449; v.x standard ITU; X.21 and G.703 interfaces. Character-oriented protocols and bit-oriented: ISO / HDLC (High-level Data Link Control). Error handling. Flow control. Layer protocols associated with the IEEE standard link: 802.x Network layer protocols: X.25 and LAPB (Link Access Procedure Balanced); IP (Internet Protocol); Frame Relay; ATM. IP addresses. Addressing schemes. DSSS, OFDM, FHSS, CDMA. WCDMA, LTE. GSM.

RE18 high-level protocols. Protocols Transport Layer: TCP (Transmission Control Protocol), UDP (User Datagram Protocol), IPX (Inter-networking Packet Exchange), AppleTalk. Layer protocols signed in: X.215. Presentation layer protocols: ASN.1 (Abstract Syntax Notation), X.409. Protocols of the application layer: X.400 (email) and X.500. SSL cryptographic protocols.

R19 Protocols for multimedia networks. FTTx. MPLS, RSVP. RTP. RTCP, SIP / SAP / SDP, RTSP, MBONE. RTCweb, H323, MGCP, videoconferencing via web browsers.

4.4 Network Intercommunication

Objective: To provide knowledge of design and functionality of large global networks, and provide the conceptual elements to implement networks of networks.

4.4.1 Interconnectivity

RE20 Theory interconnections. Graph theory. Addressing schemes (IPv4 and IPv6). IP addresses. Address resolution protocols: ARP (Address Resolution Protocol) and RARP (Reverse Address Resolution Protocol) subnets and masks. VLSM (Variable Length Subnet Masking), DNS (Domain Name System). Unix domain. Remote Procedure Call (RPC: Remote Procedure Call). Sockets programming. Routing theory. Spanning Tree (spanning trees) and source routing. Static, dynamic, exterior and interior routing. Routing Protocols: shorter, multiple, centralized, isolated, distributed and hierarchical way.

EM21 devices for interconnection. Repeaters. Wiring concentrators (hubs). Switches (switches). Multiplexers. Puentes. Routers. Configuration with RIP (Routing Information Protocol), IGRP (Interior Gateway Routing Protocol), EIGRP (Enhanced Interior Gateway Routing Protocol, Routing Protocol Enhanced Interior Gateway) and OSPF (Open Shortest Path First), BGP (Border Gateway Protocol). Intercommunication between different architectures. Dampers (gateways). Applications of the gates. Designing a network using routers. Multiprotocol routers.

RE22 network design elements. Development methodologies. Data to consider: channel capacity, traffic requirements, costs, services, types of applications. Visioning. Dimensioning and network optimization. Bertsekas-Gallagher, Flow Deviation, QoS.

4.4.2 Interoperability.

RE23 interconnected networks. Design Considerations. Analysis traffic generation produced by different protocols. Heterogeneous systems. Management and supervision. SNMP (Simple Network Management Protocol). Global networks. Precursor: ARPAnet. NSFnet, USENET, MILnet. NIC (Network Information Center). Internet. Evolution of private networks.

RE24 Internet. Family of TCP / IP protocols. Name Service (DNS: Domain Name Service). IPv4 and IPv6. Services: FTP, remote file transfer, POP3 and SMTP, email, SSH, virtual terminal. HTTP, web services. World Wide Web. Configuration and programming on the Internet. Information search tools. Consultations menus. Hypertext queries. Websites. Creating scripts and Web pages. HTML (Hypertext Markup Language). Applets. Java. Dephi. Safety considerations. WEBSERVICES based on SOAP, JSON protocol.

4.5 Security and Integrity of Information

Objective: To study the various methods to ensure the safety and reliability of data circulating on the networks, ensuring the free flow of information and maintaining the privacy defined by users and system administrators.

4.5.1 Integrity, safety and reliability of the information.

RE25 Integrity. The role of the OSI layers above the reliable transmission of information. Inserting verification points by the session layer. Format conversion. Standard ASN.1 (Abstract Syntax Notation). Methods to ensure integrity in transmission of compressed texts. Codification of context dependent. Reliable communication between applications: traps. Monitoring software.

Security RE26. Security on a site. End to end security. Coding and ciphering information (encryption). Cryptography: secret key, public key encryption elliptical, public key certificates, DES, AES, IDEA, Two Fish, RSA. ISO standards for encryption DES (Data Encryption Standard).
Protection software (firewall).

Reliability RE27. Establishing reliable channels for remote sessions, virtual networks. Authentication: access code and confirmation of identity, digital signatures. Social engineering.

4.6 Systems Distribuidos²

4.6.1 Distributed Computing and programming

R28 distributed computing. Distributed computing models, analysis and design of distributed algorithms and fault tolerance in distributed systems.

R29 Mobile Computing. Spectrum allocation. GSM, GPRS, 3GSM, CDMA, CDMA2000, TDMA. Topologies, base station, mobile station. Environmental effects. Operating modes (infrastructure and ad-hoc). WAP, WEP. SIM and SMS. Programming on mobile devices. Interceptor client side, server-side interceptor. Lack of connection problems. Synchronization. Multimedia mobile devices.

R30 Programming Internet. HTML and XHTML. Creating Scripts (CGIs). Javascript. Control structures. Manipulating forms. PHP. Control structures. Text manipulation. Session variables. Creating pages and HTML code. Access databases. Authentication and encryption.

²Depending on the selected profile should be the emphasis should be given to these subjects.

R31 Middleware. IT intermediation systems. Layered architecture. Taxonomy middleware: Database, RPC and objects. Java, EJB, Corba and RMI. IIOP. Message queues. RPC and XML-RPC. ORB. DCOM. Distributed objects. Instantiation, serialization. Transactions. Distributed automation applications.

R32 Web Services. XML, WSDL, UDDI, SOAP. WS-Transaction. XML-Security, WS- Security. WS-Policy. JSON.

7.4.5 Software Base

Study, design and construction of the pieces of software that enable computers running on different operating levels. For its training and methodological importance, this area of knowledge is essential to the development of the industry of computer programs.

5.1 Translators

5.2 Operating Systems

5.3 Utilities and Handlers

5.1 Translators

Objective: To study the theory, techniques and methodologies for the design and construction of translators: assemblers, microprocessors, interpreters and compilers, presenting the main tools for automatic generation of translators. Highlight the formative importance of these issues.

5.1.1 Translators low level.

SB1 Assemblers (Macroassembler). An assembler function. Necessary information structures. Specific procedures for the assembly process. Past the source text. Tables previously constructed and tables generated in the assembly. Treatment of operands and addressing modes of the machine object. Assembler's residents and Crusaders. Conditional assembly and its relationship with the macroensamble.

SB2 Macroensambladores. Definition of macro instructions in assembler. Expansion macroinstructions. Macros with parameters. Conditional assembly. Macrollamadas (Macro-call). Macroassembler tables and steps. Relation to the assembler.

SB3 Macroprocesadores (macroprocessor). Macros: Definition and simple expansion, parametric, with nesting, etc. associated tables. Macro libraries. Conditional expansion. Variables and operators of the expansion process. Text last source (preprocessing).

5.1.2 Translators high level.

SB4 Interpreters. Concept and difference between interpreters and translators to object code. Pseudocode directly or through interpretation. Advantages and disadvantages. Conversational and Conversational no interpreters. Cost and efficiency ratio between interpretation and translation object code. Languages for specific applications capable or suitable for interpretation. Virtual machine emulators.

SB5 Compilers. Types of grammars. Formal Syntax Notation. Lexicographical analysis, symbol tables. Syntactic analysis. Parsing algorithms (parser) descending (LL) and ascending (LR). Code generation, intermediate codes. Optimization. Error detection and recovery. Generators of lexical analyzers. Generators compiler (compiler compiler).

SB6 Topics compilation. Complex problems in the treatment of algorithmic languages. Information structures and its implementation in memory. Static and dynamic variables. Dynamic memory management. Persistence. Blocks. Procedures, parameter passing, returns. Recursion. Activation records. Extensibility. Compilation techniques for object-oriented languages, functional, logical and distributed. Compilers for mobile devices.

SB7 integrated environments. Relations between the compiler and editor. Graphic interface. Communication with the user. Error handling. Interactive debugging. You aids. Editing, compilation, assembly and execution. Handling temporary files. Buffers in memory. Compilation cloud.

5.2 Operating Systems

Objective: To study the theory, techniques and methodologies for the design and construction of operating systems, with emphasis on each of its components: processor management, memory management, device management, and information management.

5.2.1 Basic structures.

SB8 History and evolution. Objective and general functions. Concept and evolution of operating systems. Internal structure. Need the operating system. Better use of hardware resources. Management. Design layered operating systems. Complexity of the operating system: the total computer system efficiency or inefficiency. Operating systems through generations of computers. Types of systems: single-user, multi-user, network server, real-time, special purpose and others. Design layered operating systems. Use and management of operating systems.

SB9 architecture of an operating system. Core: processes, states, transitions, semaphore operations, monitors, sequentiality, concurrency, cooperation. Parallelism. Interrupt handling: Types and levels of disruption. Main memory management: partitions, paging, segmentation, transformation address, relocation, special techniques. Handling inputs and outputs: codes, buffers, spooling (temporary storage memory and disk), efficiency, error detection, regardless of peripherals, special peripherals. Management Processor scheduling (programming). Secondary memory management: policies and management techniques. Management devices E/S: Types of

devices, Storage, Communication between devices. Information management: files, access types (sequential, direct), Levels, Data Compression. Control languages. GUIs.

SB10 performance of an operating system. Performance of an operating system: forms of measurement. Associated mathematical tools: queuing theory, probability calculus, Markov processes. Scheduling algorithms (programming).

SB11 handling devices and special services. Input/output. Configuration. Construction of drivers (device drivers).

Protection and security. Access, hierarchies. Communication between devices.

5.2.2 Types of operating systems.

SB12 special types of operating systems. Network operating systems. Distributed systems. Models of distributed processes. Real-time systems. Systems for parallel and concurrent processing. Multiprocessing systems. Operating systems for mobile computing.

SB13 virtualization. Server consolidation and support of high-availability applications. Terciado computer services (outsourcing). Models hosting services (hosting). The reasoning behind cloud computing. Cost models (according to the clouds available). Performance and telecommunications.

SB14 Hypervirtualización. Scenarios, planning tools and assembly of virtual environments.

SB15 graphics environments. Graphical interfaces: menus, icons, handling mouse. Windows. Multitasking environments. Simultaneous activation process. Intercommunication between processes.

5.3 Utilities and Handlers

Objective: To study the main categories and basic tools necessary for configuration, startup, efficient use and operation of computer systems.

5.3.1 User-oriented.

SB16 backup and recovery systems. Storage media. Compaction and descompactación. Frequency and reliability. Incremental backups. Retrieving information from media with physical damage. Tools for repair and recovery. . RAID systems. Backup in the cloud.

SB17 Monitoring. Security risks. Access Control (User Authentication). Confidentiality. Information integrity. Availability. System audit. Verification of threats.

SB18 virus treatment. Types of virus and transmission vehicles. Detection and eradication. File repair.

5.3.2 Oriented system.

SB19 Chargers and linkers. Types of chargers. Charging schemes. Relocation. Types of ligatures. The problem of linkage (binding). Address resolution and external references. Dynamic schemes.

SB20 Management and monitoring and tools. Scrapbooks. Detection of physical errors. Power suspensions management and service interruptions. Tools for starting and managing physical resources. Diagnostic tools. Restarting tasks. Restart points. Performance Analysis: paging space

usage, CPU load, memory usage, network errors, memory performance and virtual file system. Use of physical resources: memory managers to optimize disk space, for communications devices. Installation and Startup: definition of initial environments, systems for automatic installation, self-installation. Handlers for monitoring and diagnosis of physical devices.

SB21 High performance. Concepts and application areas. Parallel computing, distributed computing, scientific computing, Business. Cluster Concepts of "clusters" for processing and databases, practical implementation. Languages and compilers for high-performance computing. Distribution Grid computing and Cloud. Scheduling Tasks on distributed computing and load balancing.

7.4.6 Methodologies

Body of knowledge and skills, and set of methodologies for building good software programs and systems, considering their analysis and design, reliability, functionality, cost, safety, maintenance facilities and other related aspects.

6.1 Algorithmic

6.2 Programming paradigms and languages

6.3 Software Systems

6.4 Software Industry

6.1 Algorithmic

Objective: To study the design techniques needed to formulate and express computational algorithms, structuring efficiently chosen for the information representation. Achieve building programs correctly and methodologically. Study the theoretical concepts required to recognize those problems for which there is no practical algorithmic solution.

6.1.1 Fundamentals of algorithmic

PI1 History of Computing. Primitive forms of calculation and number systems. Boolean algebra. Background of computers. Generations and classification of computers. Technology changes. Evolution of languages, operating systems and other software components base. Processing types (single processors, concurrency, multiprocessing, parallel). Multimedia. Networks. Distributed computing and cooperative.

PI2 Algorithmic basic. Description of situations. Actions to solve a problem. Expressing actions and temporality. Representation of information: data. Stored program concept. Definition of algorithm and expression. Flowcharts. Pseudocode. Elements of an imperative programming language. Information and algorithmic control structures. Considerations methodology objects.

PI3 structured approach. Basic elements of an imperative language (procedural) programming: variables, simple types (integers, reals, characters, strings, logical) expressions, algorithmic control structures (if, case, while, repeat, for). Arrangements simple types. Segmentation programs. Scope of a memory variable: global and local variables; Procedures and Functions: parameters. Program documentation.

PI4 Approach objects. Object concept. Entities abstraction, abstraction of shares. Encapsulation of information. Abstract data types. Lessons. Hierarchy of entities. Heritage. Polymorphism, persistence. Communication between objects: messages. Programming languages objects and their variants.

PI5 visual approach. Concept of visual programming, visual programming paradigm, etc.

6.1.2 Data Structures

PI6 static structures in main memory. Information: types and values. Arrangements: homogeneity of information, statism in memory, access to elements. Applications. Search techniques, deletion, insertion and classification in one-dimensional and two-dimensional arrays. N-dimensional arrays. Records: heterogeneity of information. Access elements. Applications. Orthogonalization arrangements and records. Sets.

PI7 dynamic structures in main memory. Storage media. Dynamic memory. Pointers. Lists. Trees. Mathematical properties of trees. Tracking techniques, search, delete, and insert, others. Search and insertion trees, balanced trees, binary trees, trees B. Iterative Algorithms and recursive algorithms. Recursion and mathematical induction. Concept garbage collector (garbage collector). Orthogonalization types of information.

PI8 secondary structures in memory. Files. Physical characteristics and logical characteristics. Storage media. File organization types: sequential, sequential with indexes, keys, multiple keys. Relationship between storage media and organizations. Special information files: directories. Treatment of lists and trees in secondary memory. Access and information retrieval. Backup and information security.

PI9 File Organization. Types of files according to your organization. File operations. Pointers and indexes. Dispersion (Hashing). Inspection techniques. Files B and B +. Data recovery for multiple keys. Special techniques for concurrent access. Access attributes. Blockages (record blocking, file blocking). Additional structures for security protection bits, fields, headers, redundant information.

PI10 Classification. Related data structures. Classification methods and complexity considerations (time, space): the order of n^2 , the order of $n \log n$, etc. Comparative analysis. Design and construction of algorithms in memory (insertion, exchange or bubble, quicksort, mixing, topological sorting, etc.). Need for special methods outside the central memory.

PI11 search. Search methods, data structures and complexity considerations related. Comparative analysis. Design and construction of algorithms in memory (eg, linear, binary, tables of one or more dimensions, binary trees, hash. Collisions, etc.). Need for special methods outside the central memory.

PI12. Prediction. Measurement criteria. Software tools for measurements. Efficiency.

6.1.3 Complexity

PI13 complexity measures. Notation "O" and "or". Algorithms asymptotic behavior "in order". Polynomial time algorithms and exponential time. Algorithms feasible and not feasible. Lower and upper levels. Average value, worst case. Commitments space-time. Complexity classes P, NP, NP complete. Complexity in sorting and searching methods: times in binary trees, quicksort and others. Methods for finding approximate solutions to problems infeasible.

PI14 analysis algorithms. Iterative and recursive algorithms. Analysis of recursive algorithms: recurrence equations. Cost estimate.

PI15 Strategies for constructing algorithms. Selection criteria based on efficiency methods. Types of algorithms (greedy, "divide and conquer", backtrack, Local search, transformations, etc.): definition, examples, design (and implementation as appropriate), correctness, efficiency, complexity.

6.2 Paradigms of Programming Languages

Objective: To study the nature of programming languages considering the philosophy used to describe elements of reality. Explore ways and implementation characteristics processors languages. Analyze the evolution of programming languages and present and discuss future trends of development.

6.2.1 Families and types of languages.

PI16 imperative programming. Key features of the imperative paradigm. Program: Variable state (modifiable value) sequence sentence that change the state, routines and procedures. In order to perform the operations. Control patterns execution flow (sequence, and alternative cycle). Modeling reality through representations of information and a set of actions to perform. Reference languages. (See also PI2, PI3).

PI17 Object-oriented programming. Key elements of the object-oriented paradigm: abstraction, encapsulation, hierarchy. Modularity, typing, concurrency and persistence. Objects as entities that have a given state (attributes and values), behavior (methods) and identity. Polymorphism. Modeling reality through a set of interacting objects. Semantic distance between reality and model. Ease of understanding and changing the model. Patterns of behavior of objects. Linking them. (See also PI4).

PI18 Functional programming. History of functional programming. Fundamental characteristics. The revival of functional programming. Expression evaluation models in functional programming (lazy evaluation - Lazy evaluation). Absence of variables and assignment. Abstraction. Expressions. Lists. Recursion. Higher-order functions. Lambda calculus. Referential transparency. Computing model replacement. Criminalization of functional languages: strong dynamic, static and dynamic. Representative languages: Lisp, Scheme, Clojure, Haskell, Ocaml and Standard ML, among others.

PI19 Programming logic. Horn clauses. Variables, facts and rules. Logic programming as a paradigm for specifications; specification languages, generalized relational databases, mechanisms deduction. Efficiency parameters. Prolog language, etc.

PI20 Visual programming and events. Principles: Main components graphics (icons, buttons, frames, menus, windows). Events produced by the user. Combination of algorithmic paradigm and visual elements. Event management and communication with the user's environment.

PI21 comparison of languages. History of programming languages. Comparative analysis of different languages. Analysis of the different paradigms and their representative languages. Applicability for different types of problems. Styles. Efficiency. Advantages and disadvantages of programming imperative, object-oriented, functional and logic. Implementations of languages.

6.2.2 Parallelism and concurrency.

PI22 Relations between algorithms and architectures. Sequencing and concurrency. Very high performance computers for meteorological calculations, aerodynamics, remote sensing, etc. Special Architectures for parallelism: instruction execution overlap, overlap in data handling, arrays of processors. Correspondence between architecture and algorithms: algorithms oriented special hardware features. Computers SIMD, MIMD and others. Parallel computing.

PI23 concurrent algorithms. Uniprocessor architecture: sequencing and concurrency. Simulation of parallel execution by concurrency. Communication: synchronization, information sharing, channels and messages, protocols. Deadlocks. Real time. Components of operating systems for interrupt handling and care of peripherals. Multiprocessor architecture: concurrency.

PI24 Parallelism. Parallel programming algorithms: for arrays of processors for computers SIMD, MIMD computer. Shared variables, messages. Parallel algorithms for classification methods for matrix manipulation and numerical methods: ideas about the design and construction complexity.

6.3 Software Systems

Objective: To present the different philosophies, concepts, methodologies and techniques used for the construction of large software systems, considering their analysis, specification, design, programming, documentation, monitoring and evaluation. Provide elements to achieve modular and capable of being performed by development group's designs.

6.3.1 Analysis and design.

PI25 General Concepts about systems. Concepts of general systems theory, concept of business processes, definition of systems. Nature of the systems. Reasons and criteria for automation systems. Information systems in organizations. Lifecycle: requirements, analysis, design, development or construction, implementation and testing, release. Risks, time planning, monitoring and control. Estimated overall cost and development time.

PI26 System analysis. Identification of needs. Establishment of business model. Requirements specification. Tools for analysis. Feasibility, economic analysis, technical analysis, operational and legal analysis. Importance of the analysis phase Impact of failures due to errors in the analysis: cost. Risk analysis: Identification, mitigation, contingency.

PI27 Methodologies for analysis. General principles: conventions, standards, no duplication or multiplication of work. Seeking of requirements. Questionnaires, interviews. Modeling: tools, analysis and validation of requirements. Methods of structured analysis: data flow diagram, data dictionary, entity relationship diagrams, state transition diagrams. Object-oriented methods (Rumbaugh, Booch et al) analysis. Notation for process documentation. Audits.

PI28 system design. Design Basics: abstraction, refinement, modularity, hierarchies. Importance of the design phase. Impact of design errors according to the time of detection: costs. Segmentation design: work teams. Relationships and hierarchies. Analysis and design data-driven (Warnier-Orr). Analysis and design-led functions. Object-oriented design-oriented aspects, design and software architecture design. Styles of architecture, programming design patterns.

PI29 design methodologies. Dialogue with the user. Ratification of the stages of design. Special methods for descending and ascending structured design verification. Jackson methodologies, Yourdon, Warnier-Orr diagrams. Methods of object-oriented design. Principles of object-oriented design: abstraction, information hiding, modularity. Design objects: attributes, operations and messages. Audit.

PI30 Service-oriented architecture. Service concept. Service orientation. Service-oriented architecture (SOA). Best practices and certifications. Information Technology Infrastructure Library (ITIL). Service level agreements. Management capabilities and availability. Incident Management.

6.3.2 Implementation, Testing and Maintenance

PI31 Lifecycle systems. Models for life cycle: analysis-design-development; construction-implementation; test-release and spiral-waterfall. Segmentation and modality. Criteria and connection elements between the parties. Dialogue with the user throughout the life cycle. Preparation user to use the system and to formulate requirements update.

PI32 Estimate. Effort estimation. Time and personnel. Function points. Methods based on use cases. Experts estimate based on. Nonlinearity in exchange of time against staff. Estimation models.

PI33 Agile design methodologies. And manifest principles of agile development. Specific agile methodologies: Extreme programming, Scrum, Adaptive Software Development (ASD), Agile Unified Process (AUP), Crystal Clear, Feature Driven Development (FDD), Lean Software Development (LSD), Kanban, Open Unified Process (OpenUP), Method development of dynamic systems (DSDM).

PI34 Control the progress of software projects. Control of project progress regarding the scheduled scheduling. Types of delays and analysis of its causes: lack of specifications, poor specifications, errors in earlier stages and others. Detection and correction of faults: Feedback. Network tasks, PERT and CPM methods.

PI35 Test methods. Test strategies: verification and validation. Unit tests. Integration testing. Compliance with specifications. Special controls. Robustness. Error detection and correction: debugging. Security. Audit.

PI36 Maintenance and extensions. Definition of maintenance. Relevant factors. Preventive Maintenance. Reverse engineering and reengineering. Corrective maintenance. Adaptations. Extensions of the operation. The importance of documentation for maintenance. Costs.

6.3.3 Quality Considerations

PI37 Rules, standards and documentation. Normativity of forms, methods, methodology and working procedures. Definition and adoption of standards. Division of Labour. Documentation of processes and procedures. Partial and final documentation. Documentation for the end user.

PI38 Software quality control. Methodologies for error detection. Impact of errors on the total cost. Functions and metrics of cost growth. Factors product quality: accuracy, reliability, efficiency, ease of use, testing and maintenance, adaptability and flexibility, portability, reuse, completeness, ease of audit. Process quality: ISO9001 models, 115504, Moprosoft, CMM, CMMI, etc.

PI39 Quantitative measurement of quality. Measurements. Metrics. Measurement methods. Indicators. Criteria of acceptance.

PI40 Audit systems. Documentation and monitoring standards. Inputs and outputs. Processes. Development methodologies. Files: protection, access. Rights of the computer unit staff and users. Confidentiality systems. Cost-benefit analysis of the systems. Integrated systems in isolated environments and networked PC. Reviews of integrity, consistency, confidentiality and security of information. Evaluation of construction and maintenance of the systems. Contingency plans. Audit firms.

6.4 Software Industry

Objective: To present the different elements involved in creating software products from the perspective of industrial development, including aspects of efficiency of process creation, use of automated development tools, robustness, adaptability, cost analysis and times and marketing, among others. Knowing the structure of the software industry Mexico, the good practices of the software industry, vocations industry and employment of software development roles.

6.4.1 Industrial development software.

PI41 Evolution software development. History: arts and crafts, reliability, permanent crisis of software, costs related hardware-software cost. Costs errors. Software development paradigms: classical or sequential (life cycle), new or progressive (spiral model: management planning formal risk analysis, engineering and customer service). Conceptual engineering comparisons with other engineering software. Engineering object-oriented software. Participation recipient of software product development.

PI42 evolution of the software industry in Mexico. Pioneers in development in Mexico. Vocations software industry in Mexico. Prosoft initiative. Entrepreneurship support programs software in Mexico. The industry certification: MoProSoft, CMMI. Foreign industry in Mexico. Professional certification in Mexico.

PI43 Characteristics of industrial software products. Generation of standardized and reusable components. market-oriented production. Niches. "Packaging". Software Standards in the design and construction of software. Building blocks: the use of previously developed components. Regulations to control project progress and quality. Robustness of the products. Configuration and production variations. Product specifications.

6.4.2 Building automation software.

PI44 Industrial methods for creating software. Incremental development. User interaction: shows the progress and feedback. Prototyping and experimentation. Running prototypes for simulation: reports, views and ways of use. Graphics editor. Fourth generation languages. Object-oriented methodologies. Scaling factors in the production of software. Basic principles: the importance of the development process, teams and division of labor, coordination.

PI45 Tools for creating software. Tools for project management. Tools for prototyping, simulation executions and for the rapid production of reports. Programming Tools: conventional languages, graphic editors, fourth generation languages, automatic code generators. Object-oriented tools. Tools for integration, reverse engineering and reengineering. Integration and automation tools: environments CASE (Computer Aided Software Engineering); present state, trends and developments. CASE products on the market.

7.4.7 Treatment of Information

Area of knowledge in which a multiplicity of computational topics of theory, technique and methodology required for the construction of a wide range of information solutions, essential for the proper functioning of all types of organizations is conjugated.

- 7.1 Databases.
- 7.2 Information Retrieval.
- 7.3 Information Systems.
- 7.4 Architecture of information technologies

7.1 Databases

Objective: To study the principles of data bases and their different models. Providing the knowledge necessary for the design and implementation of database systems, considering aspects of analysis, logical and physical organization, determining the appropriate model, as well as selection and application of appropriate tools.

7.1.1 Modeling and design.

TI1 General Concepts. Defining a data base. Elements of a system database. Goals. Consistency. Sharing. Rules. Security restrictions. Integrity. Centralized control and distributed control. Database management. Data abstraction. Users of the database. Manager database.

TI2 The hierarchical model. Structure. Parent-child relationships. Outline Properties. Trees. Storage structure. Types of access. Integrity and security model. complete definition of a hierarchical database.

TI3 The network model. Structure. Records. And data fields. Types and occurrences of sets. Limiting membership (insertion, retention and management).

Representations of occurrences. Singular set. Set multiple members. Recursive in September.

TI4 The relational model. Basic concepts. Domains, attributes, tuples, relationships, attributes key, foreign keys. Relational algebra. Operations. Relational calculus, View. Scheme relational database. Uniqueness rule. Referential integrity rule. Standardization. Dimensional model.

TI5 Entity-relationship model. Attributes and entities. Values and attribute domains. Types of entities. Key attributes. Relationship Types. Instances of relationships. Structural constraints. Weak entity. Diagrammatic representation model. Generalization and specialization. Aggregation. Conversion tables diagrams.

TI6 Relational design. Requirements and analysis. Conceptual design. Conceptual scheme. Design logical. Physical design and implementation. Redundancy problems. Nulls. Functional dependencies. Inference rules. Normal forms: first, second, third, interpretation of the third normal form, Boyce-Codd Normal Form. Standardization process. Decomposition algorithms. Other types of dependencies and normal forms. Multivalued dependencies.

TI7 Alternative models. Object-oriented model: abstract data types, inheritance, object identity, data modeling and design strategies, persistence, special access methods, safety considerations. Heterogeneous databases: technology for interoperability, diagrams, renaming, consultation, conflict resolution, global query optimization. Documentary Model, entity-attribute-value model star, graph model, post-relational models, model multivalued.

TI8 Distributed databases. Concurrency process. Structure and design: autonomy, dependence and cooperation functions and modules, fragmentation. Transparency of use. Problems of distributed systems: query processing, updating, retrieval. Distributed Communications: locks, link servers, payment concurrency control. Management deadlocks and falls. Replication. Clusters database (Oracle, MySQL, and Postgres). Trends: data warehousing, data mining, data marts and cubes of information. Big data. Cloud Computing.

7.1.2 Handlers and use.

TI9 Handlers. Characterization model type and internal structure. Capabilities. Security. Installation Considerations. Interfaces for data reception. Interactions with the environment. Use.

TI10 Query languages. Types of languages. Possibilities. Interactive languages. SQL: basic concepts, data definition, query and update: structures data definition (DDL), data structures manipulation (DML), control structures (DCL), management views, SQL embedded. Programming languages (4GL). Relationship with other languages and environments.

TI11 Architecture of database systems. Logical data independence. Physical data independence. Internal, conceptual and external levels of architecture. Data definition language. Data dictionaries.

Data manipulation language. Interfaces. You utilities.

7.1.3 Development and implementation of applications.

TI12 Basics. Functions of the data definition language. Functions of data manipulation language. Languages handling hierarchical data models, network and relational.

TI13 File Handling. Record storage and file organization. Secondary storage devices. Pointers. Types of records and blocks. Storage structure of various models. (See also PI8).

TI14 Safety databases. Aspects of security and integrity. Protection databases. Access protection. Encryption algorithms. Audit databases. Privileges and authorizations. Specifying restrictions. Restrictions on transactions. Validations.

7.2 Information Retrieval

Objective: To provide the theoretical elements required for handling large volumes of information, which includes the study of the characteristic aspects of hardware and software necessary for efficient processing.

7.2.1 Information Storage Devices.

TI15 devices. Special hardware depending on the model. Magnetic disks: structure, organization, access. Basic functions of reading and writing. Optical Drives: CD-ROM, interactive CD. Magnetic tapes and cartridges: formats, labels, records, bloqueaje factors. (See also AC16).

7.2.2 Files for large volumes of data.

TI16 Methods. Auxiliary data structures for organizing information: repositories, data dictionaries, directories, hypertext structures.

Selection of methods depending on the volume of data. Complexity. Optimization. Transaction processing. Concurrency transaction.

TI17 Security. Protection and recovery in case of failures. Hierarchies users. Access rights. And enciframiento coding methods. Coding algorithms.

7.3 Systems information³

Objective. Study and apply the different theories, techniques and methodologies for analysis and design conception and understanding of information management systems, in order to model the real environment situations, solve problems and optimize decision-making.

7.3.1 System Theory.

TI18 Basics of systems theory. Historical, semantic contribution, concepts, methodological contribution, trends in practical application.

³**Note.** Depending on the selected profile, should be the emphasis to be given to issues of 7.3.2 Analysis, design and development of systems and oriented programming information systems. Modality. Test design: stages integration. Determination of guidelines and regulations for developed.

TI19 Systems approach. The classic approach: reductionism, analytical thinking, mechanisms; the systemic approach: expansionism, synthetic thinking, and teleology. Computer systems as part of an overall system. The system and its environment.

TI20 System types: natural system, cyber, open and closed system, stationary and non-stationary systems, hard and soft systems, concrete systems and abstract systems. Element of a system.

TI21 Quality control. Meaning. Techniques. Control inputs and outputs of the system. Feedback. Statistic analysis. Guarantee. Reliability.

7.3.2 Analysis and design of information systems.

TI22 Analysis and design. Interaction with potential users. Requirements specification. Analysis methodologies and systems design: Yourdon, Warnier, functional, by objects. Documentation. (See also Section 6.3.1).

7.3.3 Development and implementation.

TI23 Development. Evaluation and selection of appropriate development tools: CASE tools, fifth-generation languages. Languages.

TI24 Implementation. Implementation planning. Critical stages. Development of user manuals. Testing and acceptance criteria. Feedback. Training methods. Release system.

7.3.4 Management information systems.

TI25 Organization and administration. The role of information resources. Resource allocation. Evaluation of alternative hardware and software. Personnel management systems. Attention users. Information centers. The department of information systems. (See also section 1.2). Security and control of information systems.

TI26 Business Applications. Accounting systems and enterprise resource management (ERP). Customer relationship management (CRM) and supply chain (SCM). Handlers enterprise content and training (CMS, LMS, LCMS), Decision Support System (DSS), Executive Information Systems (EIS). Management of business processes and workflow (BPM, Workflow). Workgroups (Groupware). Knowledge Management (Digital libraries and others). Electronic payments. Systems for electronic commerce.

7.4 Information Technology Architecture

7.4.1 Enterprise IT architectures.

TI27 Enterprise service-oriented architectures (SOA). Identification, analysis and design of business services. Integration models. Planning, management, subcontracting, policies and SOA lifecycle. Business process management. Government (governance) and architecture.

7.4.2 Design of IT environments.

TI28 Distributed systems against computer networks. Concepts computing load. Performance measurement. Interaction of network protocols and computer equipment. Types of delays. Service

times and basic theory of rows laws. Capacity planning. System-level modeling, component and servers. Grid architectures and clusters. Load balancing. Availability, reliability, fault resistance, scalability and performance.

7.4.8 Human Computer Interaction

Study of application domains leading to achieve higher forms of expression and interaction between man and computer, in order to find better and innovative ways of integrating technology in society.

- 8.1 Computer graphics
- 8.2 Artificial Intelligence
- 8.3 Human-Computer Interaction

8.1 Computer Graphics

Objective: To study the principles and methodologies necessary for representation, manipulation and display of figures and images in two and three dimensions, considering hardware devices with specific features for graphing processes.

8.1.1 Devices.

IH1 Input Devices. Keyboards, optical readers, audio systems, video cameras, sensors, microphones, etc. Output Devices: Monitors, Printers, Plotters, audio systems, etc. Input / Output (Mixed): storage units (magnetic disks, flash drives, CDs), touch screens, etc. Devices Virtual or Augmented Reality: helmets, goggles, gloves, etc. Processing devices: graphics acceleration cards.

8.1.2 Algorithms.

IH2 Programming Techniques. Representation, manipulation and display of objects of two and three dimensions. Representation of primitive objects (lines, curves, surfaces) and composite objects. Transformations in two and three dimensions (translation, rotation, scaling). Hidden lines and surfaces. Shading and coloring. Interactive graphics and user interface. Animation techniques.

8.1.3 Dedicated software.

IH3 products. Classification and scope as functions. General and distinguishing features. Desktop publishing: miscellaneous Facilities drawing, graphing, incorporating text, design, flowcharts, organizational charts, graphic effects, animation, incorporating sound, image manipulation, photo, filters, scriptwriting. Game Development. Virtual environments and augmented reality. Desktop publishing (Desktop Publishing).

8.2 Artificial Intelligence

Objective: To study the theory and heuristic methods required for modeling and solving difficult situations to express algorithmically. Apply the above programs in the development of expert systems and special purpose systems.

8.2.1 Methods IA.

IH4 Logic and problem solving. Inference using modus ponens. Horn clauses. The resolution rule. Backward chaining. Normal forms. Unification. Games. Heuristic searches. Minimax method. Tree representation. Planning. Treatment and representation of ambiguity. Probability and Bayesian approach. Fuzzy logic (fuzzy logic).

IH5 Search. Searches width and depth. Iterative deepening and enlargement. Searches in degrees. Open and closed lists. Backspace (backtracking) dynamic. Heuristic searches. Searches adversaries.

IH6 Special languages. Basic routines, data structures and control. Examples of languages: Lisp, Prolog, Planner, SAIL, Scheme and Strips.

8.2.2 Knowledge representation.

IH7 Learning. Representation structures. Search and control. Adaptive and self-modifying programs. Quasi-intelligent behavior. Games and strategies.

IH8 Deduction. Mechanisms for realization of deductive inference: handling or application of general rules to specific instances, proving theorems, deductive methods to answer questions, inference methods for planning, problem solving, non-monotonic, modal and intentional logic.

IH9 Neural Networks. Parallel distributed models and process. Classification and pattern recognition: representation space and Bayesian classifiers. Simple Perceptron. Multilayer networks. Backpropagation. Hopfield networks. Optimization problems. Boltzmann machines.

8.2.3. Expert systems

IH10 Characterization of expert systems. Basic concepts and structures. Functioning. Domain and limitations. Knowledge representation: theoretical, semantic networks, scripts, lists and trees, production rules, frames

IH11 Reasoning and control. Categories reasoning. Productions systems. Chainback and forward. Tree inference. Associative networks and systems frameworks. Reasoning based on models and cases. Explanation and metacognition.

8.2.4 Recognition of ways.

IH12 Vision. Digital imaging and computer processing. Low-level processing. Fourier Transforms: discrete, two-dimensional, fast. Noise removal. Feature detection. Transformations. Segmentation. Three-dimensional information recovery. Pattern recognition.

IH13 Robotics. Current Panorama. Robotics technology. Actions and ultimate effects. Sensory perception. Robot control and intelligence. Determination of autonomy and navigation. Triangulation, autonomy at the time of flight. Positioning and perception of proximity.

8.2.5 Natural Language Processing

IH14 elements for the syntactic and semantic process. Computational models for natural language. Knowledge and language. Techniques for recognition of syntactic structures and management of ambiguity. Formalisms used. Relative clauses. Basic operations for semantic interpretation. Embedded and not embedded sentences. Hierarchies in the rules. Problem of semantic interpretation strategies.

8.3 Human-Computer Interaction

Objective: To study the concepts, physical elements and design and programming techniques to achieve smooth communication using multiple media.

8.3.1 Key aspects in building interfaces.

IH15 development process. Usability: guidelines and principles. Methodologies. User representation models and needs. Prototyping. Orchestration techniques and principles, transparency and interaction. Usability evaluation: techniques and instruments. Software tools for the construction of interfaces.

IH16 interaction styles. Direct manipulation and virtual environments. Menus, forms and dialog boxes. And natural language commands. Interaction devices. Features of execution platforms. Collaboration: synchronous and asynchronous.

IH17 Design principles. Quality: response times, productivity, expectation, adaptability. Dialogue not anthropomorphic. Metaphors. Interface design: controls, windows, color, typography and multimedia. Documentation and online help.