



INSTITUTO POLITÉCNICO NACIONAL
ESCUELA SUPERIOR DE CÓMPUTO
 SUBDIRECCIÓN ACADÉMICA
 DEPARTAMENTO DE INNOVACIÓN EDUCATIVA
 INGENIERÍA EN SISTEMAS COMPUTACIONALES
 PLAN 2003 ESPECIALIDAD SISTEMAS



The curriculum of Ingeniería en Sistemas Computacionales consists of 8 semesters. There is no explicit serialization. From the second semester, to study each semester, all courses from previous semesters must be completed.

1st. Semester	
SUBJECT	OBJECTIVE
Calculus I	The student will apply the concept of limit and various techniques for solving differential and integral calculus of real functions of a real variable.
Computers and Society	The student will be able to identify the role of the Computer Systems Engineer in society and distinguish its relationship with other professionals, the scientific, technical and social needs and their interrelationship.
Discrete mathematics	The student will apply main discrete algebraic structures for solving computer science problems.
Programming I	The student will develop computer programs in C language, using algorithmics and logics.
Vector Analysis	The student will understand the formalism of vector analysis to use it operationally. This way he will solve problems with scalar functions and vector fields in situations required by subsequent courses in the curriculum.
Physics	The student will apply the basic concepts of kinematics and dynamics of the magnitudes of the electromagnetic interactions between systems of charged particles and the laws of electromagnetism, to the solution of problems related to particles and oscillating movements. It will link the knowledge gained in the classroom to real physical phenomena that occur both in nature and in technological developments.

2nd. Semester	
SUBJECT	OBJECTIVE
Linear algebra	The student will compute systems of linear equations in n unknowns, analyze properties and basic operations of vectors in the xy plane, in real space and generalized vector spaces.
Calculus II	The student will apply techniques of integration and series in solving engineering problems.
Differential Equations	The student will formulate differential equations models, engineering problems, in particular problems of the theory of electrical and electronic circuits.
Programming II	The student will analyze the main algorithms used for basic numerical techniques, wich are to be programmed to apply their knowledge in the use of the C language and thus implementing algorithms.
Electric Circuits	The student will analyze circuits RL, RC and RLC, biased with direct and alternating current, using instruments, measurement simulators and measurement and circuit simulators (EWB and PSPICE); and he will perform the measurement of the main electrical parameters.



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Oral and Written Communication	The student will express oral and produce speeches by applying the theory and practice of communication principles.
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3rd. Semester	
SUBJECT	OBJECTIVE
Software Engineering I	The student will analyze the process that involves the engineering of software in its central part, and the development and implementation of a computer system.
Programming III	The student will analyze the data structures which are required to achieve the optimal use of computer resources, and will apply programming techniques to write useful and portable programs, that implement and manage these structures.
Probability and Statistics	Students will analyze mathematically random problems and their results as an element of judgment in the decision-making process on the problems to be treated.
Administrative Process	The student will explain the importance and need of management in a changing and globalized economic and social field; also will apply the various stages of the management process (planning, organization, direction and control) in a practical field and workplace.
Analog Electronics	At the end of the course students will design electronic circuits based on bipolar, unipolar and optical devices, through the use of different electronic components and manuals with electrical specifications of these electronic circuits.
Digital Electronics	The student will establish the basis for the understanding and design of digital systems.

4th. Semestre	
SUBJECT	OBJECTIVE
Database I	The student will analyze the definitions, concepts and theory in which current databases management systems are based, and methodologies for designing and implementing relational databases.
Economy	The student will analyze the economic systems , as well as national and international economy in order to identify the elements involved in it and the micro and macro behavior of companies, institutions and social groups as well as the interrelationship between the elements.
Operating Systems I	The student will analyze the algorithms, hardware-software relationships, hardware-software limitations, main orientation of common operating systems, parameterization of common operating systems, and will design modules of an operating system, using design work for the construction of a computer system.



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Software Engineering II	The student will analyze the process that involves software engineering in the construction of an information system, using object-oriented methodology.
Introduction to Microprocessors and Microcontrollers	The student will analyze the performance of microprocessors, microcontrollers and basic architectures of digital systems. Also he will design basic assembly language programs for the computing and control of the main interfaces input / output, general purpose.
Digital Communications	The student will discuss the theoretical basis of the transmission of electrical signals in communication systems and learn the basic concepts of information theory.

5th. Semester	
SUBJECT	OBJECTIVE
Finance	The student will analyze the financial structure of the companies, describing its operation and financial reasons for achieving financial both goals, nationally and internationally, assessing the economic and financial relationships, which are presented to analyze the financial status of the production units and accordingly take decisions on the planning and control of finance, and the development of new investment projects.
Object Oriented Programming I	The student will design a software application using object-oriented language C++.
Computer Networks I	The student will analyze the essential functions performed by computer networks, particularly its communication protocols, the architectures used to construct of such networks, the technologies currently used in its main applications, and software and hardware tools available to configure and evaluate its behavior.
Data Acquisition	The student will describe some of the different systems of analog to digital conversion and the basics of digital signal processing.
Databases II	The student will apply the techniques of query optimization, data processes and security recovery used in relational databases
Operating Systems II	The student will apply knowledge of the use and operation of distributed operating systems and distributed computing in general, so he can build applications in a distributed computing environment.

6th. Semester	
SUBJECT	OBJECTIVE
Artificial Intelligence	The student will relate the basic concepts of artificial intelligence and problem-solving techniques.
Computer Networks II	The student will analyze the TCP/IP network protocol architecture and the principles underlying emerging network technologies and will create computer programs with this architecture using the sockets programming interface.



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Project Generation and Evaluation	The student will select the different tools to generate and evaluate investment projects, applying criteria under certainty and risk conditions for growth of businesses, in which he will develop professionally, and thus, he will be able to support the decisions of senior management and its expansion plans.
Compilers	The student will analyze the possibilities offered by a compiler to take advantage of their full potential. Also, he will build and evaluate a compiler, with tools such as LEX and YACC.
Object Oriented Programming II	The student will design a software tool using the Java object-oriented language, which allows to apply all the knowledge acquired during the course.
Visual programming	The student will develop fully functional programs using visual tools.

7th. Semester	
SUBJECT	OBJECTIVE
Final Project I	The student will apply the theoretical, practical and methodological knowledge acquired in the subjects of the curricula to solve a computing engineering problem. It will also test the percentage of his final project in compliance with the schedule of activities contained in the format named protocol of its final project registered and approved by the Academic Committee of Works Terminals (CATT) ESCOM.
Operations Research	The student will apply the methodological tools of Operations Research (OR) to solve problems relating to their area and workplace.
Technical Systems Development	The student will evaluate CASE tools that support specialized techniques and methodologies for developing appropriate systems to the real context of business.
Elective I	The student will take two electives that support the realization of its final project.
Elective II	

Elective 7th. Semester	
SUBJECT	OBJECTIVE
Computer Architecture	The student will design systems with the most popular RISC processors, in order to solve problems feasibly of a digital solution, and analyze the cost / performance of computer architecture relationship.
Multimedia Algorithms and Programming I	The student will design competitive Web sites that allow interactivity between the server and the user, leveraging technology to provide the multimedia systems.
Application of Microcontrollers	Students will apply advanced programming of microcontrollers with the latest technology to monitor programs handled by these devices. These programs could be interfaced by the PC, manage power devices, or perform data acquisition in their environment.



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Distributed Databases I	The student will develop an information system for a distributed database, and a database using the object-oriented model.
Computing Law fundamentals I	The student will analyze the current and positive legal regulations involved in the protection of intellectual works in the field of hardware and software, as creators and under the circumstances of being and independent professional services provider.
Web Applications Development I	The student will evaluate the basic languages for designing and maintaining applications for the WWW services.
Computer Graphics I	The student will analyze the techniques used in the theory of computer graphics by checking them with computer software designed by him.
Advanced Instrumentation I	The student will describe the most important aspects of industrial instrumentation, digital instrumentation and robot instrumentation. He will also use the most common buses for monitoring and controlling variables in instrumentation systems.
Advanced Artificial Intelligence I	The student will evaluate the main techniques of design and construction of expert systems and test programs that solve problems through inference algorithms (based on first-order logic) as well as reasoning from uncertain and/or inaccurate information.
Digital Signal Processors I	At the end of the course the student will describe the operation of processors dedicated to digital signal processing and the architecture of the systems based on these components. He will present solutions in areas such as voice and video processing (analysis and synthesis).
Signal Processing I	At the end of the course students will implement digital systems for signal processing applied to the field of digital communications signals. He will also pose the basis of speech processing and image processing for both analysis and synthesis.
Advanced Programming I	The student will apply the basic knowledge of graph theory and set theory and its implementation in programming languages like C + +, programming to solve programming problems. He will develop problem-solving models that represent problems and their possible solution.
Systems Programming I	The student will evaluate administrative and security problems in a system under UNIX platform.
Artificial Neural Networks I	At the end of the course students will apply neural structures and algorithms in the design of neural network technology-based systems to solve engineering problems of pattern recognition, signal processing and control systems.
Robotics I	At the end of the course the student will describe the basic theory to control robots, implement control laws and build basic prototype robots.



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Network Security and Cryptography	After completing the course the student will understand the basic concepts of network security and most used cryptographic techniques, and the mathematical theory behind them. Also, he know in detail some of the protocols for secure network communications currently in use.
Advanced Electronic Systems I	Students will apply advanced programming of microcontrollers with the latest technology to monitor programs supervised by these devices. These programs can interface with PC, manage power devices or perform data acquisition and its environment.
Neuro-fuzzy Systems I	At the end of the course students will solve engineering problems related to pattern recognition, robotics and intelligent control using the basic concepts of intelligent systems based on neuro-fuzzy systems and applying artificial neural networks and fuzzy logic.
Digital Image Processing	At the end of the course students will solve problems related to digital image processing. They will also develop a computational application from the basics of digital image processing.

8th. Semester	
SUBJECT	OBJECTIVE
Final Project II	The student will develop an engineering assignment from computing systems to show competency for professional practice. The student will fulfill the work program, objectives and goals of the protocol proposed by enrolling Final Project I course work, previous to this subject.
Data center Administration	The student will evaluate the administrative and legal elements, as well as those ethical values required for the administration of an area of computing.
Elective III	The student will take two electives that support the realization of its Final Project.
Elective IV	

Elective 8th. Semester	
SUBJECT	OBJECTIVE
Algorithmics and Multimedia Programming II	The student will develop programming applications for websites, using typical Internet algorithms that are used in the construction of Multimedia Systems.
Distributed Database II	The student will evaluate the problems and solutions that exist in the areas of concurrency control, recovery and security distributed databases and analyze the transformation of a query to a database referred by the teacher and the optimal representation of the same.



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Quality and Productivity	At the end of the course students will implement systems quality assurance in all types of organizations, to achieve continuous improvement in productivity, applying: principles, strategies, techniques and tools of Quality Management.
Web Application Development II	The student will evaluate advanced languages for designing and editing applications for the Web.
Computer Graphics II	The student will design three-dimensional objects using advanced computer and animation techniques.
Advanced Instrumentation II	At the end of the course students will design a data acquisition system based on an electronic board and its graphical interface.
Advanced Artificial Intelligence II	Students will develop programs that interact with people using natural language, as well as programs for processing the semantic content of texts.
Signal Processing II	At the end of the course students will implement signal processing digital systems applied to the field of digital communications. they will also pose the basis of speech processing and image processing for both analysis and synthesis.
Advanced Programming II	The student will evaluate the application of the appropriate paradigm to solve the various problems that arise in programming
Systems Programming II	The student will configure the UNIX operating system according to the user requirements.
Image Recognition	The student will evaluate the design tools for solving problems related to computer vision, with an overview of the basis of TDI, developing a computational application.
Artificial Neural Networks II	At the end of the course students will design model-based and advanced algorithm-based computer systems to solve recognition of visual, acoustic focused problems as well as solving optimization problems and data compression problems.
Robotics II	Upon completion of the course, students will build basic prototype robot manipulators, applying the basic theory of robot control
Advanced Electronic Systems II	Students will apply advanced programming of programmable logic devices, in this case FPGAS with cutting edge technology to develop all structural subsystems of modern microprocessors with RISC and CISC architecture.
Neuro-fuzzy Systems II	The student will analyze the basic concepts of intelligent systems based on the neuro-fuzzy systems, they will also apply artificial neural networks techniques and fuzzy logic, and solve engineering problems related to pattern recognition, robotics and intelligent control.
Leadership	The student will analyze personal, social, political, economic and historical aspects ranking in the field of humanistic leadership to apply the principles in their personal and professional development.