Casa abierta al tiempo

UNIVERSIDAD AUTÓNOMA METROPOLITANA

CUAJIMALPA CAMPUS
Natural Sciences and Engineering Division

Bachelor of Science in Computer Engineering
Degree: Computer Engineer

CURRICULUM

I. GENERAL OBJECTIVE

To form professionals specialist in the design and implementation of solutions based on computer systems, who are able to identify and solve, with a comprehensive perspective, the information management problems that are relevant to the society. These professionals will be responsible for the systematic application of the software development process methodologies and for the operation and maintenance of computer systems. Furthermore, they will know their environment for acting with social responsibility and ethical compromise.

II. SPECIFIC OBJECTIVES

To form professionals who have an ethical attitude in the application of their knowledge and in their professional practice, that commits them to the transformation of society and the search for the common good. Furthermore, they will be able to:

1) Identify, analyze and solve, with a comprehensive view, the social problems that emerge in the field of information management.
2) Develop software systems under different methodologies, paradigms, languages and programming tools.
3) Apply the quality standards for building software systems.
4) Integrate the requirements imposed by the hardware for building software systems.
5) Propose solutions based on computer technology that allow information management in an efficient form, the application of software development process methodologies, and the operation and maintenance of computer systems.
6) Apply, in a responsible and systematic manner, the software development process methodologies and the operation and maintenance of computer systems.

III. ADMISSION AND GRADUATE PROFILES

1. ADMISSION PROFILE

The Bachelor of Science in Computer Engineering is aimed at prospective students who have an interest in computer systems, with ability in mathematics, and logical and inductive reasoning skills in the problem-solving process, who have discipline for studying and working, with the capability to express and transmit their ideas clearly and precisely, that are innovative and creative, and that have initiative for decision making.

It is important that the applicant:

Likes:

- Solving problems that involve the use of mathematics.
- Searching for technological solutions.
- Collaborating and communicating with other professionals.

Is interested in:

- Creating computer programs and for other computing devices.
- Leading and developing large-scale software projects.
- The natural sciences (biology, physics, mathematics, etc.) and engineering.

Demonstrates readiness to:

- Dedicate to perform academic activities out of the classroom.
- Work in interdisciplinary teams to develop projects.
- Acquire the knowledge of a second language.

2. GRADUATE PROFILE

Upon completion of the curriculum, graduates of the Bachelor of Science in Computer Engineering will have the necessary preparation to lead a team capable of successfully completing a project based on computer systems, which constitutes an innovative and comprehensive solution to information management problems relevant to the society, considering interdisciplinary aspects. Furthermore, their preparation will allow them to stay updated, carry out graduate studies, and immerse in the field of research.

The graduate of the Bachelor of Science in Computer Engineering will:

Have knowledge about:

- Computer systems analysis, design and programming.
- Programming paradigms, languages, and tools.
- Different software development process models.
- Quality standards for building software.
- Databases design.
- Human-computer interaction design and evaluation.
- Mathematical foundations of engineering and computer engineering.
- Software development project management.
- Computer networks technologies and their applications.
- Handling digital hardware.
- Specialized topics in computer science.

Possess skills in:

- Working harmoniously in an interdisciplinary team for the development of solutions based on computer systems.
- Communicating with clients to understand their needs and to specify their requirements.
- Negotiating with the client the compromise between cost, functionality, and delivery time of the systems to be developed.
- Applying models and techniques to design, implement, and test computer systems efficiently.
- Designing software solutions according to the physical architecture on which the system will work.
- Communicating properly, orally and in writing.
- Understanding perfectly technical texts in both Spanish and English.
- Staying updated on technical advances required by the professional practice.

Show an attitude of:

- Leadership in interdisciplinary work teams.
- Perseverance in solving problems.
- Willingness to stay updated on their fields.
- Honesty, integrity and ethical behavior.
- Entrepreneurship and innovation.
- Social responsibility.
- Adaptation to different technological environments.
- Discipline to apply the acquired knowledge.

IV. CURRICULUM STRUCTURE

1. FIRST LEVEL: GENERAL STUDIES

a) Objective:

To strengthen the cognitive structures and the development of verbal and mathematical thinking skills aimed at the construction of knowledge that allows students to enter the fundamental fields of mathematics and computer engineering in contemporary social reality, recognizing the potential of the university education to favor better living conditions in our society and for the student. To promote, in addition, the commitment of the students with their education to achieve the graduate profile established in the curriculum and their permanence in the University until the end of their studies.

b) Courses:

Introduction to Mathematical Thinking (4000001, 9 credits)
The student will exercise the logical and mathematical skills in the approach and solution of situations related to domains of the disciplinary field and of everyday life, to develop analytical thinking and self-learning. This course is designed to promote or improve skills that contribute to develop and strengthen the logical and mathematical thinking related to how to approach and solve problems and how to explain its resolution.

Sustainability Seminar (4000007, 6 credits)
In this course, the student will understand the environmental, social, and economic principles and approaches of sustainability to critically evaluate and inform complicated problems and to integrate this view of complex analysis in the professional and personal development, so that decisions can be made consistent with this perspective. This course discusses sustainability as a problem, the natural resources as a common good and its depletion, cultural diversity and social dimension of access to knowledge as resources for sustainable development, environmental principles for sustainable development, economic growth and its impact, and environmental imbalances and risk distribution.

Academic Literacy Workshop (4000008, 9 credits)
In this course, the student will express ideas, reflections, and arguments orally and in writing with confidence, correctness, and fluency. Topics discussed in this course are the text as a multimodal framework, text structure, analysis of the elements of a text, text coherence, understanding, questioning, and discussion of ideas, arguments or significant topics, relationship of the text with experiences, previous knowledge, and with other text, description, opinion, and criticism of the text, types of text with descriptive, argumentative, and narrative dominant sequences, spelling, grammar, semantics, and rhetoric, critical apparatus.

Mathematics Workshop (4600000, 8 credits)
The student will face exercises to present and solve simple, real, and ludic problems using the tools of algebra, trigonometry, and elementary geometry. Furthermore, the student will communicate orally and in writing the approach and the solution of problems, emphasizing the logical organization of ideas and using a clear and mathematically correct language.

c) Total credits in this level: 32.

2. SECOND LEVEL: DIVISIONAL STUDIES

a) Objective:

To provide a general and common knowledge, as well as the formal languages and methodologies, of the disciplines of the natural sciences and engineering.

b) Courses:

College Algebra I (4601084, 9 credits)
In this course, the student will understand the fundamentals of algebra to apply them in the solution of problems and in demonstrations. The student will introduce to logic and demonstrations, will learn Boolean algebra, sets, natural numbers, mathematical induction, functions, and counting methods.

College Algebra II (4601085, 8 credits)
The student will understand basic algebraic structures and the properties they comply with to apply them in the solution of problems and in demonstrations. In this course, the student will learn relations, integer numbers, introduction to rings, and polynomial rings.

Introduction to Calculus (4601086, 13 credits)
At the end of the course the student will be able to apply the concepts and results of real numbers, successions, series, limits, and continuity of functions to problems that arise in different areas of knowledge. The student will learn the number line, real numbers sequences and series, functions, limits, and continuity.

Calculus I (4601087, 13 credits)
In this course, the student will be able to understand the concepts and main results of differential calculus in one variable, as well as the basic concepts of the integral of a function, in order to apply them to problems in different areas of knowledge. Topics discussed in this course are derivatives, qualitative properties of a function, Riemann sum and integral, fundamental theorem of calculus, and transcendental functions.

Calculus II (4601088, 13 credits)
The student will understand and apply the concepts and results of integral calculus in one variable to problems related to science and engineering. In this course, the students will learn integration methods, improper integrals, geometrical applications, and the application of integral calculus in different areas of knowledge.

Algorithms Workshop (4604030, 10 credits)
At the end of the course the student will be able to design algorithms to solve problems, using flowcharts and pseudocode, where the basic flow control structures are used. The topics that are discussed in this curse are the basic elements for algorithms design, the sequential, selective, and iterative flow control structures, and their variants.

Structured Programming (4604031, 12 credits)
The student will design efficient algorithms under the structured programming paradigm to solve computer problems. In this course, the student will learn how to implement the sequential, selective, and iterative flow control structures, and their variants, in a programming language and study what arrays, records, modular design, and files are.

Linear Data Structures (4604032, 12 credits)
In this course, the student will design and apply linear data structures and recursion for the solution of computer problems. Topics studied in this course are memory management, lists, queues, stacks, searching and sorting iterative algorithms, and recursion.

Nonlinear Data Structures (4604033, 12 credits)
At the end of the course the student will be able to design and apply nonlinear data structures for the solution of computer problems. The student will learn trees, binary trees, B-trees, graphs, hash tables, and their applications.

c) Total credits in this level: 102

3. THIRD LEVEL: BASIC STUDIES

a) Objective:

To provide a sound education in the scientific and technological mainstay of the analysis, design, and implementation of algorithms, theoretical and methodological elements in software engineering, integrating scientific, technical and socio-humanistic knowledge in the development of experimental projects that guarantee the student's ability to scientifically approach to problems of relevant areas of the professional field and build applicable solutions in its context.

b) Courses:

Linear Algebra I (4601093, 9 credits)
At the end of the course the student will be able to understand the basic concepts of linear algebra to solve problems in different areas of knowledge. Some subjects that the student will learn are geometry in the plane and in the space, linear equations systems, matrices and determinants, vector spaces, and linear transformations.

Object-Oriented Programming (4604032, 12 credits)
At the end of the course the student will able to build programs under the object-oriented paradigm. The student will learn the origin of the object-oriented paradigm, classes, objects, inheritance, interfaces, relationships between classes, abstract classes, polymorphism, method overriding, and exception handling.

Computer Architecture (4604036, 9 credits)
In this course, the student will understand the principles of computer architecture and organization, as a complement to computer programming. The student will introduce to computer organization and architecture, and learn combinational and sequential systems, the basic structure of microprocessors, and the personal computer low level language (assembler).

Software Engineering Fundamentals (46040037, 10 credits)
The student will understand the fundamental concepts of software engineering and its importance for building quality software products. In this course, the student will immerse in the software development process, conceive it as the structured set of activities required to develop a system (requirements, design, coding, test, and maintenance), and introduce to software development models, and software development agile methodologies.

Software Engineering Project I (4604038, 10 credits)
In this course, the student will apply the fundamentals, methods, techniques, and tools for building software through collaborative work. The subjects that will be revised include the requirements analysis, software design, software design implementation, software testing, software maintenance, and documentation.

Algorithms Analysis and Design (4604039, 10 credits)
At the end of the course the student will be able to analyze the complexity of an algorithm and use appropriate design techniques in the building of efficient solutions to classical computer problems. The student will learn algorithm complexity analysis, asymptotic measures, algorithm correctness, divide and conquer algorithms, greedy algorithms, dynamic programming, backtracking, and branch and cut algorithms.

Digital Systems (4604040, 8 credits)
The student will apply the basic techniques of analysis and design of combinational and sequential logic in the development of digital systems. In this course, the student will learn the difference between analog and digital systems, Boolean algebra, combinational circuits, basic combinational modules, and sequential circuits.

Probability and Statistics (4604041, 10 credits)
In this course, the student will analyze and solve problems in science and engineering using basic probability and statistical methods. Some topics this course include are basic concepts and theorems of probability, random variables, probability distributions, exploratory data analysis, sampling and frequency distributions, the Chebyshev's theorem, and hypothesis tests.

c) Total credits in this level: 78

4. FOURTH LEVEL: PROFESSIONAL STUDIES

a) Objective:

To develop skills for teamwork (planning, organization, quality evaluation, and presentation of results) through interdisciplinary projects for solving information processing problems. Expand the knowledge and skills of students in the different phases of the software development process, complement their education with the offer of humanistic or artistic programs and enrich their possibilities to understand other perspectives or cultures through their participation in courses of other academic programs of the University or other institutions.

b) Courses:

Requirements Analysis (4600022, 8 credits)
In this course, the students will apply the requirements process in the development of a software project. The students will learn what requirements and requirements analysis are, the requirements engineering processes, the requirements specification, the relationships between requirements management and software life cycle models, the modeling artifacts for the structured and object-oriented development of systems, and the communication methods.

Quality and Testing (4600023, 11 credits)
At the end of the course the student will be able to develop and apply basic techniques and procedures for software quality assurance. The student will acquire the quality and software quality concepts, will know the activities for the software quality control, the standards and rules for software quality, the testing process, the techniques and types of tests, the testing documentation, and the roles in the software testing process.

Project Management (4600025, 8 credits)
The student will comprehend and apply the standards, methods, techniques, and tools for software project management. Some topics included in this course are the project management scope, the people, the problem, the project management process, project planning, risk-based management, tools to increase productivity, and project recovery.

Microcontrollers (4604042, 8 credits)
In this course, the student will apply the basic techniques and concepts of microcontrollers in the development of software and hardware applications. The student will understand the organization and architecture of a simple computer system, the difference between microcontrollers and microprocessors, the microcontroller assembly language, how to program microcontrollers in a high-level language, and the communication protocols.

Operating Systems (4604043, 11 credits)
At the end of the course the student will be able to understand the control methods used by an operating system to manage the computer resources. Some topics and concepts studied in this course are processes, memory, and storage administration, the operating system services, input/output administration, safety, and security.

Object-Oriented Analysis and Design (4604044, 7 credits)
The student will learn to model a software system as a group of objects that interact with each other, so that its implementation is feasible. In addition, the students will learn the extraction of requirements of a project, the creation and tuning of use case diagrams, the creation and tuning of block and deployment diagrams, the classes and objects diagrams, and they will introduce to the design patterns.

Databases (4604045, 11 credits)
In this course, the student design data models and implement them using a relational database management system. Topics studied in this course are relational and entity-relationship data models, data definition, data manipulation, and data query languages, relational integrity, relational algebra, relational database design, system privileges, transaction management, and database normalization.

Introduction to Computer Networks (4604046, 8 credits)
At the end of the course the student will be able to apply the fundamental concepts of computer networks architecture and organization in order to configure them. The student will learn the communication model, the types and characteristics of signals, signal transmission, the OSI reference model, the TCP/IP model, and how to design and configure basic scenarios of computer networks.

Distributed Systems (4604047, 11 credits)
The student will understand the distributed basic services of computer systems for the design and development of distributed software applications. The student will introduce to the distributed services, and will learn the communication and synchronization processes, the distributed objects and components, and the distributed architectural models.

Large-Scale Software Development (4604048, 10 credits)
In this course, the student will comprehend and apply the software engineering techniques to produce a quality large-scale software system. The students will learn the problems that arise during the development of large-scale software projects, the roles and responsibilities in the development of large-scale software projects, the architectural design, the components design, the configuration management, and the maintenance and technical support activities.

User Interfaces (4604049, 8 credits)
At the end of the course the student will be able to use software design techniques for user interfaces development, in order to achieve an efficient human-computer communication and implement them using a programming language. The students will learn the interaction, software design, and processes for user interfaces, and the user interfaces development, evaluation, and testing.

Software Engineering Project II (4604090, 10 credits)
The student will develop a software project considering software engineering standard processes. Subjects considered in this course are the software design patterns and their classification, and software project planning, estimation, and risks. Students will also analyze a case study and will develop a software project following an iterative methodology and considering the learned concepts.

Concurrent Computing (4604091, 8 credits)
In this course, the student will apply the basic concepts of concurrent computing in the programming of algorithms for problem solving. The students will learn the differences and similarities between parallel, distributed and concurrent computing, the concurrent computing architectures, the basic strategies for concurrent computing, how to program applications with shared memory, and the message passing interface.

Automata Theory and Languages (4604092, 8 credits)
At the end of the course the student will be able to use the automata theory and languages to solve computer problems. Some topics this course include are finite automata and regular languages, lexical analysis, regular grammars and expressions, finite deterministic and nondeterministic automata, pushdown automata, context-free languages, and computability.

Translators (4604093, 10 credits)
The student will develop a translator from a source programming language to a target programming language. The students will learn what the general scheme of a translator is, the translation process phases, how to implement lexical, syntactical, and semantical analyzers, and how to generate code.

Final Project I (4604094, 10 credits)
The objective of this course is to develop a project in the field of scientific research, development or application of some areas in computer engineering. This project will be accomplished in three courses: Final Project I, Final Project II, and Final Project III. In this course, the student will select the project to be developed, investigate about it, define the project objectives, scope, and planning, write the project proposal, organize and analyze preliminary results (if any), and present the progress of the project.

Final Project II (4604095)
The objective of this course is to develop a project in the field of scientific research, development or application of some areas in computer engineering. This project will be accomplished in three courses: Final Project I, Final Project II, and Final Project III. In this course, the student will resume the investigation about the project, continue the project development, organization and analysis of the results, and present the progress of the project.

Final Project III (4604096)
The objective of this course is to develop a project in the field of scientific research, development or application of some areas in computer engineering. This project will be accomplished in three courses: Final Project I, Final Project II, and Final Project III. In this course, the student will finish the project, organize and analyze final results, and present the overall project.

c) Total credits in this level: 251

ELECTIVE COURSES:

The student will take different types of elective courses (divisional, interdivisional, orientation, and exchange mobility). For each type of elective courses, a minimum number of credits must be taken. The surplus credits will not be considered for another type of elective courses.

A. ORIENTATION ELECTIVE COURSES

Objective: To deepen in the areas of knowledge that correspond to the professional orientation chosen by the student.

The student must take at least 24 credits of courses offered from the following elective blocks, according to the academic programming approved by the Divisional Council of Natural Sciences and Engineering and prior authorization of the Studies Coordinator.

Block I: Scientific Systems
Block II: Distributed Systems
Block III: Information Systems and Data Processing
Block IV: Multimedia Systems
Block V: Programming
Block VI: Business
Block VII: Processes

B. DIVISIONAL OR INTERDIVISIONAL ELECTIVE COURSES

Objective: To provide a comprehensive professional and cultural education that includes general courses in the field of natural and social sciences, humanities, communication, and design.

The student must take at least 24 credits of divisional or interdivisional courses approved by the Divisional Council of Natural Sciences and Engineering and prior authorization of the Studies Coordinator.

C. EXCHANGE MOBILITY ELECTIVE COURSES

Objective: To expand the perspectives of the professional education through the exposure to different academic and cultural contexts.

The student must take at least 36 credits of exchange mobility courses after completing the Basic Studies Level, which could be taken in another UAM Campus or in another higher education institution, and prior authorization of the Studies Coordinator.

V. CREDITS DISTRIBUTION

LEVEL	CREDITS
General Studies	32
Divisional Studies	102
Basic Studies	78
Professional Studies (required)	167
Professional Studies (elective)	84 (min.)
TOTAL CREDITS	**463 (min.)**

VI. NORMAL AND MAXIMUM NUMBER OF CREDITS THAT COULD BE TAKEN PER TERM

The normal and maximum credits that could be taken per term are:

Term	Normal	Maximum	Term	Normal	Maximum
I	42	42	VII	37	48
II	42	55	VIII	37	47
III	42	55	IX	34	44
IV	44	56	X	36	46
V	43	54	XI	34	44
VI	36	47	XII	36	46

VII. REQUIREMENTS TO OBTAIN THE UNDERGRADUATE DEGREE OF COMPUTER ENGINEER

1. To have taken a minimum of 463 credits, as indicated by the curriculum.

2. To have obtained the certification of the use of the four skills of the English language (reading, writing, listening, and oral expression) at the intermediate level, issued by the Foreign Languages Program Coordination of the Cuajimalpa Campus or by any institution of foreign languages recognized by the UAM. In the case of foreigners whose native language is not Spanish, they must accredit the advanced level of this language.

3. To have accomplished with the Social Service, in accordance with the Undergraduate Level Social Service Regulation of the UAM.

VIII. EXPECTED DURATION OF THE STUDIES

The expected duration of the studies is 12 terms.