National University of Moquegua (UNAM)
Faculty of Engineering
Department of -
School of Computer Science

Book of short descriptions by course

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Contents

Chapter 1

First Semester

1.1 CS111. Introduction to Programming

This is the first course in the sequence of introductory courses to Computer Science.This course is intended to cover the concepts outlined by the Computing Curricula ACM/IEEE-CS 2013. Programming is one of the pillars of Computer Science; any professional of the area, will need to program to materialize their models and proposals. This course introduces participants to the fundamental concepts of this art. Topics include data types, control structures, functions, lists, recursion, and the mechanics of execution, testing, and debugging.

1.2 BMA101. Linear Algebra

Linear algebra is fundamental to computer science, providing essential tools for algorithm analysis, computer graphics, machine learning, and many other areas. This course provides a solid foundation in the concepts and techniques of linear algebra, with a focus on its application in computing.

1.3 BMA102. Differential Calculus

Differential calculus is a fundamental tool in computer science for understanding and modeling change. This course introduces the main concepts of differential calculus, including limits, derivatives, applications of the derivative, and optimization.

1.4 BCH101. Chemistry I

Chemistry provides a foundation for understanding the composition, structure, and properties of matter. While not directly related to many aspects of programming, chemistry is relevant to computer science in areas such as materials science (developing new materials for computer components), nanotechnology, and bioinformatics. This course introduces the basic principles of general chemistry.

1.5 FG001. General Elective

General Education Elective

1.6 BEI101. Technical and professional English I

A fundamental part of the integral formation of a professional is the ability to communicate in a foreign language in addition to the native language itself. It not only broadens its cultural horizon but also allows a more humane and comprehensive view of people's lives. In the case of foreign languages, English is undoubtedly the most pratical because it is spoken around the world. There is no country where it is not spoken. In careers related to tourist services English is perhaps the most important practical tool that the student must master from the outset as part of his comprehensive education.

Chapter 2

Second Semester

2.1 CS100. Introduction to Computer Science

This course serves as the foundation for understanding the fundamental concepts of computational thinking applicable across various professions.

The course provides, starting from ground zero, a panoramic view of: introductory computational thinking, data storage, computer architecture, operating systems, networks and the Internet, algorithms, sorting methods, software engineering, databases, data structures, software engineering, computer graphics, artificial intelligence among others.

Designed as an introductory course to Computer Science, the concepts are presented in a playful manner and using an Active Learning methodology. Throughout the course, active audience participation is encouraged, akin to a theatrical performance.

The related knowledge areas covered are directly aligned with the Computing Curricula ACM/IEEE-CS.

The course **does not require** any prior knowledge in computer handling topics and can be taken by student from any field.

2.2 CS112. Objects oriented programming I

This is the second course in the introductory Computer Science programming sequence.

It incorporates a programming language transition as a pedagogical strategy and focuses on core Object-Oriented Programming (OOP) concepts, expanding on the foundations from the first course while introducing low-level programming principles.

The course provides a solid foundation for advanced topics covered in the subsequent course of the sequence.

2.3 CS1D1. Discrete Structures

Discrete structures provide the theoretical foundations necessary for computation. These fundamentals are not only useful to develop computation from a

theoretical point of view as it happens in the course of computational theory, but also is useful for the practice of computing; In particular in applications such as verification, cryptography, formal methods, etc.

2.4 BMA103. Integral Calculus

Integral calculus is essential in computer science for modeling and solving problems involving accumulation, change, and areas under curves. This course provides the foundations of integral calculus, including integration techniques, applications, and its relationship with differential calculus.

2.5 BFI101. Physics I

Physics is essential for understanding the world around us, and its principles are fundamental in many areas of computer science, such as computer graphics, physical simulations, and robotics. This course introduces the basic concepts of classical mechanics, including kinematics, dynamics, work, and energy.

2.6 BEI102. Technical and professional English II

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Chapter 3

Third Semester

3.1 CS113. Objects oriented programming II

This is the third course in the sequence of introductory courses in computer science. This course explores C++-specific OOP mastery, focusing on high-performance systems development. Key topics include:

Core Advanced Concepts:

- Template metaprogramming (TMP) and Substitution Failure Is Not An Error (SFINAE)
- Move semantics, perfect forwarding, and Resource Acquisition Is Initialization (RAII) optimization
- Multiple inheritance pitfalls and virtual inheritance patterns

Concurrency & Systems Programming:

- std::thread, async/await, and thread synchronization
- Lock-free programming with atomic types
- Thread-safe OOP design patterns (e.g., singleton variants)

Modern C++ Paradigms:

- CRTP (Curiously Recurring Template Pattern)
- Expression templates for performance-critical code
- Compile-time introspection with constexpr and type traits

Real-World Applications:

- Interfacing C++ with other languages (FFI)
- Benchmarking and profiling template-heavy code

Prepares students for game engines, high performance computing, and embedded development where C++ dominates.

3.2 CS2B1. Platform Based Development

The world has changed due to the use of fabric and related technologies, rapid, timely and personalized access to the information, through web technology, ubiquitous and pervasive; they have changed the way we do things, how do we think? and how does the industry develop? Web technologies, ubiquitous and pervasive are based on the development of web services, web applications and mobile applications, which are necessary to understand the architecture, design, and implementation of web services, web applications and mobile applications.

3.3 AI161. Applied AI

This course provides a practical introduction to Artificial Intelligence (AI) for students from all scientific and engineering disciplines. Focused on developing AI literacy and practical skills, it covers fundamental concepts, modern AI tools (including Western and Chinese platforms), and responsible usage. Students will learn to effectively interact with diverse AI systems, write quality prompts, and apply AI solutions to problems across various domains while understanding ethical implications and cultural contexts of AI deployment.

3.4 BMA104. Advanced Differential and Integral Calculus

Advanced differential and integral calculus is fundamental for understanding multidimensional phenomena in engineering and computer science. This course delves into the concepts of vector calculus, including vector functions, multivariable calculus, multiple integrals, and fundamental theorems. These tools are essential for modeling complex systems, optimizing multivariable functions, and solving problems in computer graphics, computer vision, and physical simulations.

3.5 ST251. Probability Calculation

Probability and statistics are fundamental in computer science for algorithm analysis, system modeling, decision-making under uncertainty, and data analysis. This course integrates probability theory with statistical methods, focusing on computational applications such as algorithm analysis, machine learning, system modeling, and data science.

3.6 BEI201. Technical and professional English III

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the most important practical tool that the student must master from the outset as part of his / her integral education

Chapter 4

Fourth Semester

4.1 CS210. Algorithms and Data Structures

The theoretical foundation of all branches of computing rests on algorithms and data structures, this course will provide participants with an introduction to these topics, thus forming a basis that will serve for the following courses in the career.

4.2 CS211. Theory of Computation

This course emphasizes formal languages, computer models and computability, as well as the fundamentals of computational complexity and complete NP problems.

4.3 CS221. Computer Systems Architecture

A computer scientist must have a solid knowledge of the organization and design principles of diverse computer systems, by understanding the limitations of modern systems they could propose next-gen paradigms. This course teaches the basics and principles of Computer Architecture. This class addreses digital logic design, basics of Computer Architecture and processor design (Instruction Set architecture, microarchitecture, out-of-order execution, branch prediction), execution paradigms (superscalar, dataflow, VLIW, SIMD, GPUs, systolic, multithreading) and memory system organization.

4.4 CS271. Data Management

Information management (IM) plays a major role in almost all areas where computers are used. This area includes the capture, digitization, representation, organization, transformation and presentation of information; Algorithms to improve the efficiency and effectiveness of accessing and updating stored information, data modeling and abstraction, and physical file storage techniques.It also covers information security, privacy, integrity and protection in a shared environment. Students need to be able to develop conceptual and physical data

models, determine which (IM) methods and techniques are appropriate for a given problem, and be able to select and implement an appropriate IM solution that reflects all applicable restrictions, including Scalability and usability.

4.5 CS401. Research Methodology

This course aims to teach students how to conduct scientific research in the field of computer science. The course instructors will determine a specific study area for each student and provide relevant bibliography for analysis. Based on this and additional bibliographic sources (researched by the student), the student should be able to construct a survey-type article on the assigned topic.

4.6 MA202. Numerical Methods

Numerical methods are essential in computer science for approximating solutions to mathematical problems that cannot be solved analytically. This course provides an introduction to the most common numerical methods, including equation solving, interpolation, numerical integration, and the solution of differential equations.

4.7 BEI202. Technical and professional English IV

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Chapter 5

Fifth Semester

5.1 CS212. Analysis and Design of Algorithms

An algorithm is, essentially, a well-defined set of rules or instructions that allow solving a computational problem. The theoretical study of the performance of the algorithms and the resources used by them, usually time and space, allows us to evaluate if an algorithm is suitable for solving a specific problem, comparing it with other algorithms for the same problem or even delimiting the boundary between Viable and impossible. This matter is so important that even Donald E. Knuth defined Computer Science as the study of algorithms. This course will present the most common techniques used in the analysis and design of efficient algorithms, with the purpose of learning the fundamental principles of the design, implementation and analysis of algorithms for the solution of computational problems

5.2 CS261. Artificial Intelligence

Research in Artificial Intelligence has led to the development of numerous relevant tonic, aimed at the automation of human intelligence, giving a panoramic view of different algorithms that simulate the different aspects of the behavior and the intelligence of the human being.

5.3 CS272. Databases II

Information Management (IM) plays a leading role in almost every area where computers are used. This area includes the capture, digitization, representation, organization, transformation and presentation of information; Algorithms to improve the efficiency and effectiveness of access and update of stored information, data modeling and abstraction, and physical file storage techniques.

It also covers information security, privacy, integrity and protection in a shared environment. Students need to be able to develop conceptual and physical data models, determine which IM methods and techniques are appropriate for a given problem, and be able to select and implement an appropriate IM solution that reflects all applicable constraints, including scalability and Usability.

5.4 CS291. Software Engineering I

Modern software engineering requires professionals capable of designing robust and maintainable systems in cloud-native and agile environments. This course develops competencies in clean architecture, design patterns, professional testing, and DevSecOps practices, preparing students for the challenges of today's industry.

5.5 CS2S1. Operating systems

An Operating System (OS) manages the computing resources to complete the execution of multiple applications and their associated processes. This course teaches the design of modern operating systems; and introduces their fundamental concepts covering multiple-program execution, scheduling, memory management, file systems, and security. Also, the course includes programming activities on a minimal operating system to solve problems and extend its functionality. Notice that these activities require much time to complete. However, working on them provides valuable insight into operating systems.

5.6 BEI203. Technical and professional English V

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Chapter 6

Sixth Semester

6.1 CS231. Networking and Communication

The ever-growing development of communication and information technologies means that there is a marked tendency to establish more computer networks that allow better information management..

In this second course, participants will be introduced to the problems of communication between computers, through the study and implementation of communication protocols such as TCP / IP and the implementation of software on these protocols

6.2 CS311. Competitive Programming

Competitive Programming combines problem-solving challenges with the fun of competing with others. It teaches participants to think faster and develop problem-solving skills that are in high demand in the industry. This course will teach you to solve algorithmic problems quickly by combining theory of algorithms and data structures with practice solving problems.

6.3 CS312. Advanced Data Structures

Los algoritmos y estructuras de datos son una parte fundamental de la ciencia de la computación que nos permiten organizar la información de una manera más eficiente, por lo que es importante para todo profesional del área tener una sólida formación en este aspecto.

En el curso de estructuras de datos avanzadas nuestro objetivo es que el alumno conozca y analize estructuras complejas, como los Métodos de Acceso Multidimensional, Métodos de Acceso Espacio-Temporal y Métodos de Acceso Métrico, etc.

6.4 CS342. Compilers

That the student knows and understands the concepts and fundamental principles of the theory of compilation to realize the construction of a compiler

6.5 AI263. Introduction to Machine Learning

This course introduces the fundamentals of machine learning, covering classical and modern algorithms for classification, regression, and clustering problems. It focuses on practical implementation using scikit-learn and TensorFlow, with applications in computer vision and natural language processing.

6.6 FI201. Computational Physics

This course applies the principles of physics to computational problems, with an emphasis on light, wave propagation, collisions, and energy transfer. These concepts are essential in areas such as computer graphics, physical simulations, and video game development.

Chapter 7

Seventh Semester

7.1 CS251. Computer graphics

It offers an introduction to the area of Computer Graphics, which is an important part of Computer Science. The purpose of this course is to investigate the fundamental principles, techniques and tools for this area.

7.2 CS292. Software Engineering II

Modern software development requires mastery of DevSecOps, infrastructure as code, and SRE practices. This course prepares students to design, build, and operate reliable and secure systems in cloud-native environments, integrating automation, observability, and security throughout the software lifecycle.

7.3 CS2H1. User Experience (UX)

Language has been one of the most significant creations of humanity. From body language and gesture, through verbal and written communication, to iconic symbolic codes and others, it has made possible complex interactions Among humans and facilitated considerably the communication of information. With the invention of automatic and semi-automatic devices, including computers, The need for languages or interfaces to be able to interact with them, has gained great importance. The utility of the software, coupled with user satisfaction and increased productivity, depends on the effectiveness of the User-Computer Interface. So much so, that often the interface is the most important factor in the success and failure of any computer system. The design and implementation of appropriate Human-Computer Interfaces, which in addition to complying with the technical requirements and the transactional logic of the application, consider the subtle psychological implications, sciences and user facilities, It consumes a good part of the life cycle of a software project, and requires specialized skills, both for the construction of the same, and for the performance of usability tests.

7.4 AI264. Deep Learning

This course covers modern deep learning fundamentals, including convolutional networks, transformer architectures, and training techniques for advanced AI systems.

7.5 BBI101. Biology

Biology, the science of life, provides a foundational framework for interdisciplinary fields such as bioinformatics, computational biology, and biologically inspired artificial intelligence. This course offers an introduction to the essential concepts of biology, ranging from the cell to evolution, with particular emphasis on computational applications and perspectives.

7.6 FG211. Professional Ethics

This course adapts professional ethical principles to Artificial Intelligence, integrating ACM/IEEE codes with AI-specific challenges. Combines regulatory frameworks (GDPR) with current societal impact cases.

Chapter 8

Eighth Semester

8.1 CS281. Computing in Society

Ofrece una visión amplia de los aspectos éticos y profesionales relacionados con la computación. Los tópicos que se incluyen abarcan los aspectos éticos, sociales y políticos. Las dimensiones morales de la computación. Los métodos y herramientas de análisis. Administración de los recursos computacionales. Seguridad y control de los sistemas computacionales. Responsabilidades profesionales y éticas. Propiedad intelectual.

8.2 CS3I1. Computer Security

Nowadays, information is one of the most valuable assets in any organization. This course is oriented to be able to provide the student with the security elements oriented to protect the Information of the organization and mainly to be able to foresee the possible problems related to this heading. This subject involves the development of a preventive attitude on the part of the student in all areas related to software development.

8.3 CS3P1. Parallel and Distributed Computing

The last decade has brought explosive growth in computing with multiprocessors, including Multi-core processors and distributed data centers. As a result, computing parallel and distributed has become a widely elective subject to be one of the main components in the mesh studies in computer science undergraduate. Both parallel and distributed computing the simultaneous execution of multiple processes, whose operations have the potential to intercalar in a complex way. Parallel and distributed computing builds on foundations in many areas, including understanding the fundamental concepts of systems, such as: concurrency and parallel execution, consistency in state / memory manipulation, and latency. The communication and coordination between processes has its foundations in the passage of messages and models of shared memory of computing and algorithmic concepts like atomicity, consensus and conditional waiting.Achieving acceleration in practice requires an understanding of parallel

algorithms, strategies for decomposition problem, systems architecture, implementation strategies and analysis of performance. Distributed systems highlight the problems of security and tolerance to Failures, emphasize the maintenance of the replicated state and introduce additional problems in the field of computer networks.

8.4 CS402. Capstone Project I

This course aims to enable students to conduct a state-of-the-art study on a chosen research topic for investigation.

8.5 FG106. Theater

Favorece al estudiante a identificarse a la "Comunidad Académica" de la Universidad, en la medida en que le brinda canales naturales de integración a su grupo y a su Centro de Estudios y le permite, desde una visión alternativa, visualizar la valía interior de las personas a su alrededor, a la vez que puede conocer mejor la suya propia. Relaciona al universitario, a través de la experimentación, con un nuevo lenguaje, un medio de comunicación y expresión que va más allá de la expresión verbal conceptualizada. Coadyuva al estudiante en su formación integral, desarrollando en él capacidades corporales. Estimula en él, actitudes anímicas positivas, aptitudes cognitivas y afectivas. Enriquece su sensibilidad y despierta su solidaridad. Desinhibe y socializa, relaja y alegra, abriendo un camino de apertura de conocimiento del propio ser y el ser de los demás.

8.6 EX301. Extracurricular Activities

This course records the student's participation in activities that complement their academic training, such as workshops, conferences, social outreach, volunteering, or technical skills. Its objective is to promote comprehensive development, soft skills, and social commitment.

8.7 AI268. Computational Vision

This course covers fundamental techniques for automated analysis of digital images, essential for applications like medical diagnosis, autonomous vehicles, and surveillance systems. Aligns with ACM/IEEE-CS standards for computer vision.

8.8 CS391. Software Engineering III

Software engineering is evolving toward the AI-Native paradigm where autonomous agents co-create software in a secure and observable manner. This course trains engineers capable of designing development platforms augmented with AI, implementing LLMOps/AgentOps, and ensuring quality in systems where a significant portion of the lifecycle is automated by artificial intelligence.

8.9 CS393. Information systems

Analyze techniques for the correct implementation of scalable, robust, reliable and efficient information systems in organizations.

Chapter 9

Ninth Semester

9.1 CS370. Big Data

In today's digital era, processing large data volumes (terabytes to exabytes) is crucial. This course covers modern technologies like Spark, Hadoop, and large-scale graph processing, preparing students to design scalable solutions in distributed and cloud environments.

9.2 CS400. Pre-professional internships

This course allows students to apply the knowledge acquired during their academic training in a real work environment, under the supervision of a company and the university. Pre-professional internships are essential to develop professional, ethical, and technical competencies, ensuring that the student gains experience in projects related to the degree program.

9.3 CS403. Capstone Project II

This course aims to enable students to develop their research proposal and experiments based on the state-of-the-art previously surveyed.

9.4 AI365. Advanced Generative AI Models

This course explores modern generative models (GANs, Diffusion Models, LLMs) for multimodal content creation, covering both mathematical foundations and practical applications with ethical considerations for synthetic media.

9.5 CB309. Bioinformatics

The use of computational methods in the biological sciences has become one of the key tools for the field of molecular biology, being a fundamental part of research in this area.
In Molecular Biology, there are several applications that involve both DNA,

protein analysis or sequencing of the human genome, which depend on computational methods. Many of these problems are really complex and deal with large data sets.
This course can be used to see concrete use cases of several areas of knowledge of Computer Science such as Programming Languages (PL), Algorithms and Complexity (AL), Probabilities and Statistics, Information Management (IM), Intelligent Systems (IS).

9.6 CS351. Topics in Computer Graphics

Advanced course covering modern rendering techniques (real-time ray tracing, path tracing), advanced shaders, and GPU computing. Includes applications in games, VR/AR, and scientific visualization with focus on DirectX 12 Ultimate and Vulkan Ray Tracing.

9.7 CS353. Quantum Computing

This course introduces the fundamental principles of quantum computing, including qubits, superposition, entanglement, quantum algorithms, and hardware. Students will contrast classical and quantum models, exploring applications in cryptography, optimization, physical simulation, and quantum machine learning, using frameworks like Qiskit or Cirq. Includes a practical module on hardware architectures (superconductors, ion traps) and their impact on algorithm design.

9.8 AI369. Robotics

This course integrates principles of artificial intelligence, control systems, and programming to design autonomous robotic solutions, emphasizing complex problem analysis, teamwork, and professional ethics.

9.9 CS392. Tópicos en Ingeniería de Software

El desarrollo de software requiere del uso de mejores prácticas de desarrollo, gestión de proyectos de TI, manejo de equipos y uso eficiente y racional de frameworks de aseguramiento de la calidad y de Gobierno de Portfolios, estos elemento son pieza clave y transversal para el éxito del proceso productivo.

Este curso explora el diseño, selección, implementación y gestión de soluciones TI en las Organizaciones. El foco está en las aplicaciones y la infraestructura y su aplicación en el negocio.

9.10 CS3P3. Internet of Things

The last decade has an explosive growth in multiprocessor computing, including multi-core processors and distributed data centers. As a result, parallel and distributed computing has evolved from a broadly elective subject to be one of the major components in mesh studies in undergraduate computer science.

Both parallel computing and distribution involve the simultaneous execution of multiple processes on different devices that change position.

Chapter 10

Tenth Semester

10.1 CS3P2. Cloud Computing

This course covers modern cloud computing fundamentals including virtualization, containerization, distributed processing, and serverless architectures. Students will learn to implement scalable solutions using AWS, Azure, and GCP platforms, focusing on current industry practices.

10.2 CS404. Research Workshop

This course aims to enable students to properly complete their thesis draft.

10.3 AI367. Topics in Artificial Intelligence

Provides a set of tools to solve problems that are difficult to address using traditional algorithmic methods. Includes heuristics, planning, knowledge representation and reasoning formalisms, machine learning techniques, methods for action-reaction problems (e.g., reinforcement learning), as well as applications in natural language processing, computer vision, and robotics.

10.4 AI368. Evolutionary Computing

This course introduces biologically-inspired algorithms for solving complex optimization and design problems. It covers genetic algorithms, evolutionary strategies, and genetic programming, with applications in engineering, logistics, and machine learning. Students will implement solutions using modern frameworks like DEAP.

10.5 FG350. Leadership and Performance

En la actualidad las diferentes organizaciones en el mundo exigen a sus integrantes el ejercicio de liderazgo, esto significa asumir los retos asignados con eficacia y afán de servicio, siendo estas exigencias necesarias para la búsqueda

de una sociedad más justa y reconciliada. Este desafío, pasa por la necesidad de formar a nuestros alumnos con un recto conocimiento de sí mismos, con capacidad de juzgar objetivamente la realidad y de proponer orientaciones que busquen modificar positivamente el entorno.