ETSI Informática
University of Málaga

Foundations of Computer Science

Course Guide
2026-2027

http://www.informatica.uma.es

Welcome

We welcome you to study at the **School of Computer Science at the University of Malaga** (ETSI Informática – UMA). In this course guide, which is first and foremost designed to help incoming students to plan their studies during the exchange period, you will find descriptions of all the courses taught in English at our School during the academic year **2026-2027**. Further inquiries will be handled by the contact teachers and the International Coordinator of the School:

Inmaculada Fortes Ruiz
international-mobility.informatica@uma.es

Also, the International Office is there to help you:

Patricia Prados y Diana Gardumi
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http://www.uma.es/relaciones-internacionales/

We hope you will enjoy your stay at University of Malaga!

http://www.uma.es

For more information and the official programs* visit our website:

http://www.informatica.uma.es

*** Disclaimer:** This document is a succinct translation of the original programs in Spanish. In no case the contents of this translation may be interpreted as a replacement or modification of the conditions specified in the original documents.

Course Syllabi

CODE 101

NAME Electronic Foundations

Credits 6 ECTS

Period Fall Semester

Course Specifications
This subject aims to provide a comprehensive overview of the different aspects of digital electronics, starting from a level of physical devices and reaching a description of logical devices. The course is composed of theory lessons, problem solving classes and laboratory practices.

Objectives and contents
The main objective of the subject is to provide the students with a first approach to the electronics fundamentals of informatics, helping them to understand the basic elements behind common computer devices (such as processors, memories, etc.) and their operation.

Contents
1. Electronic concepts
2. Electronic devices
3. Switching electronics. Logic families
4. Introduction to digital systems
5. Gate-based combinational analysis and design
6. Combinational logic blocks
7. Sequential logic

Assessment
Regarding the assessment of the subject, it is performed taking into account laboratory practices (30%) and a final exam (70%). Besides, there are two mid-course exams. Passing the mid-course exams implies removing their content from the final exam.

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Course Syllabi

CODE 102

NAME Physical Foundations of Computer Science

Credits 6 ECTS

Period Fall Semester

Course Specifications
The course aims to provide computer engineering students with the knowledge that will enable them to understand the basic physical aspects of electronic devices, especially those related to computer technologies. The methodology is a combination of lectures, problem solving classes and practical laboratory classes. The course also aims to collaborate in inculcating the procedures and rigor of the scientific method within the framework of the development of their future work as engineers.

Objectives and contents
This course develops the fundamentals of electromagnetic theory and quantum and solid-state physics, with emphasis on semiconductors and computer applications.

Contents
1. Electric Field.
2. Magnetic Field.
3. Electromagnetic waves.
4. Fundamentals of Quantum Physics.
5. Introduction to Solid-State Physics.
6. Semiconductor Physics.

Assessment
Continuous evaluation with a partial exam of the first part of the course and a laboratory exam. There will be a final exam for the second part of the course, with the possibility of retaking the partial exam of the first part for those students who have not passed it previously.

Lecturer
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Course Syllabi

CODE 103

NAME Introduction to Programming

Credits 6 ECTS

Period Fall Semester

Course Specifications
Learning computer programming. Most of the hard work in this course will be done in front of a computer. The theoretical background and concepts are not complex and are previously discussed beforehand in the classes.

Objectives and contents
The main objective is to acquire correct programming skills. A general programming language is used. References are made to other languages and techniques. The focus is on acquiring skills in algorithmic construction and code organisation. An understanding of the underlying concepts of computer science and a light approach to its formal basis will provide the necessary background.

Contents:
1. Computer science and programming
2. Introduction to a programming language
3. Procedural abstraction
4. Structured data types

Assessment
Class attendance is compulsory. Apart from the unavoidable final exam, there will be at least two mid-term exams. Each practical, homework exercise, class activity and participation in forums and mid-term exams will be part of a continuous assessment.

Lecturer
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Course Syllabi

CODE 104

NAME Discrete Mathematics

Credits 6 ECTS

Period Fall Semester

Course Specifications

Lectures in the lecture room. Problem solving with and without computers support in the lecture room. Individual work is required.

Objectives and contents

The Discrete Mathematics contents of this course provide a solid foundation in mathematics and analytical reasoning, while providing the mathematical tools necessary for analysis, optimization and decision making in software design and development. Their understanding allows evaluating the efficiency of algorithms, optimizing computer systems and developing intelligent software solutions based on data analysis.

Contents:

1. Preliminary concepts and Number Theory.
2. Sets, functions, counting and recurrence relations.
3. Binary relations and graphs.
4. Classical Propositional Logic.

Assessment

In general, in the assessment of students, their attitude and work during the teaching sessions will be assessed. In the practical sessions of the course, the student's active work will be encouraged to solve the exercises proposed in each of the topics. In all sessions, the student will be able to use the computer software recommended in the course.

FIRST ORDINARY CALL:

The course will be subject to continuous assessment, which will consist of the submission of completed activities and exercises, with or without computer support, in-class work, questionnaires distributed throughout the course and midterm exams. The number of assessments will depend on the organization and progress of the course and may be influenced by the coordination criteria established by the School and the actual size of the classes.
The course content is divided into four topics. The final grade for the course is a weighted average with the following weights: 25% for Topic 1, 30% for Topic 2, 25% for Topic 3, and 20% for Topic 4. To calculate the final grade, the average grade for Topics 1 and 2 must be greater than or equal to 3, and the same applies to the average grade for Topics 3 and 4.

The weight of the course assessment during the teaching period will be 100%.

On the date scheduled by the School for the first regular session, exams will be held to make up for topics failed during the teaching period (wxMaxima grade obtained during the teaching period will be saved.). The grade obtained for each topic in the make-up exam will replace the corresponding grade for that subject obtained during the teaching period, and the weighted average grade, which will determine the final grade, which will be recalculated.
A student's grade will only be transferred to their oficial records if they pass the course by continuous assessment or seat for the first regular call of the course in January.

SECOND ORDINARY CALL:
On the date scheduled by the School, the exam covering the entire course must be taken, which will account for 100% of the grade. The grade obtained will be recorded in the official examination report along with the corresponding grade.

EXTRAORDINARY CALL:

On the date scheduled by the School, the exam covering the entire course must be taken, which will account for 100% of the grade. The grade obtained will be recorded in the examination report along with the corresponding grade.

Lecturer:
Mª Carmen Fernández Gago

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Office Room: 2.2.17

Course Syllabi

CODE 105

NAME Business Organization

Credits 6 ECTS

Period Fall Semester

Course Specifications

The professional development of students enrolled in this degree programme, regardless of the sector in which they may operate, requires a thorough understanding of the nature of managerial functions, entrepreneurial leadership, and the challenges associated with these areas.
Upon successful completion of the course, students will have acquired foundational knowledge that enables them to comprehend how a business operates, its strategic behaviour, and the issues arising within its various subsystems (management, production, marketing, finance and investment, and human resources). Additionally, they will have developed a basic understanding of entrepreneurship, having explored in depth the process of creating and developing a business idea through the formulation of a Business Plan.

Objectives and contents

1. To provide training for the practice of management within organisations.
2. To introduce key concepts related to Planning, Organising, Leading, and Controlling.
3. To present the core functional areas of production, marketing, finance, and human resources.
4. To foster an understanding of the importance and distinctive nature of the managerial function, its necessity across all types of organisations, and its relevance to social progress and well-being, corporate social responsibility, and business ethics.
5. To understand the decision-making process and apply relevant techniques to the various managerial functions.

Contents

1. The Company and the Entrepreneur
2. Competitiveness in Business
3. Management Subsystem
4. Production Subsystem
5. Commercial Subsystem
6. Financing Subsystem
7. Investment Subsystem
8. Human Resources Subsystem
9. The company and the IT sector

Assessment

The assessment of the subject is carried out taking into account
Practices (40%) and a final exam (60%).

Course Syllabi

Lecturer
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Course Syllabi

CODE 201

NAME Analysis and Design of Algorithms

Credits 6 ECTS

Period Fall Semester

Course Specifications
Flipped-classroom model. In-classroom activities: discussion sessions, problem solving sessions, laboratory work; Individual work: online lectures, problem assignments.

Objectives and contents
The objectives of the course are (1) knowing the main techniques for algorithm design (i.e., being able to apply these for solving specific problems and being able to reason about their applicability and suitability) and (2) attaining adequate knowledge about algorithmic complexity (i.e., analyze the algorithms built, reason about their efficiency and perform comparisons among algorithms).
The course is organized in two thematic parts, a short one dealing with algorithm analysis (introductory topics, computational complexity) and another one –which will comprise most of the course– tackling algorithm design (including techniques such as divide-and-conquer, dynamic programming, greedy algorithms, backtracking and branch-and-bound).
The overall focus of the course is on applied matters and practical problem solving with algorithms. Programming knowledgeability in Java is assumed.

Assessment
A continuous assessment methodology is used: partial tests and several lab projects will be conducted during the semester. The final mark will be based on their outcome plus a bonus obtained by actively participating in class (e.g., delivering proposed assignments, solving problems in class, etc.).

Lecturer
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Course Syllabi

CODE 202

NAME Databases

Credits 6 ECTS

Period Fall Semester

Course Specifications

Lectures in the classroom will introduce the foundations of Conceptual Dababase Design an Relational Database Management Systems. Practical activities will allow the students to learn how to handle a commercial database manager system. The student will put in practice the basic topics and tools concerning database systems. This course is mainly developed in the labs, directly interacting with professional database software.

Objectives and contents

The objectives are to learn the concepts of the Conceptual Modelling and the Relational Database Model and to use these elements via a commercial database manager. Contents include the Entity-Relationship and Relational models, the data definition language and data manipulation language of SQL and an introduction to the database architecture.

Assessment

There will be 2 main activities to be developed and evaluated in the semester: database design (project activity) and database implementation by using the Oracle software (lab activity). A final exam regarding SQL language (lab activity) and a questionnaire completes the evaluation. The students have to engage in all the activities, participate in every evaluation milestone, and show a minimum level in all of them.

Lecturers

José F. Aldana Montes

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Room 3.2.5

Course Syllabi

CODE 203

NAME Computer Organization

Credits 6 ECTS

Period Fall Semester

Course Specifications
Lectures in the classroom, individual work, questionnaires on-line by virtual campus and laboratory work
Objectives and contents
The objective of the subject is to understand the internal organization of a computer (from a hardware point of view).
Contents:
Theory

Topic 1. Improving Processor Performance with Pipelining (40%)
a. Performance Measurement and Amdahl's Law
b. RISC-V Pipelining
c. Data Hazards
d. Control Hazards
e. Advanced Parallelism

Topic 2. Memory Hierarchy (30%)
a. Introduction
b. Cache Memory
c. Improving Memory System Bandwidth: Interleaving
d. Virtual Memory: Paging

Topic 3. Input/Output and Peripherals (30%)
a. Devices, Controllers, and Input/Output Ports
b. Input/Output Programming:
a. Programmed I/O
b. Interrupt-Driven I/O
c. Direct Memory Access (DMA)

Lab Work

Lab 1. RISC-V Pipelining
Lab 2. Cache
Lab 3. Input/Output
Lab 4. Advanced Code Optimization Techniques

Assessment

There will be no final exam in the first ordinary session, where the continuous assessment method is applied. This continuous assessment will consist of mandatory partial tests (C1, C2, C3) conducted throughout the course, which will cover the theoretical and practical content of the three course topics. There is no minimum

required score for each test, except for the final test of the course, which requires a minimum score of 3 (out of 10). Based on the test results, a weighted average grade will be calculated as follows:
average_grade = 0.50*C1 + 0.30***C2 + 0.20*C3**

The exams will be held in laboratories. During the exams, students will not have access to AI tools.

To calculate the final grade, students with an average_grade of 5 or higher may receive up to 1 additional point from activities proposed by the teaching staff throughout the course, with the final grade capped at 10.

Lecturer
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Course Syllabi

CODE 204

NAME Data Structures

Credits 6 ECTS

Period Fall Semester

Course Specifications
Lectures and laboratory work.

Objectives and contents
This course provides an in-depth exploration of data structures, which are essential for organizing large datasets to enable efficient algorithmic processing. Aimed at students with prior experience in imperative programming using languages such as C, and object-oriented programming with Java, the course offers a comprehensive introduction to the most significant data structures in the field of Computer Science.

Participants will gain insights into various implementations of these structures using previously mentioned programming languages. The course will analyse and compare the performance of these implementations, providing a clear understanding of their efficiencies. Additionally, the practical application of these data structures in solving diverse problems will be demonstrated, highlighting their importance in computational tasks.

Contents
1. C Programming Language Review. An examination of dynamic memory management and the implementation of array-based and linked data structures in C.
2. Java Programming Language Review. A study of linear data structures in Java, including stacks, queues, lists, sets, bags, dictionaries, and priority queues.
3. Trees in Java. Coverage of binary search trees, heaps, and balanced trees, along with different data structure implementations based on trees.
4. Hash Tables in Java. An analysis of hash functions, collision resolution techniques, and the use of hash tables to implement various data structures.
5. Graphs in Java. Exploration of both directed and undirected graphs, including depth-first and breadth-first traversals and topological sorting.

Assessment
Continuous assessment during some laboratory sessions and on computer examinations.

Lecturer
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Course Syllabi

CODE 205

NAME Statistics Methods

Credits 6 ECTS

Period Fall Semester

Course Specifications
Classes will be held in the classroom and will include lectures, problem-solving sessions, and practical activities. Individual work and active participation are expected throughout the course.
GitHub will be used as a supporting platform for the management of practical assignments and collaborative work. Students are therefore encouraged to have a basic knowledge of version control systems and repositories.
Objectives and Contents
The course provides an introduction to the fundamental concepts and methods of Statistics. It aims to develop the ability to describe and analyse data, understand the basic principles of probability, and apply statistical inference techniques to solve practical problems. Throughout the course, students will acquire the knowledge and skills required to interpret statistical results and make informed decisions based on data.
Contents

1. Descriptive Statistics: Descriptive Statistics for One and Multiple Variables.
2. Statistical Models: Simple and Multiple Linear Regression. Statistical Modelling.
3. Time Series: Time Series Decomposition.
4. Probability Calculation: Probability. Random Variables and Distributions. Notable Distributions.
5. Statistical Inference: Point Estimation and Confidence Intervals. Parametric Hypothesis Testing. Non-Parametric Estimation.

Assessment
The course will be assessed through a continuous assessment system based on the completion of:

Two midterm exams, accounting for 77% of the continuous assessment grade.
Practical assignments, accounting for 23% of the continuous assessment grade.

The continuous assessment grade will be expressed on a scale from 0 to 10 and will be calculated by weighting the midterm exams and practical assignments according to the percentages indicated above.

Students who obtain a continuous assessment grade of 5 out of 10 or higher, provided that they have completed the compulsory practical assignments, will pass the course without having to take the final exam.

Final Exam

Students who do not pass the course through continuous assessment may take a final exam.

Final Grade

For students who take the final exam, the final grade will be the more favourable of the following two options:

1. The grade obtained through continuous assessment.
2. The combined grade calculated as:

60% Final Exam + 40% Continuous Assessment

Ordinary Examination Sessions
The assessment system described above will apply to both ordinary examination sessions.
In the second ordinary examination session, students who have not passed the course through continuous assessment may take the final examination. The final grade will be calculated using the same criteria described above.
Extraordinary Examination Sessions
In extraordinary examination sessions, assessment will consist of a single final examination covering all the learning outcomes of the course.
Minimum Assessment Requirements
To be assessed in the course, students must participate in at least one partial examination; and complete the compulsory practical assignments.
A student will be considered **NOT PRESENTED** if they do not complete the minimum assessment requirements.
A student will be considered **PRESENTED** if they participate in any assessable activity.

Lecturer
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Course Syllabi

CODE 301

NAME Analysis and Design of Applications

Credits 6 ECTS

Period Fall Semester

Course Specifications
Lectures and laboratory work.

Objectives and contents
This course focuses on the early stages of the software development process, addressing requirements analysis, structural, functional, and architectural system modeling, as well as the detailed design of user interfaces and test planning. It provides students with an integral view of the software lifecycle from its inception, serving as a bridge between the specification of needs and the effective implementation of software solutions. To undertake this course successfully, students should have already assimilated the concepts taught in "Introduction to Software Engineering" (108) and "Databases" (202). During the course, an active learning methodology will be used through case studies, group projects, and professional modeling and design tools. Principles and design patterns will be emphasized to foster the construction of high-quality applications and continuous integration.

Contents
1. **Analysis and modeling in the context of Software Engineering.** Review of the software engineering process stages. Identification, specification, and types of requirements. Use case modeling.
2. **Structural and Architectural Modeling.** Class diagrams. Physical data models. Architectural diagrams.
3. **Behavioral Modeling.** Sequence diagrams.
4. **User and System Interface Modeling.** Mockup and wireframing tools.
5. **Software Design.** Design principles. Design patterns. Refactoring and code smells.
6. **Software Testing in the Application Lifecycle.** Verification and validation concepts. Requirements and testing traceability. Test-Driven Development (TDD). Test plan development (unit testing design, integration testing, test environments, and Continuous Integration).

Assessment

- **First Ordinary Call:** Theory exam (30%, minimum score of 4 out of 10 required) and group project development carried out during the teaching period (70%, minimum score of 4 out of 10 required).
- **Second Ordinary Call:** Theory exam (50%) and the project grade obtained during the semester (50%).
- **Extraordinary Calls:** A single final exam comprising 100% of the grade (minimum score of 5 out of 10 required in both theory and practical sections)

Lecturers

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Dr. Francisco Javier Servant Cortes, fservant@uma.es
Room 3.3.2.IV E.T.S.I. Informática

Course Syllabi

CODE 302

NAME Cybersecurity in Computer Systems

Credits 6 ECTS

Period Fall Semester

Course Specifications
The course "Cybersecurity in Computer Systems" represents the first contact that students have in the bachelor's degree with subjects related to security and privacy in computer and communication environments. Therefore, the syllabus is designed so that students acquire a broad understanding of the techniques, mechanisms, protocols, and tools that provide protection at different levels of these environments, from the lowest level (networks) to the highest levels (applications and services).

Objectives and contents

1. Introduction
1.1 Basic security concepts and principles
1.2 Security services and mechanisms

2. Basic Cryptographic Techniques
2.1 Introduction to cryptography
2.2 Symmetric and asymmetric algorithms
2.3 Other cryptographic primitives: Hash functions and MACs

3. Schemes, Protocols, and Supporting Mechanisms
3.1 Key management
3.2 Access control mechanisms
3.3 Advanced cryptographic protocols and mechanisms

4. Security and Privacy in Telematic Applications
4.1 Application security: e-mail and electronic payments
4.2 User privacy in applications

5. Security in TCP/IP Networks
5.1 Transport Layer security
5.2 Internet Layer security
5.3 Wireless network security

Assessment

The assessment in the first ordinary examination period will be carried out as follows:

- 70% of the final grade will be based on two written theoretical exams (PT1, PT2). The two tests/midterm exams will be held during the course's class schedule. If, due to time constraints or calendar issues, the second part (PT2) cannot be carried out during class hours, it will be held on the date established for the final

examination. Each test (PT1 and PT2) will have an equal weighting, accounting for 50% of this component each.

- 30% of the final grade will be based on practical contents and laboratory activities. The assessment of this component will be based on two practical tests (PP1, PP2) (e.g., online tests, online practical exercises, etc.), each weighted at 50%.

In both components, the theoretical midterm exams (PT1 and PT2, accounting for 70%) and the practical tests (PP1 and PP2, accounting for 30%), students must obtain a minimum grade of 5 out of 10 for the corresponding component to contribute to the final grade. Students who do not achieve a passing final grade (≥5.0) must take the second ordinary examination period or any other extraordinary examination periods.

A student will be considered to have taken this first ordinary examination period if they complete 50% of the continuous assessment activities.

Additionally, the application of specific learning methodologies will be considered during the assessment process of the first ordinary examination period. Students who participate in these activities must attend classes; therefore, attendance will be considered. Depending on the activity, students may obtain up to 0.5 extra points added to their final grade, if they have successfully passed the course (with a grade ≥5.0). This additional grade will also be retained for the second ordinary examination period, but not for extraordinary examination periods.

The assessment in the second ordinary examination period is considered a recovery procedure for the continuous assessment carried out during the first ordinary examination period. This assessment will be performed through a written examination, which will evaluate the content block(s) (theoretical (70%) and/or practical (30%)) that were not passed in the first ordinary examination period. It should be noted that the design of the individual practical assignments makes it impossible to complete them outside the teaching period of the course; therefore, the assessment of these practical activities in this examination period must be carried out through a written authorship examination.

Finally, if a student wishes to opt for the assessment of 100% of the course during this second ordinary examination period, they will have the option of taking a written examination that evaluates both the theoretical content block (70%) and the practical content block (30%). This final option (taking the 100% assessment of the course) automatically implies forfeiting the grade obtained during the first ordinary examination period.

For extraordinary examination periods and extraordinary final-year examination periods, students must pass 100% of the course through a single final assessment — a written examination — covering both the theoretical content block (70%) and the practical content block (30%).

It should be noted that part-time students and high-level university athletes are not required to attend classes, if they notify the corresponding teaching staff. However, they may not obtain the additional points from the activities carried out in class ([0.0–0.5]). Regarding the midterm exams of the first ordinary examination period (PT1-2 accounting for 70%, PP1-2 accounting for 30%) and the written examinations (30% and 70%) in the

remaining examination periods, these groups of students will be subject to the same conditions as the rest of the students and must complete them in person.

Lecturer
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Course Syllabi

CODE 305

NAME Intelligent Systems

Credits 6 ECTS

Period Fall Semester

Course Specifications
Lectures, written exercises, individual work, programming laboratory practices.

Objectives and contents
This is a first course in Artificial Intelligence (AI). AI is ‘the art of creating machines that
perform functions that require intelligence when performed by people’ (Kurzweil, 1990). The aim is to provide a knowledge of the fundamental techniques of present AI and also some fluency in the use of Python and some of its libraries. Course contents include fundamental concepts in: supervised learning; decision trees; linear and logistic regression; artificial neural networks; search and problem solving.

Assessment
The assessment will be based on the following elements,
1) One voluntary midterm exam, taken during a class session and comprising part A of the subject's theory lessons.
2) A final exam (compulsory for each assessment period). The exam will be divided into three parts. The first will comprise the same part A evaluated in the voluntary midterm exam. The second part will comprise part B of the subject's theory lessons. The third part (part C) will comprise the content of the lab lessons. Students that obtained a mark equal or higher than 5 (out of 10) in the midterm exam will not take part A.
The exams will assess theoretical and practical knowledge of the subject, analytical and synthesis skills, correct use of language, order of presentation, etc. All exam grades will be expressed between 0 and 10 points. If a student does not show up for an exam (or part of an exam), their grade will be zero points for that exam (or part of the exam).
To calculate the grade, the following variables are defined,
PartiaMarkA = Mark for the first midterm exam (part A of the course).
FinalMarkA = Mark for part A of the final exam.
MarkB = Mark for part B of the final exam.
MarkC = Mark for part C of the final exam.
AttendedA = Has taken part A of the final exam.
MarkA = IF NOT AttendedA AND (PartialMarkA >=5), THEN PartialMarkA ELSE FinalMarkA
It will be sufficient and necessary condition to receive a grade in one of the assessment periods, to take the final exam of that period. The grade for the first assesment period will be calculated as follows:
To pass the course, the following condition must be met,
(MarkA >=3) AND (MarkB >=3) AND (MarkC >=3) AND (2*MarkA + MarkB + MarkC) / 4 >= 5)
If the course is passed, the overall grade is,
(2*MarkA + MarkB + MarkC) / 4

The exams for the second assessment period will cover for each student all parts not passed in the first assessment period, that is, students will need to resit only for those parts (A,B,C) with a mark lower than 5 in the midterm or final exams. This way, new marks (MarkA, MarkB and MarkC) will be obtained as needed, and the same rules for the first assesment period stated above will apply. For the extraordinary assessment period there is a single exam comprising all parts, and to pass the course the overall grade needs to be at least 5. The same rules will apply to students granted by the University with part-time or high-level athlete status.
The use in the exams of programmable calculators, mobile phones or any other similar smart devices (including, but not limited to, smart watches or glasses) is explicitly not allowed. In any case, these items will need to be out of the student's reach (inside a closed backpack or similar item). The use of non-programmable calculators will be allowed only when explicitly mentioned in the exam. Non-compliance with these norms will result in a 'fail' evaluation in the exam.

Lecturers

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Room: 3.2.38

Francisco Román Villatoro Machuca, Ph.D.
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Room 2.130.D - ESCUELA DE INGENIERÍAS INDUSTRIALES

Jorge García González, Ph.D.
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Course Syllabi

CODE 920

NAME Computational Intelligence

Credits 4.5 ECTS

Period Fall Semester

Course Specifications
The course is based on lectures in which the main ideas of the course are given as specific details of the problems and algorithms to be discussed and applied should be taken from reading the suggested related scientific publications. For each of the topics of the course, a computer-based practice should be carried out together with a report of the work done and the results obtained.

Objectives and contents
The objective of the course is that the students acquire the knowledge and abilities needed in order to choose and apply computational intelligence algorithms for solving real problems in bioinformatics.

Contents:
1. Clustering algorithms application to DNA microarray data.
2. Classification algorithms application for prediction of disease evolution.
3. Evolutive algorithms application to feature selection.
4. Probabilistic algorithms application to sequence detection and alignment.

Assessment
Continuous assessment is based on class participation, on the elaboration of reports and on two partial tests, with which the student can pass the course. A final exam is also possible as an alternative to pass this subject.

Lecturers
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Dr. Miguel Ángel Molina
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Room 3.3.2.I.

Course Syllabi

CODE 106
NAME Calculus for Computing
Credits 6 ECTS
Period Spring Semester

Course Specifications

The training activities rely on theory, problem-solving, and practical classes, alongside the student's personal work with exercises and provided materials. Classes pursue continuous interaction between the teacher and the student, balancing theoretical presentations with practical activities and encouraging the use of mathematical software as a support tool.

During classroom sessions, active student participation is encouraged to solve proposed exercises. Students will also perform practical computer work, introducing mathematical software (WolframAlpha, GeoGebra, wxMaxima, etc.) to help solve problems.

Objectives and Contents

This subject develops the mathematical foundations needed for solving problems that involve differential and integral calculus.

1. Preliminaries (Elementary functions, solving equations, complex numbers).
2. Differential calculus.
3. Integral calculus (including ordinary differential equations).
4. Sequences and series.

Assessment

Continuous evaluation relies on practical tasks (20% weight per block) and partial tests (80% weight per block) divided into Block A (Topics 1 and 2) and Block B (Topics 3 and 4). Unsubmitted tasks or unattempted tests receive a 0. Furthermore, if a partial test score is below 3.5 out of 10, the practical task grade for that block also becomes 0.

The final mark is the weighted average of the blocks (40% for Block A and 60% for Block B). Students scoring below 5 may take a makeup exam on the date set by the ETSII, allowing them to replace their grade in one or both blocks.

Second Ordinary Call

On the date scheduled by the ETSII, students will take a comprehensive exam covering the entire subject content.

Lecturer

Dr. Sergio Ortega Acosta (Room 2.2.19, sergio.ortega@uma.es)

Course Syllabi

CODE 107

NAME Algebraic Structures

Credits 6 ECTS

Period Spring Semester

Course Specifications

Lectures in the lecture room. Problem solving with and without computers support in the lecture room. Individual work is required.

Objectives and contents

The course on Algebraic Structures for Computing will set the foundations for the students to be trained on specific formal languages that will be useful for them in future courses such as 'Algorithms Design', 'Distributed Systems and Networks', 'Automata Theory and Formal Languages' and many others.

Contents:

1. Preliminary Concepts. Cardinality
2. Lattices and Boolean Algebra
3. Groups, Rings and Fields
4. Linear Equations Systems
5. Vector Space
6. Linear Transformations
7. Diagonalization
8. Inner Product and Euclidean Space

Assessment

The attitude and work done by the student during the classes will be taken into consideration. During the practical sessions of the course, the active participation of the student will be encouraged in order to solve the proposed exercises.

** First Call**

The course is divided into two thematic blocks, with equal weight for obtaining the successive grades and their transfer to the official records:

- Block 1. Consists of the topics:

  - Preliminaries. Cardinality.

  - Partially ordered Sets, lattices and Boolean algebras.

- Algebraic structures: groups, rings and fields. Coding theory.

- Block 2. The contents will be those related to linear algebra:

  - Linear equations systems.

  - Vector Space.

  - Linear transformations.

  - Diagonalization.

  - Euclidean Vector Space.

In the first ordinary call, the subject will follow a continuous evaluation. For each block, the following will be done:

- A midterm exam of the contents of the block, to be carried out in the lecture room, with a weighting of 85%.

- An individual practice to be done with a computer, during lectures. This practice has a weighting of 15%.

This weighting results in an independent rating for each block.

If a grade greater than or equal to 3.5 is achieved in the written exam for each of the both blocks, the average of both grades will be calculated. If said average is equal to or greater than 5, this will be the grade that is transferred to the official records in the first call.

On the date indicated by the School for the exam of the first call, two midterm exams will be held, one for each block. Each student has to take the midterm corresponding to each block where he or she has not obtained at least a 5.

The grade obtained in these midterms will replace the one achieved through continuous evaluation (midterms and practices) in the corresponding block, since these last midterms represent the final milestone of the continuous evaluation of the course.

After completing these midterm exams, the evaluation will follow the same scheme as in the continuous evaluation.

Those students who, having not passed the course through continuous assessment, do not take the corresponding midterm exams of the first call, on the date set by the School, will appear in the official records as "not presented."

**Second ordinary call and extraordinary calls **

If the first call is not passed, on the date proposed by the School, a single exam will be taken on the complete content of the course, the grade of which will be the one that is transferred to the official records.

Part-time students

Part-time students may take the exams of each call on the date scheduled by the School, whose grade will be the one that is transferred to the minutes.

Lecturer:

Mª Carmen Fernández Gago

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Office Room 2.2.17

Course Syllabi

CODE 108

NAME Introduction to Software Engineering

Credits 6 ECTS

Period Spring Semester

Course Specifications

The course is mainly based on lectures in which student participation is encouraged through classroom debates and collaborative development of exercises. Students will work on assignments both individually and in groups. Lab work will be used to teach selected software engineering tools and to develop the ability to apply the theoretical knowledge in practical scenarios. Extra activities include peer reviews, writing essays and solving proposed exercises.

Objectives and contents

This is an introductory course in Software Engineering. As such and given the wide domain of the subject in terms of techniques and tools, the course is necessarily dense in content. We cover the concepts, processes, techniques, tools, and standards that affect the development of a software project with a focus on the aspects of code management, version control, testing and quality assurance. Our goal is to provide students with a good understanding of the pillars of software development that will provide them with the necessary skills to successfully take courses on other specific areas of software engineering.

Assessment

Continuous assessment of the student participation in lectures, debates, and lab sessions throughout the course. Evaluation of student assignments. Written and practical (on computer) examinations.

Lecturer

Dr. Javier Cámara Moreno

jcamara@uma.es

Room 3.3.2.II

Course Syllabi

CODE 109

NAME Advanced Programming I

Credits 6 ECTS

Period Spring Semester

Course Specifications
Lectures where the theoretical concepts are described. Individual and laboratory work where the students put in practice these theoretical concepts using the Java programming language.

Objectives and contents
The course introduces students to object oriented design and programming using the Java programming language.

Contents
1. Introduction in Java to Object Oriented Programming Fundamentals: classes, objects, methods, messages, composition, variables, predefined types.
2. Inheritance and interfaces. Single and multiple inheritance, interface implementation, abstract classes, static and dynamic binding.
3. Exception management. Error handling with exceptions. Throwing exception, definition of tailored exception classes.
4. Basic predefined Java classes. System basic classes (java.lang), system utility classes (java.util), input/output in java (java.io).
5. Collections. Generic programming in Java. Predefined Java collections (lists, sets) and maps.

Assessment
Attending the lectures and the laboratory sessions, short questions to be answered during lectures, short programs to be developed during laboratory sessions, partial and final exams in the laboratory.

Lecturer
Dr. José Mª Álvarez Palomo
jmalvarez@uma.es
Room 3.2.6

Course Syllabi

CODE 110

NAME Computer Technology

Credits 6 ECTS

Period Spring Semester

Course Specifications
The course follows an active learning methodology where students work in varying teams, solve exercises, and upload and present the solutions in class. We work with several features in the CV system such as tasks, workshops and fora.

Objectives and contents
Go into the wonderful world of the computer processor. The student designs processors based on Boolean logic and observes its functioning based on code we feed it. We get a feeling for the language the processor understands based on creating assembly code. The design follows the new RISC-V conventions.

Assessment
The English of the student is promoted due to interacting in the team work and discussions and presentations. The assessment of the course is done in a continuous way by providing 7 small tests evaluating each part after it is finished. Moreover, handed in assignments in the GUAC system are assessed. Those assignments are directly used in the individual evaluations.

Lecturer
Dr. Eligius M.T. Hendrix
eligius@uma.es https://sites.google.com/site/eligiushendrix/
Room 2.116D (Escuela de Ingenierías)

Course Syllabi

CODE 206

NAME Foundations of Artificial Intelligence

Credits 6 ECTS

Period Spring Semester

Course Specifications
Lectures, written exercises, individual work, programming laboratory practices.

Objectives and contents
This is a first course in Artificial Intelligence (AI). AI is 'the art of creating machines that perform functions that require intelligence when performed by people' (Kurzweil, 1990). The aim is to provide a knowledge of the fundamental techniques of present AI and also some fluency in the use of Python and some of its libraries. Course contents include: decision trees; linear and logistic regression; artificial neural networks; search and planning.

Assessment
There are two written exams: a midterm exam covering part A of the theoretical content (Machine Learning and Neural Networks) and a final exam covering part B of the theoretical content (Search and Planning) and part C (practical data analysis).
Also, there are lab sessions and programming exercises, to be coded in Python. Therefore, programming skill is a prerequisite.

Lecturer
Dr. José Luis Pérez de la Cruz
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Room: 3.2.24

Course Syllabi

CODE 207

NAME Advanced Programming II

Credits 6 ECTS

Period Spring Semester

Course Specifications
Lectures where theoretical concepts, problems and algorithms are explained in the classroom whereas, in the laboratory, every student puts in practice these concepts resolving well-defined problems following the guidelines of the teacher. The course follows a practical approach using the Scala and Java programming languages.

Objectives and contents
The main objectives are to learn functional and parallel programming in contrast to traditional programming models. Classical problems are shown as well as their solutions following different approaches and the syntactic and semantics resources provided by Scala. A last objective is to learn how to create programs with GUI (Graphical User Interfaces) using a well-founded methodology.
Contents
1. Functional programming.
2. Concurrency: main concepts.
3. Concurrency: communication and synchronization. 4. Event driven programming.

Assessment
There are 4 exams on i) functional programming (midterm, 30%), ii) semaphores (midterm, 30%), iii) monitors/locks (final, 30%), and iv) GUI (final, 10%). Each exam must be passed with a minimum mark of 4 over 10, and a weighted mean of 5 or greater. A passed exam is kept (no need to retake it) in any ordinary call of the course.

Lecturer
Dr. Sergio Gálvez Rojas
galvez@uma.es
Room 3.2.33

Course Syllabi

CODE 208

NAME Networks and Services

Credits 6 ECTS

Period Spring Semester

Course Specifications
The course includes lectures, problem-solving sessions, individual work, and laboratory sessions.

Objectives and contents
This course provides an overview of computer networks, starting with the basics of networking, including their structure and how networks are organized.

Contents
It introduces layered models, such as the Internet models, and the standards that define network protocols and operations. The discussion of network access and link control includes the services and functionalities of the link layer, focusing on multiple access networks, local area network (LAN) technologies, and other specialized networking technologies. Network Interconnection Protocols and Internet Services cover VLANs, and IP protocols (IPv4 and IPv6), including Internet routing. It also explores transport layer services, discussing protocols like UDP and TCP, along with network programming with sockets APIs. Additionally, it presents classical Internet services such as DNS, the World Wide Web, and email among others, and advanced Internet services, such as cloud computing, multimedia, and other cutting-edge elements.

Assessment
The acquisition of concepts is evaluated considering: class attendance and participation; midterm and final exams (70% aprox.). The practical part of this course counts 30% of the final score.

Lecturer
Dra. Lidia Fuentes
lfuentes@uma.es
Room 3.2.8

Course Syllabi

CODE 209

NAME Operating Systems.

Credits 6 ECTS.

Period Spring Semester.

Course Specifications

The course includes lectures about fundamental concepts involved in the internal design of any Operating System. It also includes laboratory work about programming complex software services on the POSIX of the UNIX family of operating systems.
It requires deep and strong knowledge of the hardware structure of the computer (knowledge of previous subjects like Computer Technology and Computer Structure is compulsory, as the concepts will appear frequently during description of the implementation of the OS).

Note for Erasmus students
If you come from a **non Computer-Science or Information Technology degree**, you are advised to **not choosing this subject**.
We have a
recurring series of badly advised students that fail to understand the theory of the subject
because of the lack of previous knowledge.
Just being an experienced programmer is not enough as a base to approach this subject.

Objectives and contents
The subject focuses on the Operating System as an interface between the developer and the computer hardware in a general-purpose system. Any kind of usage of the computer is done through the Operating Systems and never directly:
• Many abstractions offered by programming languages (like threads, processes, files, network sockets, memory allocation, etc.) are not part of the programming language. Instead, the OS implements them and the languages just call the through system calls. This is why all programming languages offer the same abstractions.
• Security is also implemented in the Operating System. The concept of user and access permissions does not exists in the hardware but created and managed by the code of the OS. That includes controlling the access to the hardware resources by the programmer.
With these concepts in mind, you will understand that High Level Languages are only one more layer on top of OS software. You will become a better programmer understanding that any language is just generating code that uses the common OS implementation of resources. In this sense, you will be able to focus on management of resources more than on the language itself.

Theory (slides):
1. Processes and threads.
2. Process scheduling.
3. Memory management.

4. Input/output subsystem.

Laboratories:
5. The UNIX programming environment: Programming on the POSIX standard.
6. Pointers and shell commands.
7. Signals and processes.
8. Implementation of a Shell Operating System for accepting user commands.

Assessment
For the standard student, continuous evaluation of the progress is compulsory. There will be NO FINAL exam at the end of the course.
Assessment involves three parts: Theory 1 and 2, theory 3 and 4, and laboratory. To pass the subject, it is required to pass each part with a minimum score of 4.

Lecturer
Dr. Manuel Ujaldón
ujaldon@uma.es

Course Syllabi

CODE 210

NAME Automata Theory and Formal Languages

Credits 6 ECTS

Period Spring Semester

Course Specifications
The course is mainly based in lectures in which student participation is encouraged through the presentation of exercises, individual work, and group work. Extra activities include writing essays and solving proposed exercises.

Objectives and contents
The course gives a basic introduction to the classic and contemporary theory of formal languages and automata theory.

Contents
Include the following topics: Mathematical preliminaries, Alphabets and Grammars, Regular Expressions, Finite automata, Regularity conditions, Context Free Languages, Introduction to computation, The Turing Machine, Recursive functions, The "While" language, Equivalence theorem, Universality, Formal limits of computation.

Assessment
The course contents will be evaluated in blocks. A minimum of 5 is needed in each of the blocks to pass the course, and to achieve this, the students have one opportunity during the continuous evaluation and a second and third ones in the two ordinary final exams calls. The final grade will be obtained by averaging the best grades obtained from each of the blocks plus some extra points from proposed activities. The number of blocks into which the subject will be divided will be between 2 and 4.

Lecturer
Dr. Karl Thurnhofer Hemsi
karlkhader@uma.es
Room 3.2.48

Course Syllabi

CODE 306

NAME Databases II

Credits 6 ECTS

Period Spring Semester

Course Specifications
Lectures and laboratory work.

Objectives and contents
Advanced knowledge of Database Management Systems is essential for the proper functioning of an Information System. Beyond the mathematical foundations and basic concepts studied in the previous "Databases" course, this subject covers physical design, server-side programming, database security, concurrency control, and the particularities of systems designed to handle large volumes of data.
To successfully undertake this course, it is recommended that students have passed the first-year programming subjects and the second-year "Databases" course. The learning methodology includes the case study method and the development of objects on the server side.

Contents
Block 1 Database Architecture:

1) Basic administration concepts.
2) Server-side programming: stored procedures, functions, packages, triggers, and jobs.
3) Management of the physical and logical space of a database.

Bloc 2 Security and Integrity Control:

4) Security control in a database.
5) Semantic integrity and concurrent access control.

Bloc 3 Non-relational Databases:

6) Introduction to scalable database engines.

Assessment

- **First Ordinary Call:** Continuous evaluation consisting of individual assessment (7 points) and a group project (3 points). The individual assessment includes server-side programming (3 pts), physical/logical/security management (2 pts), and a theory exam (2 pts). To pass the course, students must obtain a total score of at least 5 points, with a minimum of 50% in the sum of individual tests, 50% in the group project, and over 30% in the theory exam.

Group work is essential to pass the subject; if it is not passed, it is not possible to pass the first ordinary call, and no results will be saved for the second call. The grade for the group project is individual and will be established through the evaluation of the work, interviews, and other activities set to clarify each student's participation in the project. If the group project is passed but the assessment of individual activities is not, the grades for the individual parts scoring above 50% of their value will be maintained for the second ordinary call

- **Second Ordinary and Extraordinary Calls:** A single exam worth 100% of the grade, divided into: Physical, logical, and security management (3 pts); Server-side programming

(3 pts); and Theory exam (4 pts). A minimum total of 5 points is required, with at least 30% achieved in the theory section.

Lecturers

Dr. Laura Panizo Jaime, laurapanizo@uma.es
Room 3.2.37 E.T.S.I. Informática

Dr. Maciej Rybinski, maciek.rybinski@uma.es
Room 3.3.12 E.T.S.I. Informática

Course Syllabi

CODE 307

NAME Web Application Development

Credits 6 ECTS

Period Spring Semester

Course Specification
The course includes lectures, individual work, group work, and laboratory sessions.

Objectives and contents
The course introduces the concepts of web services and microservices in the context of the hexagonal architecture. It describes microservices development patterns and technologies to develop RESTful web services, including object-relational mapping, message-oriented middleware, exchange languages (JSON and XML), security, and deployment. The lab sessions and practical work are based on the Spring framework using Java, Maven, and Docker.

Contents

1. Introduction
2. Service-oriented architectures
3. Technologies for RESTful Web services development
4. Microservices-based applications
5. Deployment of web services and applications

Assessment
The theoretical part of the course is worth 30% and is evaluated through exams during the course and on the official exam dates. The practical part of the course is worth 70% and is evaluated through small lab assignments and a larger assignment during the course.

Lecturer
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