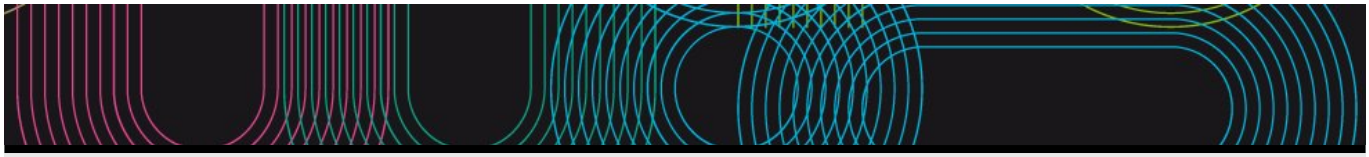
Universidade Vigo

Subject Guide 2020 / 2021



IDENTIFYING DATA				
Computer science: Computing for engineering				
Subject	Computer science: Computing for engineering			
Code	P52G381V01107			
Study programme	(*)Grao en Enxeñaría Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Rodelgo Lacruz, Miguel			
Lecturers	Barragáns Martínez, Ana Belén Fernández Gavilanes, Milagros Rodelgo Lacruz, Miguel			
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General description	This course belongs to the module of Basic Formation, and its main goal is providing to the students an overview of the world of the computers. The course is focused on making the students to learn how a computer works internally, from hardware and software perspective, as well as to design programs employing a high level language. It is proposed a course of computing and conceptual programming sufficiently general, oriented to provide to the student a perspective of designer and programmer of small applications. Although the course is not oriented to the study of a particular operating system or programming language, it does necessary employ a concrete language in the realization of the practical activities, becoming the learning of this language a secondary aim of the course.			

Competencies	
Code	
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of Industrial Engineering in Mechanical specialty.
C3	Basic knowledge on the use and programming of computers, operating systems, databases and software applications in engineering.
D1	Analysis and synthesis
D2	Problems resolution.
D5	Information Management.
D6	Application of computer science in the field of study.
D7	Ability to organize and plan.
D17	Working as a team.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Computer and operating system skills.	B3 B4	C3	D2 D5 D6 D7
(*)- Coñecemento das ferramentas conceptuais e analíticas que ofrece a lingüística para o estudo e descrición das linguas.			

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Basic understanding of how computers work	B3	C3	D1 D6
Database fundamentals	B3	C3	D5 D6
Capability to implement simple algorythims using a programming language	B3 B4	C3	D1 D2 D5 D6 D7 D17
Structured and modular programming fundamentals	B3	C3	D6 D7
Skills regarding the use of computer tools for engineering	B3 B4	C3	D5 D6
ENAEE learning outcome: KNOWLEDFE AND UNDERSTANDING: LO1.1- Knowledge and understanding of the mathematics and other basic sciences underlying their engineering specialisation, at a level necessary to achieve the other programme outcomes [Intermediate (2)].	B3	C3	
ENAEE learning outcome: ENGINEERING ANALYSIS: LO2.2.- Ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to recognise the importance of non-technical - societal, health and safety, environmental, economic and industrial - constraints [Intermediate (2)].	B4	C3	D1 D2
ENAEE learning outcome: ENGINEERING DESIGN: LO3.2.- Ability to design using some awareness of the forefront of their engineering specialisation [Intermediate (2)].	B4	C3	D1 D2
ENAEE learning outcome: ENGINEERING PRACTICE: LO5.2.- Practical skills for solving complex problems, realising complex engineering designs and conducting investigations in their field of study [Intermediate (2)].	B4	C3	D2
ENAEE learning outcome: COMMUNICATION AND TEAM-WORKING: LO7.2.- Ability to function effectively in a national and international context, as an individual and as a member of a team and to cooperate effectively with engineers and non-engineers [Intermediate (2)].			D7 D17

Contents

Topic	
INFORMATION NOTE	Due to circumstances that have arisen in the 2020-2021 academic year (delay in the date of incorporation of new students and the need to spend three weeks on a zero level course of mathematical-physical knowledge to allow the course to begin with guarantees), 85% of the 150 hours corresponding to a subject of 6 ECTS will be programmed: 128 hours.
Concepts and basic programming techniques applied to engineering	Objectives and development: This topic aims to explore the concepts and basic programming techniques and algorithms, as well as modular and structured programming methodologies. Topic index: Introduction to programming. Programming methodologies. - Modular programming. - Structured programming. Algorithms and its description. Programming languages. Phases in the development of a program. Conclusions.

Introduction to C programming language	Objectives and development: Once the student has mastered the basic concepts of programming, this unit introduces the C programming language. Most of this unit will be addressed in the practical sessions of the course. Topic index: Data types - Variables. - Expressions. - Operators. Structure of a C program. - Style in programming. - Basic instructions. - Sequential structure. The conditional structure. - Simple conditional structure. - Multi-conditional structure. The repetitive structure. - Repetitive structures controlled by condition. - Repetitive structures controlled by counter. Strings and arrays. - Strings. - Vectors and matrices. Structured programming. Modules and subroutines. - Definition of functions. - Passing parameters by value and by reference. Files. - Input and output with format. - Handling files. Conclusions.
Foundations of operating systems: concept, evolution and structure	Objectives and development: The objective of this unit is, on the one hand, to establish the concept of operating system, its functions and its aims, and on the other hand, to present its structure and main components to provide to the student with an overview. Topic index: Concept of operating system. History and evolution of the operating systems: types of systems. Components and services of the operating system. Structure of the operating system. Conclusions.
Basic computer architecture	Objectives and development: This unit is intented to present the structure and main components of a computer to provide to the student with an overview of its operation. Topic index: History and evolution of computers. Basic computer architecture. Main components. Conclusions.
Practice 0: Introduction to the computer lab and its tools.	Objectives and development: In the first session of laboratory the student will familiarise with the tools to be used during the course: Linux operating system, the command interpreter, gcc compiler and different text editors emacs, saw, nano, gedit, etc.
Practice 1: Variables. Data Input/Output.	Objectives and development: The fundamental goal of this session is that the student knows the different types of existent data, and that understands which functions allow to carry out the data input by keyboard and the data output by screen.
Practice 2: Flow diagrams.	Objectives and development: The goal of this session is that the student learns to develop flow diagrams in the design phase of a program.
Practice 3: Selective and repetitive structures.	Objectives and development: The main goal of these sessions is that the student understands the operation of the selective structures if-else and switch as well as the repetitive structures for, while and do-while.

Practice 4: Manipulation of strings and arrays.	Objectives and development: The main goal of this session is that the student understands how the mechanisms of manipulation of strings and arrays work in the C language.
Practice 5: Manipulation of files.	Objectives and development: The fundamental goal of this session is the familiarization with data files. The student learns to design and implement solutions to a problem where it is necessary to access to text file to read and/or write data, being also an objective that the student understands how the system calls work.
Practice 6: Programming project.	Objectives and development: This practice consists in the resolution of a more complex problem, posed so that its solution needs the cooperative work of two students (or three students, as an exception).

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	12	24	36
Practices through ICT	14	21	35
Project based learning	10	12	22
Seminars	10	0	10
Problem solving	6	0	6
Systematic observation	0	0	0
Essay questions exam	11	4	15
Essay questions exam	2	2	4

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Participatory masterclasses. In these sessions, the faculty will explain in detail the basic theoretical contents of the course, exposing clarifying examples that help to better understand the concepts. Computer presentations and the blackboard will be used, especially to transmit information like definitions, charts, algorithms, etc. When it is possible, a copy of the presentations will be given to the students in advance, focusing the effort of the professor and the students on the exhibition and understanding of the concepts. Anyway, the reproductions in paper of the presentations should not be considered like substitutes of the texts, but like complementary material.
Practices through ICT	Small participatory master sessions. Sometimes, it will be necessary to explain in the laboratory practical concepts giving useful advices for the best advantage of the practical classes. Supervised laboratory practices. The didactic method to be followed in the teaching of the practical classes consists in that the professor supervises the work and progress done by the different groups. The practices of laboratory are headed to strengthen the theoretical concepts tackled in the sessions in the classroom (with the master sessions as well as with the design of the project).
Project based learning	Project-based learning. As the course progresses, it will be proposed a project to be done in group (preferably of two people) that will last several weeks. We will use the educational methodology of project-based learning. The solution of the project will demand the contribution of the knowledge acquired by each member of the group, guaranteeing the positive interdependence that is required for the success of the collaborative work. On the other hand, the project will be evaluated guaranteeing the individual work and the positive interdependence, this is, all the members of the group must have worked and contributed to the final product and have to know all the aspects of the project. It will be provided material and bibliography, and it will exist the possibility of a public presentation of the project.
Seminars	An intensive course (10 hours long) is organized for those students who have failed the subject at first call, prior to the exam in second call. Group tutoring with the lecturer.
Problem solving	Resolutions of problems and/or exercises. These sessions, that take place in seminars and under the format of small group meetings, will serve for the resolution of questions about the project. Problems and exercises will be resolved by the students themselves.

Personalized assistance

Methodologies	Description

Problem solving	Regarding tutorials, it is possible to distinguish between academic and personalised tutorials. Students will be offered office hours so that they can ask every question related to contents, organisation and planning of the course. They can be one-to-one tutorials although group tutorials will be fostered in order to sort out the problems related to group activities or just in order to inform the instructor of the development of group work. Regarding one-to-one tutorials, each student will be able to talk to the instructor about any problem which is preventing her/him from coping with the subject properly, so that both can find a solution. By merging both kinds of tutorials, it is intended to compensate the different learning paces through measures of attention to diversity. The teachers will personally attend to the doubts and queries of the students, both in person, according to the timetable that will be published on the centre's website, and by telematic means (e-mail, videoconference, FAITIC forums, etc.) by appointment.

Assessment

	Description	Qualification	Training and Learning Results
Project based learning	The assessment of the programming project (practice 6) will be done by means of the following collection of strategies employed to value the process of project based learning: - Assessment of initial design of the project: 5% (Competencies CG3, CG4, CE3, CT1, CT6, CT7, CT17). - Delivered final product (code and report): 20% (Competencies CG3, CG4, CE3, CT1, CT2, CT5, CT6, CT7, CT17). - Improvements carried out over the initial specification of the project: 5% (Competencies CG3, CG4, CE3, CT1, CT2, CT5, CT6, CT7, CT17). - Project defense (personal interview): 10% (Competencies CG4, CE3, CT6, CT17). Since the project has to be evaluated so that it is guaranteed the individual work as well as the positive interdependence (this is, all the members of the group must have worked and contributed to the final product and have to control all the aspects of the project), in the session of oral presentation, all the members of the group will intervene and, in the defence session, any member of the group must be able to answer to any question regarding the project, independently of the part in which they were specialised. All of them must show, therefore, deep knowledge of the delivered product, independently of the part on which they had focused their efforts.	40	B3 C3 D1 B4 D2 D5 D6 D7 D17
Systematic observation	The participation and attitude of the student will be assessed during all the semester in theoretical classes and seminars as well as contributions in the online teaching platform.	5	B4 D2 D6 D7
Essay questions exam	Written exam: theoretical questions and problems The main goal of this exam is to assess the learning of all of the theoretical contents of the course. This exam must be complete, i.e., it will cover all of the contents, since the main goal is to assess what students know about the subject in general, not of a part of it. Second, the exam has to consist in a series of questions that make the conceptual and logical reasoning prevail, in order to verify the intellectual maturity of the students to obtain conclusions from the notions or the exposed theories in class.	35	B3 C3 D1 B4 D2 D6
Essay questions exam	The evaluation of the practices (with the exception of the practice 6 - project of programming) will be carried out through an examination of questions where it will be assessed the knowledge acquired by the student in the laboratory. This way, the instructor will ask about any aspect related to the practices implementation.	20	B3 C3 D1 B4 D2 D6

Other comments on the Evaluation

The evaluation criteria of each section will be published at the beginning of the semester.

The final assessment of student will be the sum of the punctuation awarded to each one of the before commented parts, being their grade of continuous evaluation (CEG): CEG = 0,35 * THEORY EXAM GRADE + 0,4 * PROJECT GRADE + 0,2 * PRACTICAL EXAM GRADE + 0,05 * PARTICIPATION.
However, some minimum requirements in any of the sections will be demanded to guarantee the balance between all the types of competencies. Those requirements are: 1. To get at least a 5 over 10 in the project evaluation. 2. To get at least a 4 over 10 in the theory exam.
Those students that do not fulfil any of the previous requirements, will have to attend to the ordinary examination to be able to pass the course, and their grade of continuous evaluation will be calculated as follows: FINAL_CEG = min(4,CEG).
All those students that wish to improve their qualification (obtained by continuous evaluation) will be able to attend to the ordinary exam. So much in the ordinary exam as in the extraordinary (July) all the competencies of the course will be

evaluated. Thus, said examinations will include a practical programming test in the laboratory. Once finished the second semester, an intensive course (10 hours long) is organized to prepare the extraordinary exam.
ETHICAL COMMITMENT: it is expected that the students show an appropriate ethical behaviour. If any unethical behaviour (cheating, plagiarism, use of unauthorized electronic devices or others) is detected, the student will be punished with the impossibility to pass the course by continuous evaluation (where she/he would obtain a qualification of 0.0). If this type of behaviour occurs in ordinary or extraordinary exams, the student will obtain a qualification in the academic record of 0.0.

Sources of information

Basic Bibliography

Osvaldo Cairó, **Fundamentos de Programación: Piensa en C**, 978-9702608103, Pearson Prentice Hall, 2006

Complementary Bibliography

A. Silberschatz, P. Galvin, y G. Gagne, **Operating Systems Concepts**, 978-0470128725, 8ª edición, John Wiley & Sons, 2008

Gregorio Fernández Fernández, **Curso de Ordenadores. Conceptos básicos de arquitectura y sistemas operativos**, 84-7402-304-1, 5ª Edición, 2ª Edición en el Servicio de Publicaciones de la E.T.S.I. Telecomunicación. UPM, 2004

Recommendations

Other comments

This course has no prerequisites and no prior knowledge about the course is expected. The knowledge and skills that are acquired will allow the student to develop with guarantees skills of later courses in which the management of a computer and / or computer applications related to engineering is required.
To be able to successfully complete the course, it is recommended that students have:
- a well-developed written and oral comprehension capacity,
- capacity for abstraction and synthesis of information,
- skills for group work and for group communication.

Contingency plan

Description

In case the situation caused by COVID-19 results in the suspension of on-site activity, the following aspects must be considered.

ADAPTATION OF THE CONTENTS

The modification of the theoretical contents of the course is not considered necessary, given that the theoretical and seminar classes could be carried out by telematic means in a similar way to face to face.

The practices would be adapted in time and complexity to the situation of non physical attendance to be carried out by means of e-learning platforms, in a similar way to the face to face one.

The virtual machine, which is provided to the students, will allow them to work autonomously, especially in the programming project, and to carry out the practices remotely.

ADAPTATION OF TEACHING METHODOLOGIES

The following teaching methodology will be included:

Synchronous virtual masterclasses/practices: It is given through a web video-conference platform. Each virtual classroom contains various display panels and components, that can be customized to best suit the needs of the class. In the virtual classroom, the teacher (and those authorized participants) can share their computer screen or files, use a whiteboard, chat, stream audio and video, or participate in interactive online activities (surveys, questions, etc.).

Theoretical and seminar classes will be conducted via participatory video conferencing. For the practical sessions, the same platform will be used with the support of the virtual machine distributed to the students.

ADAPTATION OF THE EVALUATION

The modification of the evaluation system is not considered necessary, but its format should be changed, since it would be carried out remotely by telematic means combining the FAITIC-Moodle e-learning platform and the Remote Campus of the