Course guide
330234 - SO - Operating Systems

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Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: BACHELOR'S DEGREE IN ICT SYSTEMS ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Spanish, English

LECTURER

Coordinating lecturer: Demirkol, Ilker Seyfettin

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. The ability to analyze, design and maintain computer applications as well as knowledge of the principles and tools of software engineering and its application.
2. Knowledge and ability to use existing tools and instrumentation for the analysis, design, development and verification of electronic, computer and communications systems.
3. The ability to perform the typical activities of the degree, taking into account the corresponding standards, rules and regulations.
4. Knowledge of the structure and functions of operating systems and the ability to use their services to solve problems
5. The ability to perform the typical activities of the degree, taking into account the corresponding standards, rules and regulations.

Transversal:
6. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
7. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.
8. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

The course consists of face-to-face activities consisting of 2 hours a week in the classroom (large group) and 2 hours a week in the laboratory (small group). The student learns through various mechanisms. In the participatory lecture classes in the classroom, the contents of the subject are presented, where teaching methods of cooperative learning and active learning are used. These methods will allow interaction among students, and between students and the teacher.

In the laboratory classes the students carry out a previous work that helps to put in context the work that is intended to be carried out in the laboratory. The laboratory activity itself is carried out in groups of two students and allows them to experiment with certain aspects developed in the subject.

Through the projects, students will practice project-based learning. The projects will provide students with the opportunity to develop a solution to realistic engineering problems. The writing of the memory and the presentation of the projects allow working the oral and written communication skills.

LEARNING OBJECTIVES OF THE SUBJECT

After finishing this course, the student will:
1. Understand the fundamentals and structure of operating systems and how to apply them to solve engineering problems.
2. Obtain and interpret technical information and communicate results both orally and in writing.
3. Write simple technical reports and present them orally (in a third a language, as well).

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	30,0	20.00
Hours small group	30,0	20.00

Total learning time: 150 h

CONTENTS

TOPIC 1: Introduction to Operating Systems

Description:
The concept of the operating system is presented and an outline is given of its function, the agents that interact with it, and the different types that exist. The structure of the class will also be explained.
Keywords: Operating system, user, shell.

Specific objectives:
Once the topic is covered, the student is expected to:

1. Understand what an operating system is, what functionality it offers and what typologies of systems exist.

Related activities:
All the relevant ones.

Full-or-part-time: 10h
Theory classes: 2h
Laboratory classes: 2h
Self study : 6h

TOPIC 2: Shell use

Description:
The general aim of this topic is to introduce the concept of the shell and understand the general features of its use, both interactively and in shell-script mode. The main elements emphasized will later play a more relevant role throughout the rest of the course.
Keywords: Shell, process, file, pipe, device.

Specific objectives:
Once the topic is assumed, the student will:
1. Know how to write small programs for the shell.
2. Understand the concepts of process, file and device.
3. Know how to combine processes using pipes.
4. You must know the most frequent system orders.

Related activities:
All the relevant ones.

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

TOPIC 3: Operating system services

Description:
The aim of this topic is to introduce students to the main services offered by operating systems, focusing specifically on files, processes and devices, as well as some inter-process communication tools.
Keywords: File, process, fork, exec, device, pipe, semaphore, lock, signal.

Specific objectives:
Once the topic is done, the student will:
1. Be able to design and implement C-written applications that take advantage of the operating system services.
2. Know the main services of the operating system and its semantics.

Related activities:
All the relevant ones.

Full-or-part-time: 60h
Theory classes: 12h
Laboratory classes: 12h
Self study : 36h

TOPIC 4: Operating system implementation

Description:
The topic is aimed at showing students the most common techniques for implementing operating system services, specifically how to implement processes, concurrency control mechanisms, memory and device management. Keywords: File, process, fork, exec, device, pipe, semaphore, lock, signal.

Specific objectives:
Once the topic is covered, the student is expected to:
1. Understand the main techniques of implementing an operating system.
2. Be able to apply the learned techniques to small implementations.

Related activities:
All the relevant ones.

Full-or-part-time: 60h
Theory classes: 12h
Laboratory classes: 12h
Self study : 36h

ACTIVITIES

LECTURES

Description:
Face-to-face sessions specifically focused on understanding the subject content, especially the more theoretical content.

Material:
The support materials are:
- Main references of the subject.
- Collection of problems of the subject.

Delivery:
Occasionally, quizzes will be conducted.
The grades obtained in these activities corresponds the variable QUIZ.

Full-or-part-time: 30h
Theory classes: 30h

LABORATORY WORK

Description:
Students must solve short exercises that complement the subject contents and help improve their comprehension thereof. Practicals are held in the laboratory and involve the actual implementation of programs on the computer and their verification. This may mean completing practicals during independent learning time.

Delivery:
During the lab sessions, the achievement of the objectives will be assessed taking into account the degree of understanding of the work demonstrated for each student.
At the end of each practice, each group will give the teacher a file explaining the work done and the knowledge gained.
The grade obtained in these activities defines the overall grade variable LAB.

Full-or-part-time: 30h
Laboratory classes: 30h

COMPLETION OF PROBLEMS

Description:
Programming problems that students must solve on their own, usually without needing to use a computer.

Delivery:
1. The project report.
2. The source code resulting from the project.
3. An explanation of the code.
The report, the code and the explanation are evaluated. The evaluation determines the PRJ parameter of the final grade.

Full-or-part-time: 36h
Self study: 36h

INDEPENDENT STUDY

Description:
Independent study consists of studying to understand and solidify knowledge, vocabulary and techniques either alone or in a group.

Material:
The support materials are:
- Main references of the subject.
- Collection of problems of the subject.

Full-or-part-time: 44h
Self study: 44h

EXAM

Description:
There will be a final exam consisting of a set of exercises to be solved on paper without any support material, in a short amount of time and on working alone.

Delivery:
The individual exam solutions are delivered and evaluated.
The exam grade corresponds to the course grade variable FIN.

Full-or-part-time: 10h
Self study: 10h

GRADING SYSTEM

The final grade is calculated with the following weights:

Overall grade = 0.30 * QUIZ + 0.25 * PRJ + 0.25 * FIN + 0.20 * LAB

EXAMINATION RULES.

The activities will be carried out following the uses and customs of academic work and, in particular, the following guidelines will be respected:

* Those activities that are explicitly declared as individual, whether they are face-to-face or not, will be carried out without any collaboration by other people.
* The dates, formats and other delivery conditions established will be mandatory.
* If any of the activities of the subject is not carried out, it will be considered graded with zero.
* The completion of laboratory activities is a necessary condition to pass the course.
* The use of the computer laboratory will be reserved exclusively for academic activities and in no case may abusive use be made.

BIBLIOGRAPHY

Basic:
- Bovet, Daniel P.; Cesati, Marco. Understanding the Linux kernel [on line]. 3rd ed. Bejing: O'Reilly, 2005 [Consultation: 27/05/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=443134. ISBN 9780596005658.
- Stevens, W. Richard; Rago, Stephen A. Advanced programming in the UNIX environment. 3rd ed. Uper Saddle Rive: Addison-Wesley, 2013. ISBN 9780321637734.
- Silberschatz, Abraham; Galvin, Peter B; Gagne, Greg. Operating system concepts: global edition. Global edition (tenth edition). Hoboken: John Wiley & Sons, [2019]. ISBN 9781119454083.

Complementary:
- Harbison, Samuel P.; Steele, Guy L. C: a reference manual. 5th ed. Upper Saddle River: Prentice-Hall, 2002. ISBN 013089592X.