COURSE DATA

Data Subject	
Code	34887
Name	Operating Systems
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1403 - Degree in Telematics Engineering	School of Engineering	2	Second term

Subject-matter

Degree	Subject-matter	Character
1403 - Degree in Telematics Engineering	12 - Programming	Obligatory

Coordination

Name	Department
MARTINEZ DURA, RAFAEL JAVIER	240 - Computer Science

SUMMARY

The course "Operating Systems" is a compulsory 6 ECTS, taught in the second quarter of second-degree course in Informatics Engineering and Telematics Engineering. In the degree in Telematics is part of the matter "Programming"

The course covers the operating systems from three complementary viewpoints:

- The operating system as an interface for developing and running applications. From this point of view we consider the basic abstractions provided by the operating system (processes, memory, files and input / output) and the services related to them.
- The operating system as a control system that manages the use of computer resources and relies on the hardware (hardware) to ensure the proper functioning of the system.
- The OS as a program. Therefore it also takes into account aspects such as its internal structure, and the data structures and algorithms used to perform their functions.

Overall Objectives

- Show what an operating system is and what services it offers, providing an overview of the functioning of today's computers and, specifically, the roles played by the operating system.
- Show basic abstractions provided by the operating system and what operations can be done with them, emphasizing the role of the operating system as a platform for developing and running applications.
- Show the correspondence between these basic abstractions and the physical components of a computer, illustrating how the operating system requires hardware support to provide these abstractions. And how operating systems manage the physical resources available, with special emphasis on the efficiency and cost of the different solutions.
- Analyze current concepts and relate them to older ones, highlighting the benefits of new solutions and why they were introduced.
- To enable the student as a user and as a programmer in the operating system environment.
- To initiate the student in the administration of operating systems and its security.

Contents

- Introduction
- Processes and threads
- Processor scheduling
- Memory Management
- Process communication and synchronization
- Input/ouput management
- Filesystems
- Security
- Virtualization

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is recommended to have completed the following courses: Computer Science, Advances in Computer Science and Programming.

OUTCOMES

1403 - Degree in Telematics Engineering

- R1 - Ability for self-learning of new knowledge and techniques appropriate for the conception, development and exploitation of telecommunications systems and services.
- G3 - Acquisition of the knowledge of the basic and technological subjects that allows students to learn new methods and theories and endows them with the versatility to adapt to new situations.
- G4 - Ability to solve problems with initiative, decision-making and creativity, and to communicate and transmit knowledge, abilities and skills, understanding the ethical and professional responsibility of the activity of a telecommunications technical engineer.
- R2 - Ability to use communication and computer applications (offimatics, databases, advanced calculation, project management, visualization, etc.) to support the development and exploitation of telecommunications and electronics networks, services and applications.
- R3 - Ability to use computer tools to find bibliographic resources and information related to telecommunications and electronics.
- E6 - Ability to design networks and telematic services architectures.
- E7 - Ability to programme networked and distributed telematic services and applications.

LEARNING OUTCOMES

This course allows for the following learning outcomes:

1. Describe what an operating system (OS) is and what its role is, being able to compare major operating systems. (R1, R2, R3, G3)
2. Explain what are processes and threads and how they are managed by the operating system, and write simple programs which use the services to manage processes and threads. (R1, R2, R3, G3, G4, E6)
3. Explain the advantages and disadvantages of several scheduling algorithms and evaluate their suitability based on certain objectives. (R1, R2, R3, G3, E6, E7)
4. Explain the advantages and disadvantages of the different mechanisms of memory management including virtual memory. (R1, R2, R3, G3)
5. Describe the different communication and synchronization mechanisms and select which one to use in a particular case, being able to design and implement concurrent algorithms that use them. (R1, R2, R3, G3, E6, E7)
6. Explain the differences among different I/O devices based on how they are managed by the operating system and what is the structure of the I/O. (R1, R2, R3, G3, G4, E6, E7)
7. Explain the basic abstractions provided by filesystems and the services related to them, and compare different file systems. (R1, R2, R3, G3)
8. Explain the objectives of operating systems security, compare different security policies and choose the most suitable for each case. (R1, R2, R3, G3, G4, E6, E7)
9. Explain the concept of virtual machine and the differences among different types of virtualization, identify situations where it is beneficial to use virtualization and select the most appropriate type for

each case. (R1, R2, R3, G3)

To complement the above results, this subject also allows to acquire the following dexterities and social skills:

Dexterities:

- Understanding what an operating system (OS) is, being able to compare among major operating systems.
- Using operating system services for sequential and concurrent application development.
- Understanding the relationship between OS services and hardware, as well as the relationship among the abstractions, getting an overall knowldedge of how an operating system works.
- Compare and select the most appropriate algorithms for the management of processes and threads, memory, I/O and filesystems.
- Install, configure and perform basic system administration taking into account operating system security.
- Solve problems that span different concepts of the subject.
- Analyze the reasons for low performance or malfunctioning of operating systems.
- Compare and select different virtualization solutions and use some of them to create and maintain virtual machines.

Social skills:

- Being able to justify in writing the work done, including the analysis of different options and why one of them was selected.
- Being able to discuss issues orally on the subject.
- Being able to collaborate with others in problem solving and implementation of programs, participating in the organization and review of group work.

DESCRIPTION OF CONTENTS

1. Introduction

Theory and problems (3T)
- Definition and purpose of operating systems
- Milestones in the development of operating systems
- Operating system performance

Laboratory
- Creating a virtual machine and installing a Linux operating system (2.5 hours)
- Shell scripting(2.5 hours)
- C Language (2.5 hours)

2. Processes and threads

Theory and problems (2T +1 P)
- Concept of process Concept
- Creating and destroying
- Context change
- Multithreaded processes
- Creating and destroying threads
- Advantages and disadvantages of using multiple threads

3. Processor scheduling

Theory and problems (4T+2P)
- Short, medium and long-term scheduling
- Scheduling algorithms for single processsor systems
- Multiprocessor and real-time scheduling

Laboratory
- Process and thread creation (2,5 hours)

4. IPC and synchronization

Theory and problems (4T +2 P)
- Concept of concurrency
- Communication and synchronization models
- Mutex and condition variables
- Message Passing
- Other mechanisms of communication and synchronization
- Deadlocks

Laboratory
- Concurrent Programming (2.5 hours)

5. Memory

Theory and problems (4T +2 P)
- contiguous allocation
- segmented model
- paged model
- virtual memory

6. Filesystems

Theory and problems (4T +1 P)
- Filesystem concept
- Logical description: files, folders, aliases, indirect files
- Physical Description: filesystem structure, free space management, space allocation
- Example cases

Laboratory
- Filesystems (2.5 hours)

7. Security

Theory and problems (2T +1 P)
- authentication
- access control

Laboratory
- Introduction to System Administration (2.5 hours)
- Security (2.5 hours)

8. Input/output

Theory and problems (3T)
- Requirements and general structure
- Device Drivers
- Device-independent I/O software, access control, synchronous and asynchronous I/O
- User-mode code, system and I/O libraries, queue management

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Classroom practices	10,00	100
Development of individual work	8,00	0
Preparation of evaluation activities	12,00	0
Preparing lectures	30,00	0
Preparation of practical classes and problem	40,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Theoretical classroom activities will be used to introduce the main points of the subject, providing a global and inclusive vision, analyzing in detail key issues, encouraging student participation. These activities are complemented by practical activities in order to apply the basics and expand the knowledge and experience. They include the following types of classroom activities:

- Problem-solving sessions. (Individually and in groups). (R1, R2, R3, G3, G4)
- Labs. (In couples). (R1, R2, R3, G3, G4)
- Evaluation tests. (R1, R2, R3, G3, G4)

In addition to classroom activities, students must perform personal homework (directed bibliographic research, questions, problems, preparation of classroom activities, study). These tasks will be primarily on an individual basis, in order to promote autonomous work, but they will also include work requiring the participation of small groups of students (2-4) to build team work skills. (R1, R2, R3, G3, G4)

The e-learning platform of the University of Valencia will be used to support communication with students. This platform will provide access to course materials.

EVALUATION

The evaluation of the subject will be carried out on the first call by:

• Assessment of theory and problems (TP).

This part will have a weight of 75% of the final grade and it will be necessary to reach a 4 out of 10 to average. In turn, the weights of this part are divided into:

o 30% for continuous assessment (CE), based on participation and degree of involvement in the teaching-learning process, taking into account regular attendance at planned face-to-face activities and resolution of proposed questions and problems.

70% of this part corresponds to academic work and problems done at home

30% corresponds to class attendance (either face-to-face or by videoconference)

o 70% for the individual objective tests that will consist of both theoretical-practical questions and problems.

33% of this part corresponds to the first partial T1 (it is done at the end of the first half of the semester) and contains the first 3 topics. It will be necessary to take a minimum of 4.5 to remove material from the final test.

33% of this part corresponds to the second partial T2 (it is carried out during the second half of the semester) and contains topics 4 and 5. It will be necessary to take a minimum of 4.5 to remove material from the final test.

33% - 66% - 100% (depending on the subject eliminated) of this part corresponds to the Final Test of the final topics of the course and of the partial T1 and T2 where the 4.5 has not been passed. Additionally, a student may request a week in advance the repetition of any of the T1 and T2 tests, thus cancelling the previous grade of said test.

• Evaluation of practical laboratory activities (L) based on the achievement of objectives in laboratory sessions.

These activities will be carried out in pairs, their weight will be 25% of the final grade and it will be necessary to reach a 4 out of 10 to average (both in the first and second calls). All laboratory sessions will have the same weight on the final grade.

In case of not being able to attend a session, the student may submit the corresponding work to their laboratory teacher. The delivery must be in person, during tutoring hours and the student must be prepared to answer questions about the practice and to carry out parts of it at the moment (with small changes). This type of delivery must be made before any laboratory group has carried out the practice and will have a 20% penalty.

In the second call the subject will be evaluated in the same way as in the first call, with the following exceptions:

• The mark of the continuous evaluation will be calculated without taking class attendance into account, so the weight of the academic work will be 100%. A deadline for submitting new works will be opened if you want to improve the grade, but it will be taken into account that there will be a 40% penalty. The delivery limit will be the day before the examination of the second call.

• The exam of the second call will follow the same rules as in the first call, so it will only be evaluated for the parts of the subject not previously approved. In the same way, you can also request the repetition of some part to improve the grade.

• An internship delivery period will be opened with the same conditions as in the 1st call (logically they will not be carried out in the laboratory), except that the penalty will be 30%. The delivery limit will be the day before the examination of the second call.

Anyway, the evaluation system is managed by what is written in the “Reglament d'Avaluació i Qualificació de la Universitat de València per a Graus i Màsters” (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639)

REFERENCES

Basic

- Sistemas Operativos. William Stallings. Prentice Hall.

- Fundamentos de Sistemas Operativos. Abraham Silberschatz, Peter Baer Galvin y Greg Gagne. John Wiley & Sons.
- Sistemas Operativos. Una visión aplicada. Jesús Carretero, Félix García, Pedro de Miguel y F. Pérez. McGraw-Hill.

Additional

- Programación estructurada en C. James L. Antonakos, Kenneth C. Mansfield. Prentice Hall.
- Unix and Linux System Administration Handbook, Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley. Prentice Hall. (Libro electrónico).
- Administración de sistemas Linux, Evi Nemeth, Garth Snyder y Trent R. Hein. Anaya.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contents

The contents initially included in the teaching guide are maintained.

Workload and temporary teaching planning

The different activities described in the teaching guide are maintained with the planned dedication.

The material for the follow-up of the classes of theory/practices allows to continue with the professor of temporary planning so much in days as in schedule, so much if the teaching is face-to-face in the classroom or if it is not.

Teaching methodology

In classroom theory and practices, students will tend to have the maximum physical attendance possible, always respecting the sanitary restrictions that limit the capacity of the classrooms as indicated by the competent public health authorities to the estimated percentage of their usual occupation.

Depending on the capacity of the classroom and the number of students enrolled, it may be necessary to distribute the students into two groups. If this situation arises, each group will attend classroom theory and practical sessions with physical presence in the classroom by rotating shifts, thus ensuring compliance with the criteria for occupying spaces.

The rotation system will be established once the actual enrollment data is known, guaranteeing, in any case, that the attendance percentage of all the students enrolled in the subject is the same.

With respect to laboratory practices, attendance at sessions scheduled in the schedule will be totally face-to-face.

Once the actual enrollment data is available and the availability of spaces is known, the Academic Committee of the Degree will approve the Teaching Model of the Degree and its adaptation to each subject, establishing in said model the specific conditions in which it will be developed teaching the subject.

If there is a closure of the facilities for sanitary reasons that totally or partially affects the classes of the subject, these will be replaced by non-contact sessions following the established schedules.

Evaluation

The evaluation system described in the teaching guide of the subject in which the different evaluable activities have been specified as well as their contribution to the final grade of the subject is maintained.

If there is a closure of the facilities for health reasons that affect the development of any face-to-face evaluable activity of the subject, it will be replaced by a test of a similar nature that will be carried out in virtual mode using the computer tools licensed by the Universitat de València.

The contribution of each evaluable activity to the final grade for the course will remain unchanged, as established in this guide.

Bibliography

The bibliography recommended in the teaching guide.