

**Operating Systems**

Code: 102747  
ECTS Credits: 6

Degree	Type	Year	Semester
2502441 Computer Engineering	OB	2	1

**Contact**

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**Teaching groups languages**

You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

**Teachers**

Porfidio Hernandez Bude

**External teachers**

Alvaro Wong

Carles Carrillo

Christian Guzmán

Cristina Peralta

Joan Piedrafita

Xiaoyuan Yang

**Prerequisites**

Previous content:

- Students should be familiar with Fundamentals of Computers, Fundamentals of Computing and Programming Methodology

**Objectives and Contextualisation**

Students will become familiar with the services provided by the Operating System attending its functional description. We will cover management policies applied to system basic modules. Important concepts include: process and thread model, communication and synchronization between processes and threads, memory system, file systems, and some advanced aspects of the Operating Systems.

## Competences

- Acquire personal work habits.
- Capacity to design, develop, select and evaluate computer applications and systems, ensuring reliability, security and quality, in accordance with ethical principles, and applicable standards and legislation.
- Have the capacity to define, evaluate and select hardware and software platforms for the development and execution of computer systems, services and applications.
- Know and apply the basic and main techniques of parallel, concurrent, distributed and real time programming.
- Know and apply the functional and structural characteristics of distributed systems and computer and Internet networks, and design and implement applications based on these.
- Know the characteristics, functionalities and structure of operating systems and design and implement applications based on their services.

## Learning Outcomes

1. Create thread and socket based applications, including mutex primitives and condition-type variables.
2. Desenvolupar estratègies d'aprenentatge autònom.
3. Design, develop, select and evaluate computer systems, ensuring their reliability, security and quality.
4. Determine the influence of the operating system on the run performance of applications.
5. Evaluate an operating system on different work levels: user, advanced user, programmer, advanced programmer, etc.
6. Know and apply the basic and main techniques of concurrent and distributed programming.
7. Know and apply the characteristics, functionalities and structure of distributed hardware systems and computer networks to design and implement applications based on the same.
8. Know and understand the concepts related with computer networks, knowing how to situate them in a hierarchical system of protocols.
9. Prevent and solve problems.
10. Work with commands and command sequences (Shell Scripts), and with the programming interface (API) of the operating system.

## Content

1-Subject presentation

Description of contents and subject methodology

2-Introduction to Operating Systems

Introduction to main O.S. concepts. User view. OS kernel. Virtualization.

3. Process management

Processes, threads and Containers. System calls.

#### 4. Concurrency

Critical section problem. Producers/consumers. Communication and synchronization.

#### 5. CPU Scheduling

Resource planning, scheduling levels and policies: FCFS, RR, SSTF, SRTF, feedback queues. Multiprocessor scheduling

#### 6. Memory management.

Mono/multiprogramming models. MFT, MVT systems. Paging and segmentation. Virtual memory. Paging and Segmentation on demand

#### 7. File Systems

Files and folders. System calls. Space management algorithms. Acceleration techniques

#### 8. Advanced topics

Introduction to Distributed Systems

### Methodology

Theory classes will be based on lectures, although students will be encouraged to actively participate in the resolution of examples and practical questions. Theory classes will be scheduled in the official subject planning published in the Engineering school degree web site. The syllabus is detailed in the session list that will be available the first day of class.

Problem sessions are defined in the timetable published in the Engineering school degree web site. Problem sessions are organized in small groups of students following alphabetical order of surnames. The list of problems to be solved during sessions will be published the first day of class. This list will be the guide of the practical work during the course.

Laboratory sessions will be distributed in different sessions during the course following the timetable published in the Virtual Campus of the subject. Lab teachers will generate the list of students and sessions to attend. All laboratory work will be done in groups of two students

Sessions cannot be recorded (images, video, audio) without the explicit permission from the teachers.

Communications and results of assessment will be published in the virtual campus subject space. This will be the default channel of communication between students and teachers. Any specific question must be address from and to an UAB institutional address.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

### Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lab sessions	10	0.4	5, 6, 7, 1, 2, 10

Theory lectures	22	0.88	5, 6, 7, 8, 1, 4, 3, 9
problem classes	10.5	0.42	5, 6, 7, 1, 4, 9, 10
Type: Autonomous			
Autonomous	100	4	5, 6, 7, 8, 1, 2, 4, 3

## Assessment

### a) Assessment process and activities

The subject is composed of the following activities:

Theory: 50% of the final grades. It is divided into two written examinations where each of the tests corresponds to 25% of the final grades.

Problems: 15% of the final grades

Laboratory: 35% of the final grades. 17% belongs to the evaluation of the work done in the sessions and 18% of a lab exam.

Students must have a minimum grade of 5 in theory and problems and a final global mark of 5.0 to pass the subject. In case of not obtaining this minimum, the numerical value in the student record will be the lower value between 4,5 and the average of the grades.

Theory evaluation will be done in the form of two written partial examinations. The test scheduling and the topics to be evaluated in each of the tests will be described in the subject planning sheet. Theory final grade will be the average of the theory tests. It is important to state here that second test will not cover the first part of the theory of the subject.

Laboratory work: Last year students can compensate last year marks by request to the theory coordinator. Lab group teams will be managed using the virtual campus. Activation date to register in a specific lab will be public in the news part of the subject in the virtual campus. Remember that attendance is compulsory for all the sessions for all the group members.

Laboratory sessions are of compulsory attendance. Students must show the adequate work of lab deliveries that will be verified by the lab teachers. Each student in the lab also must correctly answer the questions of the teachers and must deliver in due time a written report of the lab sessions. Contents of the report will be:

Objective of the lab

Description and proposed work: pseudo code, block design

Descriptions of the reasons of the answers to the questions in the report

Description of the procedures used and their functionality.

Description of the problems found during the lab sessions and solutions proposed for the problems.

Conclusions of the work done in the lab

Source code of the work

Procedure steps of building an application from provided source code

Lab teachers will evaluate the individual work done of each student. Aspects like session attitude, technical level of the work done, level of participation in the sessions, answers given to questions and descriptions done in the lab reports. Lab assessments do not have a re-examination.

### b) evaluation activities calendar

The actual calendar of the evaluation activities will be published the first day of class in the virtual campus and in the Engineering school website. These dates could be modified, so any modification on calendar will be published in the virtual campus that will be the main channel of official documentation and notifications

between students and teachers.

c) final examination process

Theoretical content of the subject will be evaluated in two different exams during the course. The second test will not cover the topics of the first part of the subject. Students will need a minimum score of 3.0 of the theory partial exams to re-examine.

Those students that have not reached the minimum grade to pass the subject will have a final examination of the subject theory at the end of the semester. Students will have to take a final exam of each part of the subject previously evaluated with a grade smaller than a 5.0. Students must get a grade above 5.0 to pass the theoretical part and calculate the average with problems and labs for the final subject evaluation grade.

Labs and classroom problem deliveries are not re-examined.

d)Qualification revision

For each evaluated activity, there will be a place, date and hour for the students to review the activity with the teacher. If the student does not attend the revision date the activity will not be revised again.

e)Qualifications

A student can get the maximum qualification when the final grade is above 9. In order to provide a selection of this qualification we will consider the maximum amount of honor qualifications that can be given following the general UAB regulations.

Given the continuous evaluation methodology used in this subject, if a student delivers any evaluable proof of work like problem test, lab report or theory test it will be interpreted as the student will be evaluated and to get a different evaluation than Non-Evaluable (NA). A NA qualification can only be obtained when absolutely no delivery is made during the semester.

Last, it is important to consider the importance of correct formal expression in any delivery provided by students. The quality of the text of the deliveries will be evaluated. All errors found related to grammar, spelling or low quality text expressions will account up to 20% of the final grade.

f) Irregular behavior and plagiarism

According to the current UAB norms, and apart from any other disciplinary measures, any plagiarism activity detected in an evaluated activity will be qualified as zero (0). Activities qualified in this way will not be reexamined during the course. If plagiarism is detected in a compulsory activity, the subject will be considered not passed and there will be no further opportunities to get a new evaluation during the course. These activities include, among others:

Total or partial copy of a lab, report or any other evaluation activity

encourage any plagiarism activity

deliver a group work not done by all the components of the group

deliver material of others as it was done by the components of the group, being those translations or adaptations.

Have communication devices during the individual evaluation tests: smartphones, smart watches, cameras installed in pens, etc.

Speak with students during evaluation tests or exams

Copy or try to copy from other students during the evaluation tests or exams

Use or try to use written material during the evaluation tests or exams when these have not been explicitly permitted

In summary, any plagiarism activity in any of the evaluation activity will be equivalent to the impossibility of passing the subject, without any opportunity of re-examine in the same course and without any compensation of any part of the subject in the next courses.

g) Evaluation of students from last courses

Students taking the subject during a second year must deliver all problem and labs assessments to pass the subject.

f) Single assessment

Single assessment of the subject will have the following activities:

theory: exam, 50% of final grades

problems: exam, 15% of final grades

labs: exam, 35% of final grades

re-examination: the same system of the continuous assessment will be applied.

final assessment revision: the same system of the continuous assessment will be applied.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
2 theory test evaluations	50%	4	0.16	5, 7, 8, 2, 4, 3
Lab evaluation	35%	2	0.08	5, 6, 1, 10
Problem assessment	15%	1.5	0.06	5, 6, 7, 8, 2, 4, 3, 9

## Bibliography

Teoria:

- "Sistemas Operativos", Pedro de Miguel Anasagasti, Fernando Pérez Costoya. D. Arquitectura y Tecnología de Sistemas Informáticos, ETSE, UPM. 2016. Bajo licencia Creative Commons NoComercial Compartirlgual 4.0.
- "Sistemas Operativos: una visión aplicada". Tercera edición. Jesús Carretero Pérez, Félix García Carballeira, Fernando Pérez Costoya, 2021.
- "Operating System Concepts", Avi Silberschatz, Peter Baer Galvin, Greg Gagne, Tenth Edition, John Wiley & Sons, Inc, April 2018, ISBN: 978-1-119-32091-3 (e-book)
- "Sistemas Operativos". William Stallings, 5a Edición Prentice Hall 2005

Pràctiques:

- "El entorno de programación Unix", R. Pike & Brian Kernighan, Ed. Mc. Graw-Hill
- "Docker in Practice". Ian Miell. Aidan Sayers. Manning 2019. Disponible a la biblioteca com e-book
- "Advanced Unix programming", Rockind M. Ed. Prentice-Hall
- "Administración avanzada del sistema operativo GNU/Linux". Remo Suppi, Josep Jorba. Universitat Oberta de Catalunya, setiembre 2014. <http://hdl.handle.net/10609/61266>

## Software

In the subject, we will use the latest version of the following tools and systems:

-Windows 11 with PowerShell 7 and WSL

-Ubuntu Linux v. 20

-Docker containers