Course Guide

1. Descriptive information on the subject

- **Academic year:** 2011-12
- **Subject's name:** Operating Systems **Subject's code:** 21421, 21724, 21653
- **Type of subject:** Optative subject in Bachelor's degree in Computer Science and Bachelor's degree in Telematics Engineering. Optional subject in Bachelor's degree in Audiovisual Systems Enginnering
- **Degrees:** Bachelor's degree in Computer Science, Bachelor's degree in Telematics Engineering and Bachelor's degree in Audiovisual Systems Enginnering
- **Number of ECTS credits:** 4
- **Time commitment :** *(number of ECTS x 25)* 100
- **Timing:**
    - Year: 2nd year
    - Type: Term
    - Period: 2nd term
- **Coordinator:** Rafael Ramirez
- **Department:** Department of Information and Communication Technologies
- **Teaching staff:** Rafael Ramirez, Xavier Perramón, Josep Prados and Oriol Martinez
- **Group:** (selection of the group which is assigned in the syllabus)
- **Languages:** Catalan, Spanish and English
- **Building where the subject is taught:** Roc Boronat

2. Presentation of the subject

Operating Systems is a compulsory subject offered during the course of Engineering in Computer Science and Telematics Engineering, being part of the second year of these degrees. The subject deals with the organization, structure and characteristics of operating systems, management and administration of processes and memory. The subject has a theoretical component and another practical. Within the theoretical component, the emphasis is on understanding the concepts more in an intuitive level than the strict use of mathematical language.

The subject consists of three main activities: lectures, seminars and laboratories. In the lectures, the formal concepts and examples of its application will be introduced. In the seminars, students solve small problems. Each problem corresponds to one of the concepts introduced in lectures. The labs are also problems of a more computational complexity because students have the opportunity to put the learned concepts into practice.

3. Previous requirements to follow the formative itinerary

The previous knowledge to follow the subject is certain notions that have been acquired during the first year of degrees. In particular, the previous knowledge required for the subject is:

- Programming basics: Syntax and semantics of languages, program development, data structures, manipulation algorithms and files.
- Basic arithmetic.
- Capacity to understand and write basic mathematical expressions at an element level.

This subject assumes the assimilation of concepts learned in Programming Fundamentals as well as in Structure of Data and Algorithms.

4. Competences to be obtained in the subject

The main objective of the subject is that students acquire the fundamental aspects related to the operating systems: parts of operating systems, processing, processing synchronization, CPU scheduling, deadlocks, memory management, virtual memory and file systems.

Transferable skills	Specific competences
Instrumental 1. Capacity to reason abstractly 2. Cognitive skills 3. Common sense **Interpersonal** 4. Communicative competences **Systemic** 5. Capacity to identify the best methodology to solve a problem 6. Capacity to solve problems joining in a new and non-trivial way known elements 7. Capacity to generate ideas **Others**	1. Capacity to understand intuitively and formally the different aspects of operating systems: parts, processing, memory management and file system. 2. Capacity to put knowledge of processing, memory management and file system into practice. 3. Capacity to understand and modify the internal working of the modern operating systems.

5. Learning aims

The aim of this subject wants to get that students understand the usefulness of the operating system as a link between the computing applications and physical level (hardware). In the same way, this subject wants to get that students manage the resources of a computer using the services provided the operating system. More specifically, it aims to achieve the following objectives:

- Review the current context of operating systems
- Understand the operating system components properly
- Analyze and use the processing management mechanisms of the operating system
- Understand the mechanisms of memory management
- Review and implement mechanisms for managing input / output devices
- Understand the mechanisms for managing files of the operating system

6. Evaluation

6.1. General criteria to evaluate

The continuing assessment takes into account each of the three activities that constitute the subject: lectures, laboratories and seminars. In the continuing assessment, each of the activities must be passed separately and the final mark is obtained with the weighted average as follows:

T: evaluation of the theory through a final exam
L: laboratory evaluation of the programming practical activities and the final exam of practical activities.
S: evaluation of seminars

Final Mark = 0.6 * T + 0.3 * L + 0.1 * S

The theory exam will be performed on the contents developed in lectures and seminars. It is an individual and written exam that evaluates all competences developed through the subject. This evaluation is compulsory and must be qualified with, at least, 50% in order to pass the subject.

The laboratories will perform a series of practical activities that test students' capacity to apply theory in the form of programs on a computer. The practical activities are done in pairs, so that students must learn to communicate and cooperate to solve problems. This evaluation is also compulsory and must be qualified with, at least, 50% of the practical activities and 50% of the final exam to pass the subject.

Before each seminar, problems for students will be introduced and they will have to solve them before the session in groups of three people, as a preparation to the seminar. These problems are related to concepts or

knowledge explained in lectures. Students must deliver solutions at the beginning of the seminar, and, in addition, students will be asked to present their solutions on the blackboard. The assessment will consider the preparation of the seminar, the attendance and also the use of it. The evaluation of the work of the seminars is compulsory and as stated, the mark S must be qualified with, at least, 50% to pass the subject.

In case to fail the subject in the continuing assessment exposed previously, the student has the right to a sitting in September. The mark of this sitting will be obtained in an exam of the contents of lectures and in mark L. If a student has failed L in continuing assessment, he or she will be able to deliver the whole practical activity of the whole subject and it will be evaluated again. Once passed mark T and L separately, the mark of September will be obtained as follows:
Mark in September: 0,6*T+0,4*L

6.2. Precision for competences

Competences to be obtained in the subject	Achievement indicator	Evaluation procedure	Timing
Transferable skills 1. Capacity to reason abstractly 2. Cognitive skills 3. Common sense 4. Communicative competences 5. Capacity to identify the best methodology to solve a problem 6. Capacity to solve problems joining in a new and non-trivial way known elements 7. Capacity to generate ideas	1. Capacity to solve abstract problems 2. Capacity to suggest solutions to problems 3. Capacity to suggest solutions to problems 4. Coherent and well-written solutions in practical activities and seminars 5. Coherent solutions in practical activities and seminars 6. Coherent solutions in practical activities and seminars 7. Ingenious solutions to presented problems	1. Evaluation of practical activities, seminars and final exam 2. Evaluation of practical activities, seminars and final exam 3. Evaluation of practical activities, seminars and final exam 4. Evaluation of practical activities and seminars 5. Evaluation of practical activities and seminars 6. Evaluation of practical activities, seminars and final exam 7. Evaluation of practical activities, seminars and final exam	1. During the entire term 2. During the entire term 3. During the entire term 4. During the entire term 5. During the entire term 6. During the entire term 7. During the entire term

Specific competences			
1. Capacity to define the operating system of a computer, identify its functions and the types of operating systems that are used nowadays.	1. Answer correctly the presented questions and participation in seminars	1. Evaluation of practical activities and final exam	1. During the entire term
2. Capacity to identify elements of an operating system and do operations with the services provided by the operating system components	2. Answer appropriately to the presented questions and making correctly the laboratory practical activities	2. Evaluation of practical activities and final exam	2. During the entire term
3. Capacity to identify mechanisms for managing processes on a computer and apply them in real situations of run.	3. Good explanation of the processing management of an operating system and appropriate practical use of the mechanisms that this system has for this purpose.	3. Evaluation of specific questions in the final exam and practical activities report delivered by the student	3. During the entire term
4. Capacity to identify and use properly the mechanisms provided by the operating system to manage the memory of a computer	4. Manage properly the memory of a computer and explain the mechanisms of the operating system to facilitate its management	4. Evaluation of the theoretical final exam and practical activities	4. During the entire term
5. Capacity to manage correctly input and output devices in real situations of using a computer	5. Describe properly the input and output operations of a computer and do properly input / output operations on a computer	5. Evaluation of the theoretical final exam and practical activities	5. During the entire term
6. Capacity to identify and carry	6. The student has to describe	6. Final exam of the subject and	6. During the entire term

out operations with the file system of the operating system	correctly the characteristics of the file system of the operating system and do the correct use of them.	practical activities report	

7. Contents

7.1. Units

- **Unit 1.** Operating system elements
- **Unit 2.** Processing management
- **Unit 3.** Memory management
- **Unit 4.** Dispositius d'entrada/sortida
- **Unit 5.** File systems

7.2. Organitzation and precision of the contents

Unit 1. Operating system elements

Concepts	Processes	Attitudes
- calls to the system - system processing - memory and files - virtual machine - work session - System library - system tools - core (kernel) - applications	- Introduction to the elements of a computer - Brief description of the evolution of computers and description of the types of operating systems - Description of the parts of an operating system - Description of the interpretation of commands and the types of commands that exist - Description of types of system libraries - Description of the general development processes and running applications	- Interest in learning new concepts and go deeply into concepts learned previously - Interest in abstract concepts and relate them to real situations

Unit 2. Processing management

Concepts	Processes	Attitudes
- program - concurrency - process - thread - processing synchronization - CPU schedule - deadlocks	- Analysis of necessary elements to create a concurrent program - Description of the process control block - Analysis of possible states of concurrent processes - Processing management; creation, destruction, synchronization, change of image, input / output - CPU scheduling strategies	- Willingness to try to understand concepts that seem complexes initially - Interest in learning new concepts and go deeply into concepts learned previously - Interest in abstract concepts and relate them to real situations

Unit 3. Memory management

Concepts	Processes	Attitudes
- memory space - memory address - memory allocation - memory partition - memory segment - pagination - virtual memory - cache	- Analysis of the space of processing memory - Types of memory management - Go deeply into partitions of fixed and variable memory - Go deeply into segmentation and memory and pagination	- Willingness to try to understand concepts that seem complexes initially - Interest in learning new concepts and go deeply into concepts learned previously - Interest in abstract concepts and relate them to real situations

Unit 4. Input and output devices

Concepts	Processes	Attitudes
- input device - output device - buffer - controller - tube	- Analysis of the characteristics of input and output devices - Description of the concept "buffer" and its relation with the input and output devices - Description of the concept "spooling" and its relevance in input / output devices - Characteristics of the physical, logical and virtual devices, and go deeply into its access and control operations - Analysis of communication between processes through tubes.	- Interest in learning new concepts and go deeply into concepts learned previously - Interest in abstract concepts and relate them to real situations

Unit 5. File system

Concepts	Processes	Attitudes
- file - directory - root directory - work directory - home directory - name of the file - link - protection	- Description of types of existing files and their properties - Analysis of possible operations applicable to files - Analysis of the characteristics of different types of files namespaces - Characteristics and operations applicable to file systems - Analysis of available mechanisms for protection files	- Interest in learning new concepts and go deeply into concepts learned previously - Interest in abstract concepts and relate them to real situations

8. Methodology

8.1. Methodological focus of the subject

Lectures

In these classes, the theoretical concepts of this subject's units are explained. In the subject of Operating Systems, there are two groups of theory, T1 and T2. The lectures consist of 9 sessions (for each group) for two hours in which the two groups of theory T1 and T2 attend separately and entirely. The lecturer will explain the theoretical content of the subject. For this purpose, a computer, a projector and a blackboard will be available as supporting material. Slides will be used as notes of the lecture to students. The discussed concepts in these sessions will be used in the two other learning activities of the subject: seminar sessions and practical sessions.

Practical sessions

In these sessions, the practical content of this subject's units is developed. The first group of theory T1 is divided into two practical groups that are P11 and P12. The second group of theory T2 is not divided and it is group P21.

These sessions are done in the laboratory and last two hours. The teacher of practical activities will deliver a statement in which it is explained the development of the practical activity and the teacher will give the necessary guidelines for the students to check and do what they are requested in the statements of the practical activity. The student will deliver a report of the practical activity at the end of the practical session, on which the teacher will evaluate that the practical concepts, which have been raised in the statement of the activity, are developed correctly. This activity is carried out in pairs and assumes that continues outside the classroom. The practical sessions are designed to cover practical aspects of content explained in lectures.

Seminar sessions

These sessions are devoted to describing aspects of particular relevance to the units of the subject. These seminar sessions are sessions of two hours. In these sessions, the teacher will lead and express specific problems that will help students to reinforce the knowledge acquired in lectures and practical activities of the subject. Students must deliver solutions at the beginning of the seminar and, in addition, students are asked to present their solutions on the blackboard. For this activity, the teacher will have computer, projector and whiteboard as supporting material. Slides may be used and, generally, any type of material to help reinforce the concepts learned in lectures of the subject. The activities will be carried out in groups of 3-4 students. The first group of theory T1 is divided into three seminar groups which are S111, S112 and S121.

The second group theory T2 is divided into two seminar groups which are S211 and S212.

9. Bibliography and didactic resources

9.1. Information sources for the learning. Basic bibliography (on paper or electronic media)

Abraham Silberschatz, Peter B. Galvin. Sistemas operativos; traducción Roberto L. Escalona. Prentice Hall - Addison-Wesley Longman, 1999. ISBN 968-444-310-2

9.2. Information sources for the learning. Complementary bibliography (on paper or electronic media)

William Stallings. Sistemas operativos : aspectes internos y principios de diseño traducción y revisión técnica: José María Peña Sánchez ... [et al.] 5ª ed. Madrid [etc.] : Prentice Hall, cop. 2005. ISBN 84-205-4462-0

Duran Rodriguez, Lluís. Sistemas operativos : referencia bàsica. Marcombo, cop. 2000. ISBN 8426712568

Tanenbaum, Andrew S., Modern operating systems. Prentice Hall, cop. 2001 2nd edition. , ISBN 0-13-031358-0

Teodor Jové Lagunas, Josep Lluís Marzo i Lázaro, Dolors Royo Vallés. Introducció als sistemes operatius ; Col·lecció Manuals (EDIUOC) 19. ISBN 84-95131-10-2. Barcelona: EDIUOC, 1998

Stevens, W. Richard, Advanced programming in the UNIX environment. Addison-Wesley, 1993. ISBN 0-201-56317-7

Milenkovic, Milan. Sistemas operativos conceptos y diseño. McGraw-Hill cop. 1994. ISBN 84-481-1871-5

9.3. Information sources for the learning. Reinforcement bibliography (on paper or electronic media)

9.4. Didactic resources. Teaching material of the subject

All material will be available in the webpage or the subject's Moodle

Slides

Notes

Collection of activities

Statements of practical activities

Set of seminar problems

9.5. Didactic resources. Supporting material and tools

Programació d'Activitats

Grup 1

Setmana	*Activitat a l'aula* *agrupament / tipus d'activitat*	*Activitat fora de l'aula* *agrupament / tipus d'activitat*
Setmana 1	Sessió 1 Teoría Sessió 1 Prácticas (P11, P12)	*Realizar práctica*
Setmana 2	Sessió 2 Teoría Sessió 1 Seminario (S112, S111)	*Preparacion de problemas del seminario*
Setmana 3	Sessió 3 Teoria Sessió 1 Seminario (S121) Sessió 2 Prácticas (P11, P12)	*Preparacion de problemas del seminario* *Realizar práctica*
Setmana 4	Sessió 4 Teoria Sessió 2 Seminario (S112, S111)	*Preparacion de problemas del seminario*
Setmana 5	Sessió 5 Teoria Sessió 2 Seminario (S121) Sessió 3 Prácticas (P11, P12)	*Preparacion de problemas del seminario* *Realizar práctica*
Setmana 6	Sessió 6 Teoria Sessió 3 Seminario (S112, S111)	*Preparacion de problemas del seminario*
Setmana 7	Sessió 7 Teoria Sessió 3 Seminario (S121) Sessió 4 Prácticas (P11, P12)	*Preparacion de problemas del seminario* *Realizar práctica*
Setmana 8	Sessió 8 Teoria	
Setmana 9	Sessió 9 Teoria Sessió 4 Seminario (S112) Sessió 5 Prácticas (P11, P12)	*Preparacion de problemas del seminario* *Realizar práctica*
Setmana 10	Sessió 4 Seminario (S121, S111)	*Preparacion de problemas del seminario*

Grup 2

Setmana	*Activitat a l'aula* *agrupament / tipus d'activitat*	*Activitat fora de l'aula* *agrupament / tipus d'activitat*
Setmana 1	Sessió 1 Teoría	
Setmana 2	Sessió 2 Teoría Sessió 1 Prácticas (P21)	*Realizar práctica*
Setmana 3	Sessió 3 Teoria Sessió 1 Seminario (S211, S212)	*Preparacion de problemas del seminario*
Setmana 4	Sessió 4 Teoría Sessió 2 Prácticas (P21)	*Realizar práctica*
Setmana 5	Sessió 5 Teoria Sessió 2 Seminario (S211, S212)	*Preparacion de problemas del seminario*
Setmana 6	Sessió 6 Teoria Sessió 3 Prácticas (P21)	*Realizar práctica*
Setmana 7	Sessió 7 Teoria Sessió 3 Seminario (S211, 212)	*Preparacion de problemas del seminario*
Setmana 8	Sessió 8 Teoria Sessió 4 Prácticas (P21)	*Realizar práctica*
Setmana 9	Sessió 9 Teoria Sessió 3 Seminario (S211)	*Preparacion de problemas del seminario*
Setmana 10	Sessió 4 Seminario (S212) Sessió 5 Prácticas (P21)	*Realizar práctica*