

Course guide

340377 - SIOP-I4001 - Operating Systems

Last modified: 19/06/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 701 - DAC - Department of Computer Architecture.

Degree: BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2018). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: MONTSERRAT FARRERAS ESCLUSA

Others: Sanchez Lopez, Sergio
Herebero Lazaro, Ana M.

PRIOR SKILLS

In order to be able to acquire the new concepts in this subject, the following knowledge is required: -Basic understanding of computer architecture; - A high level programming language (such as C, which will be used in this subject)

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

- 3. CEFC10. Knowledge of characteristics, functions and structure of operating systems and of designing and implementing applications based on their services.
- 4. CEFC5. Knowledge, management and maintenance of systems, computing services and applications.
- I_CEFB4. CEFB4. Basic knowledge of use and computer programming, as well as of operating systems, data base and generally informatic programs with engineering applications.
- 5. CEFC9. Ability to know, understand and assess computer structure and architecture, as well as basic components forming them.

Transversal:

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

TEACHING METHODOLOGY

The lectures with the complete class will be delivered using the available resources in the classrooms (blackboard, multimedia equipment) and there will be two types of sessions:

- Frontal lectures, these lectures will consist of oral presentations, done by the teacher, of the subject topics. In these sessions the teacher will engage the students through short active learning activities such as: strait questions, problem solving activities done by the students, short student presentations, debates or other activities, which could be in groups, that encourage critical thinking.
- Problem solving sessions: In this sessions a set of problems previously defined and solved autonomously and individually by each student (aka. assignment), will be corrected in the classroom. The students will share their solution. Each student will self-evaluate his/her assignment, and this will be the mark for the continuous evaluation.

In this sessions we focus on developing: autonomous learning, self-assessment and critical thinking skills.

The sessions with the small group will be done in the laboratory classrooms: It consist of a collaborative project that will develop during the term, on the last day there will be a competition among all the projects. The project is structured so that it can be done during the laboratory sessions and it is coordinated with the theoretical lectures. The students need to prepare for each session in advance by reading the corresponding assignment that will be made available in the digital campus. During the laboratory sessions the teacher will assist the students to solve the different sections of the project. In these sessions we develop team working and collaborative learning skills.

LEARNING OBJECTIVES OF THE SUBJECT

Know the main functions of an OS and because of its necessity (abstraction / virtualització hardware, security, efficiency)

Understanding how the OS manages and provides its services and capabilities internally through data representation and management of resources, algorithms and hardware support.

An overview of information systems: know the different interfaces and components that interact with the OS (hardware, system libraries, libraries + language user programs).

For each basic functionality of the system (process management, memory and I/O) know influencing basic aspects of the different architectures and environments that can support operating systems.

For each basic functionality of the system (process management, memory and I/O): Understanding the hardware element that we want virtualizing

For each basic functionality of the system (process management, memory and I/O) know and be able to use the basic functionality offered by the system to the user.

For each basic functionality of the system (management processes, memory and I/O) know the basic elements of design (data types, data management structures and management algorithms) to offer this functionality.

For each basic functionality of the system (process management, memory and I/O):to know the basic architecture of the basic design elements in SO.

For each basic resource which manages the OS (processes, virtual memory and I/O):to know the basic metric to assess service system and be able to apply the theoretical level.

For each basic resource which manages the system (processes, memory, I/O), know and be able to use basic tools to analyze a system's implementation and to monitor the state of the system to detect potential problems.

Understanding the implications, from the viewpoint of system and user of a multi-user parallel system.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Self study	90,0	60.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

1. Introduction to Operating Systems

Description:

- 1.1. OS Overview
- 1.2. OS as an interface
- 1.3. Accessing the kernel

Related activities:

- Activity 1: Initial knowledge review
- Activity 2: Laboratory: Introduction to OS
- Activity 3: Introduction to OS Problems

Related competencies :

I_CEFB4. CEFB4. Basic knowledge of use and computer programming, as well as of operating systems, data base and generally informatic programs with engineering applications.

I_CEFC9. CEFC9. Ability to know, understand and assess computer structure and architecture, as well as basic components forming them.

07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

Full-or-part-time: 32h

Theory classes: 8h

Laboratory classes: 4h

Self study : 20h

2. Process Management

Description:

- 2.1. Proces' concepts
- 2.2. Using processes (System calls)
- 2.3. Synchronous Process communication: Signals
- 2.4. Internal proces management

Related activities:

- Activity 1: Processes Problems
- Activity 2: Processes Laboratory

Related competencies :

I_CEFB4. CEFB4. Basic knowledge of use and computer programming, as well as of operating systems, data base and generally informatic programs with engineering applications.

I_CEFC10. CEFC10. Knowledge of characteristics, functions and structure of operating systems and of designing and implementing applications based on their services.

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

Full-or-part-time: 30h

Theory classes: 6h

Laboratory classes: 4h

Self study : 20h

3. Management of input / output

Description:

- 3.1. I/O Concepts
- 3.2. Using I/O System Calls
- 3.3 Asynchronous process communication: Pipes and sockets
- 3.4. Internal Implementation

Related activities:

- Activity 1: Input/Output Problems
- Activity 2: Input/Output Laboratory

Related competencies :

- I_CEFB4. CEFB4. Basic knowledge of use and computer programming, as well as of operating systems, data base and generally informatic programs with engineering applications.
- I_CEFB10. CEFB10. Knowledge of characteristics, functions and structure of operating systems and of designing and implementing applications based on their services.
- 05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
- 07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

Full-or-part-time: 42h

- Theory classes: 8h
- Laboratory classes: 6h
- Self study : 28h

4. File System

Description:

- 4.1. Introduction to File System
- 4.2. Implementation
- 4.3. File System Optimizations

Related activities:

- Activity 1: File system problems

Related competencies :

- I_CEFB5. CEFB5. Knowledge, management and maintenance of systems, computing services and applications.
- CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
- 07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

Full-or-part-time: 18h

- Theory classes: 6h
- Self study : 12h

5. Memory management

Description:

- 5.1. Concepts
- 5.2. Virtual Memory
- 5.3. Implementation and Optimizations

Related activities:

- Activity 1: Memory management problems
- Activity 2: Complementary assignment

Related competencies :

- I_CEFB4. CEFB4. Basic knowledge of use and computer programming, as well as of operating systems, data base and generally informatic programs with engineering applications.
- I_CEEC5. CEEC5. Knowledge, management and maintenance of systems, computing services and applications.
- I_CEEC9. CEEC9. Ability to know, understand and assess computer structure and architecture, as well as basic components forming them.
- CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

Full-or-part-time: 28h

- Theory classes: 8h
- Self study : 20h

GRADING SYSTEM

$$NF=30\%LAB+ \text{MAX}(30\%AC+40\%EF, 70\%EF)$$

LAB: lab

AC: Continuous evaluation (a deliverable per topic)

EF: Final Exam*

There is no mid-term exam, it has been replaced by a set of assignments (one per topic) that will be delivered roughly every fortnight.

The EF Final Exam can be re-evaluated.

A student is entitled to re-evaluation if he has failed the subject with a mark above or equal to 2,0. The new mark will replace the previous mark only if it is higher. The maximum final mark will be a 7,0. If the student fails the subject despite the re-evaluation, the highest mark will be kept.

BIBLIOGRAPHY

Basic:

- Robbins, Kay A; Robbins, Steven. UNIX systems programming : communication, concurrency, and threads. Upper Saddle River, N.J.: Prentice Hall PTR, 2003. ISBN 9780134424071.

RESOURCES

Other resources:

All available resources to accomplish the goals of this subject will be available on the digital campus (Atenea platform): course notes, presentations, problems, previous exams, videos etc.