Course guide
270066 - CASO - Advanced Concepts on Operating Systems

Last modified: 06/02/2025

Unit in charge: Barcelona School of Informatics
Teaching unit: 701 - DAC - Department of Computer Architecture.

Degree: BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Optional subject).

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

LECTURER

Coordinating lecturer: XAVIER MARTORELL BOFILL

Others: Segon quadrimestre:
JORGE FORNES DE JUAN - 11, 12
XAVIER MARTORELL BOFILL - 11, 12

PRIOR SKILLS

- User-level Operating Systems
- Basic level on the internal structure of the operating system
- Programming languages C and C++
- Compile and link mechanisms
- Basic concepts of computer architecture

REQUIREMENTS

- Pre-Corequisite SO2
- Pre-Corequisite SOA

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEC2.1. To analyse, evaluate, select and configure hardware platforms for the development and execution of computer applications and services.
CEC2.3. To develop and analyse software for systems based on microprocessors and its interfaces with users and other devices.
CEC2.4. To design and implement system and communications software.
CEC2.5. To design and implement operating systems.
CEC3.1. To analyse, evaluate and select the most adequate hardware and software platform to support embedded and real-time applications.
CEC4.1. To design, deploy, administrate and manage computer networks.
CEC4.2. To demonstrate comprehension, to apply and manage the guarantee and security of computer systems.
CTI1.4. To select, design, deploy, integrate, evaluate, build, manage, exploit and maintain the hardware, software and network technologies, according to the adequate cost and quality parameters.
CTI3.4. To design communications software.

Generical:
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

TEACHING METHODOLOGY

The teacher presents the topics proposed in the theory sessions, while open discussions among and with students on various topics. Each session includes the theory of motion of various topics related to the class, students work independently on his compte.Les lab follow the issues raised in the theory and serve to entrench the use and evaluation of abstractions and system services operatiu.Per to work in the competition for autonomous learning, the course will be 2 staff work activities related to the services offered by operating systems. The themes of the activities will be defined during the course. Will for example, the introduction of new system calls, the interacio between Android and Linux systems, add the OS services through libraries, performance evaluation system, etc..

LEARNING OBJECTIVES OF THE SUBJECT

1.Working with the abstractions of the operating system
2.Analysis and evaluation of operating system abstractions
3.Use the operating system development tools
4.Know how to use the hardware support for the operating system
5.Use the techniques of performance evaluation of operating systems
6.Operating System Support for file systems
7.To know, know how to use and implement management devices within the operating system
8.Implement and evaluate support for real time
9.Implement and evaluate virtualization support
10.Use the operating system support for mobile devices
11.Manage facilities informatiques

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Self study	84,0	56.00
Hours small group	30,0	20.00
Guided activities	6,0	4.00

Total learning time: 150 h

CONTENTS

OS Abstractions

Description:
This topic presents the abstracccions operating systems offer the user level and applications: processes and flows, regions of memory, data storage and input / output device management. Comparisons are made between different abstractions offered as equivalent and determine which are most appropriate

Development tools for operating systems

Description:
It presents the tools needed to develop operating systems: compiler and linker, management protocols, etc..

Hardware tools supporting the operating system

Description:
Basic tools provided by the hardware in order to implement operating systems.

Synchronization Tools

Description:
Using the tools provided by the synchronization of hardware and operating system are provided as efficiently at the level of applications.

Evaluation of performance of the operating system

Description:
To determine the overhead introduced by using the abstraction of the operating system and performance appraisal system

File Systems

Description:
Managing data in file systems and tools to support the integrity

Device Management

Description:
Representation of devices within operating systems, treatment of the different devices: disk, network, user interaction.

Development of device drivers

Description:
Introduction of new management devices in the operating system

Operating system support for real time applications

Description:
Tools and libraries to support applications that respond in real time

Operating system support for virtualized environments

Description:
Deploying virtual machines with / without hardware support. Options for implementing virtual machines native and non-native (in physically different environments).

Operating System Support for Mobile Devices

Description:
We present the differences between a system desktop / laptop and operating system that supports mobile devices

Management of computer installation

Description:
Managing a facility computer science from the planning and purchase, installation, commissioning and maintenance

ACTIVITIES

OS Abstractions

Description:
The student participates actively in the session, working group on the topics presented, and comparisons of the possible implementations.

Specific objectives:
1, 2

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 15h
Self study: 8h
Theory classes: 3h
Laboratory classes: 4h

Development of Operating Systems

Description:
Study of operating system development tools, participate in class discussions and the practices of compilation of the operating system

Specific objectives:
3

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

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

Hardware support tools

Description:
Participation in discussions about the use of hardware support within the operating system for the implementation of the address space and memory management, and synchronization

Specific objectives:
1, 4

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 8h
Self study: 2h
Theory classes: 2h
Laboratory classes: 4h

First control

Description:
This test assesses the knowledge and practice gained in the first 3 topics of the course. It consists of a written exam, done in a theory class.

Full-or-part-time: 12h
Self study: 10h
Guided activities: 2h

Performance Evaluation of the operating system

Description:
Participation in discussions on performance evaluation techniques and alternatives that exist for reliable measurements and low impact on the execution system

Specific objectives:
1, 2, 5

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 8h
Self study: 4h
Theory classes: 2h
Laboratory classes: 2h

File Systems

Description:
Participation in discussions on the possibilities to implement filesystems in jounaling

Specific objectives:
1, 2, 6

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 8h
Self study: 4h
Theory classes: 2h
Laboratory classes: 2h

Development of management devices

Description:
Participation in discussions on the implementation of alternative device drivers

Specific objectives:
3, 4, 7

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 15h
Self study: 6h
Theory classes: 3h
Laboratory classes: 6h

Second control

Description:
This test assesses the knowledge and practice acquired in the first nine weeks of the course, including items 1 through 7.

Specific objectives:
1, 2, 3, 4, 6, 7

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 12h
Self study: 10h
Guided activities: 2h

Support for real-time applications

Description:
Participation in discussions on the implementation of alternatives to support real-time

Specific objectives:
1, 2, 8

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 8h
Self study: 4h
Theory classes: 2h
Laboratory classes: 2h

Operating system support for virtualized environments

Description:
Participation in discussions on implementation techniques of virtualized environments in a non-native and native ways

Specific objectives:
1, 2, 9

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 8h
Self study: 4h
Theory classes: 2h
Laboratory classes: 2h

Operating System Support for Mobile Devices

Description:
Participation in discussions about alternative operating systems for mobile devices

Specific objectives:
1, 2, 3, 10

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 12h
Self study: 6h
Theory classes: 2h
Laboratory classes: 4h

Management of informatica installation

Description:
Participation in discussions on the sizing of a facility informatica

Specific objectives:
2, 11

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 1h
Theory classes: 1h

Third control

Description:
This test assesses the knowledge and practice gained during the course.

Specific objectives:
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 12h
Self study: 10h
Guided activities: 2h

Laboratory exam

Description:
In this exam, students solve practical problems related with all course subjects, individually. You can have books and notes.

Specific objectives:
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 10h
Self study: 8h
Guided activities: 2h

Final exam

Description:
For those students that would need to reach the minimum level of the course or those that want to raise their marks, this examination will be hold after the period of the classes

Specific objectives:
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Related competencies :
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 15h
Self study: 12h
Guided activities: 3h

GRADING SYSTEM

The autonomous learning competence is evaluated based on the reports delivered by the student during the course. Its weight is 10% on the final mark.

The technical competences are evaluated based on the theory (40%) and the laboratory exam (50%).

The theory gets evaluated based on the partial and the final exams. The mark of the 3 partial exams is computed as the averaged mean of the 3 tests, with the following weights: 25, 25, and 50%. If this mark is equal or larger than 6.0, attending the final exam is optional.

In case a student attends the final exam, his/her theory mark will be the highest between the mark obtained in the final exam and the averaged mean of the partial exams.

BIBLIOGRAPHY

Basic:
- Silberschatz, A.; Galvin, P.B.; Gagne, G. Operating system concepts. 10th ed. John Wiley & Sons, 2019. ISBN 9781119454083.
- Stallings, W. Operating systems: internals and design principles. 9th ed. Pearson Education Limited, 2017. ISBN 9781292214306.