# UNIVERSIDAD DE CASTILLA - LA MANCHA

# GUÍA DOCENTE

## 1. General information

**Course:** OPERATING SYSTEMS I
**Code:** 42313
**Type:** CORE COURSE
**ECTS credits:** 6
**Degree:** 346 - DEGREE IN COMPUTER SCIENCE AND ENGINEERING
**Academic year:** 2019-20
**Center:** 604 - SCHOOL OF COMPUTER SCIENCE AND ENGINEERING (AB)
**Group(s):** 10 11 12
**Year:** 2
**Duration:** First semester
**Main language:** Spanish
**Second language:** English
**Use of additional languages:**
**English Friendly:** N
**Web site:**
**Bilingual:** Y

Lecturer: **ENRIQUE ARIAS ANTUNEZ** - Group(s): **12**

| Building/Office | Department | Phone number | Email | Office hours |
|---|---|---|---|---|
| Agrupación Politécnica/ Desp. 0.A.8 | SISTEMAS INFORMÁTICOS | 2497 | enrique.arias@uclm.es | The tutoring schedule will be at the Computing Systems Dept. web site: http://www.dsi.uclm.es/pers.php?codpers=earias |

Lecturer: **DIEGO CAZORLA LOPEZ** - Group(s): **10**

| Building/Office | Department | Phone number | Email | Office hours |
|---|---|---|---|---|
| ESII / 1.B.2 | SISTEMAS INFORMÁTICOS | 926053057 | diego.cazorla@uclm.es | http://esiiab.uclm.es/pers.php?codpers=dcazorla |

Lecturer: **JOAQUIN FERNANDEZ MARTINEZ** - Group(s): **10**

| Building/Office | Department | Phone number | Email | Office hours |
|---|---|---|---|---|
| ESII / 1.A.6 | SISTEMAS INFORMÁTICOS | 2436 | joaquin.fdez@uclm.es | Consultar: http://esiiab.uclm.es/tutorias.php |

Lecturer: **ANA AMELIA GONZALEZ LOPEZ** - Group(s): **11**

| Building/Office | Department | Phone number | Email | Office hours |
|---|---|---|---|---|
| ESII / 1.C.4 | SISTEMAS INFORMÁTICOS | 2459 | ana.gonzalez@uclm.es | Consultar https://www.esiiab.uclm.es/tutorias.php |

## 2. Pre-Requisites

This subject is based on the competences and knowledge acquired in the subjects:

- Basics of Programming I (1st course)
- Basics of Programming II (1st course)
- Computer Structure (1st course)

## 3. Justification in the curriculum, relation to other subjects and to the profession

An operating system is a program that manages the hardware of a computer and facilitates the interaction between it and the user. It is, therefore, a low-level software element that acts as an interface between high-level software and hardware.

This subject addresses the question of how a program can finally run on a physical system (hardware), and therefore his knowledge is indispensable for a computer engineer. It can be considered as one of the fundamental subjects of the degree and appears in all similar study plans, both national and international.

This subject belongs to a degree qualification that complies with what is specified in the Resolution of June 8th, 2009, of the "Secretaría General de Universidades" that establishes recommendations for the proposal by the Universities of reports of applications for official degrees that lead to the profession of Technical Engineer in Computer Science, and covers the specific competences common to the branch of computing [CO5] Knowledge, administration and maintenance of systems, services and computer applications, and [CO10] Knowledge of the features, functionalities and structure of the Operating Systems and design and implement applications based on their services.

It is, therefore, a compulsory subject in the curriculum, regardless of the specific technology that the student wants to follow. The knowledge acquired in this subject is complemented not only with those obtained in the subjects cited in the section of prerequisites but also with those of other contemporary subjects in the curriculum (Organization of Computers, Real Time and Concurrent Programming ) as well as those of higher-level subjects (Distributed Systems, Operating Systems II).

## 4. Degree competences achieved in this course

**Course competences**

| Code | Description |
|---|---|
| CO10 | Knowledge about the features, functions, and structures of operating systems and the design and implementation of applications based on their services. |
| CO5 | Knowledge, administration, and maintenance of systems, services and digital systems. |
| INS4 | Problem solving skills by the application of engineering techniques. |
| PER1 | Team work abilities. |
| PER2 | Ability to work in multidisciplinary teams. |
| SIS3 | Autonomous learning. |
| UCLM2 | Ability to use Information and Communication Technologies. |

## 5. Objectives or Learning Outcomes

### Course learning outcomes

Description

Understanding and use operating systems, both at user level and at programming level using its services.
Performance of the basic administration of an operating system.

## 6. Units / Contents

**Unit 1: Computer Systems Overview**
- **Unit 1.1** Mode of operation
- **Unit 1.2** Interrupts
- **Unit 1.3** Input/Output

**Unit 2: Operating systems: a brief introduction**
- **Unit 2.1** What is an Operating System?
- **Unit 2.2** Components of the operating system
- **Unit 2.3** Evolution of operating systems.
- **Unit 2.4** Operating systems structure
- **Unit 2.5** Types of operating systems
- **Unit 2.6** Activation of the operating system

**Unit 3: Processes**
- **Unit 3.1** Process Concept
- **Unit 3.2** Multitasking
- **Unit 3.3** Process information
- **Unit 3.4** Lifecicle of a process
- **Unit 3.5** Threads
- **Unit 3.6** Services

**Unit 4: Deadlocks**
- **Unit 4.1** Principles of concurrency
- **Unit 4.2** Principles of deadlock
- **Unit 4.3** Deadlock prevention
- **Unit 4.4** Deadlock Avoidance
- **Unit 4.5** Deadlock detection and recovery

**Unit 5: Scheduling**
- **Unit 5.1** Introduction
- **Unit 5.2** The problem of resource scheduling
- **Unit 5.3** Characterization of processes
- **Unit 5.4** Objectives of scheduling
- **Unit 5.5** Scheduling levels
- **Unit 5.6** Non-expulsive scheduling algorithms
- **Unit 5.7** Expulsive scheduling algorithms

**Unit 6: Memory management**
- **Unit 6.1** General aspects of memory management
- **Unit 6.2** Swapping
- **Unit 6.3** Management of partitioned memory
- **Unit 6.4** Paging and Segmentation
- **Unit 6.5** Introduction to Virtual Memory

**Unit 7: File and directory management**
- **Unit 7.1** Functions and structure of a file system
- **Unit 7.2** Files
- **Unit 7.3** Directories
- **Unit 7.4** Physical storage of files: block allocation and free space management
- **Unit 7.5** Case studies

**Unit 8: Lab**
- **Unit 8.1** Introduction to Linux
- **Unit 8.2** Introduction to shell-scripts
- **Unit 8.3** The awk tool
- **Unit 8.4** Process and thread services in Windows

## ADDITIONAL COMMENTS, REMARKS

In parallel to theoretical classes (topics 1 to 7), practical sessions (topic 8) will be conducted weekly where issues related to the Linux and Windows operating systems, both at the user level as a programmer and administrator, will be addressed.

## 7. Activities, Units/Modules and Methodology

| Training Activity | Methodology | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | R | Description |
|---|---|---|---|---|---|---|---|---|
| Class Attendance (theory) [ON-SITE] | Lectures | CO10 CO5 | 0.66 | 16.5 | N | - | - | [MAG] Review of theoretical concepts previously prepared by students |
| Problem solving and/or case | Problem solving and exercises | CO10 CO5 INS4 PER1 | 0.72 | 18 | N | - | - | [PRO] Problem solving (individual |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| studies [ON-SITE] | | SIS3 | | | | | | and group) |
| Progress test [ON-SITE] | Assessment tests | CO10 CO5 INS4 | 0.12 | 3 | Y | N | Y | [EVA] Tests of theory and exercises (individual) |
| Laboratory practice or sessions [ON-SITE] | Practical or hands-on activities | CO10 CO5 SIS3 | 0.66 | 16.5 | N | - | - | [LAB] Completion of the proposed laboratory practices (individual) |
| Progress test [ON-SITE] | Assessment tests | CO10 CO5 | 0.12 | 3 | Y | N | Y | [EVA] Tests of practices (individual) |
| Final test [ON-SITE] | Assessment tests | CO10 CO5 INS4 | 0.12 | 3 | Y | Y | Y | [EVA] Final evaluation test. It allows to recover parts not overcome during progress tests (theory, exercises and practices). If a student has passed the subject in the progress tests will not have to perform this final test (individual) |
| Study and Exam Preparation [OFF-SITE] | Combination of methods | CO10 CO5 INS4 | 1.4 | 35 | N | - | - | [EST] Preparation/study of theory and exercises tests (individual) |
| Writing of reports or projects [OFF-SITE] | project-based learning | CO10 INS4 PER1 PER2 SIS3 UCLM2 | 0.8 | 20 | Y | N | Y | [RES] Development of a group project: memory and code (in group) |
| Study and Exam Preparation [OFF-SITE] | Combination of methods | CO10 CO5 | 0.48 | 12 | N | - | - | [EST] Preparation/study of practice tests (individual) |
| Writing of reports or projects [OFF-SITE] | Combination of methods | CO10 CO5 INS4 PER1 SIS3 UCLM2 | 0.4 | 10 | Y | N | N | [RES] Elaboration of deliveries during the whole course related to theory topics (individual) |
| Other off-site activity [OFF-SITE] | Self-study | CO5 SIS3 UCLM2 | 0.52 | 13 | N | - | - | [PLAB] Preparation of laboratory practices (individual) |
| | | **Total:** | **6** | **150** | | | | |
| | | **Total credits of in-class work: 2.4** | | | | | | **Total class time hours: 60** |
| | | **Total credits of out of class work: 3.6** | | | | | | **Total hours of out of class work: 90** |

As: Assessable training activity
Com: Training activity of compulsory overcoming
R: Rescheduling training activity

## 8. Evaluation criteria and Grading System

| | Grading System | | |
|---|---|---|---|
| **Evaluation System** | **Face-to-Face** | **Self-Study Student** | **Description** |
| Theoretical exam | 40.00% | 0.00% | [ESC] There will be 2 controls (progress tests) of theory and exercises throughout the course. A final exam will be scheduled to recover the parts not passed during the course. |
| Laboratory sessions | 30.00% | 0.00% | [LAB] There will be 2 controls (progress tests) of practices throughout the course. A final exam will be scheduled for those students who have not passed the practices in the progress tests. |
| Projects | 20.00% | 0.00% | [INF] Realization of a programming project and a report on the assigned topic (in a group) |
| Assessment of active participation | 10.00% | 0.00% | [INF] Elaboration of deliveries during the whole course related to theory and exercises topics. |
| **Total:** | **100.00%** | **0.00%** | |

**Evaluation criteria for the final exam:**

There will be a final test of Theory, Exercises and Practices for the students that didn't pass the tests made during the continuous evaluation.

To pass the subject it will be necessary to pass the block "Theory and Exercises" + "Practices" taking into account the weights shown in the previous table. In addition, the global mark of the subject must be greater than or equal to 5. That is, it must be fulfilled simultaneously that
"Theory and Exercises" * 0.4 + "Practices" * 0.3> = 3.5 (out of 7)
and "Theory and Exercises" * 0.4 + "Practices" * 0.3 + "Project" * 0.2 + "Deliverables" * 0.1> = 5 (out of 10)

The student who does not pass the theoretical exam will have a grade not higher than 4.00 even if the overall mark obtained is another, including more than 5.00.

**Specifications for the resit/retake exam:**

There will be an extraordinary test of Theory, Exercises and Practices for the students that didn't pass the ordinary test.
The students that didn't pass the Project in the ordinary call will be allowed to deliver it again.
To pass the subjet, the same conditions must be fulfilled as in the ordinary call.

**Specifications for the second resit / retake exam:**

There will be an extraordinary test of Theory, Exercises and Practices. The marks of "Project" and "Deliverables" of the last year in which the subject was taken will be saved.

To pass the subjet, the same conditions must be fulfilled as in the extraordinary call.

## 9. Assignments, course calendar and important dates

**Not related to the syllabus/contents**

| **Hours** | **hours** |
|---|---|

| | |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 3 |
| Progress test [PRESENCIAL][Assessment tests] | 3 |
| Progress test [PRESENCIAL][Assessment tests] | 3 |
| Final test [PRESENCIAL][Assessment tests] | 3 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 21 |

**General comments about the planning:** This course schedule is APPROXIMATE. It could vary throughout the academic course due to teaching needs, bank holidays, etc. A weekly schedule will be properly detailed and updated on the online platform (Virtual Campus). Note that all the lectures, practice sessions, exams and related activities performed in the bilingual groups will be entirely taught and assessed in English. Classes will be scheduled in 3 sessions of one hour and a half per week. The assessment activities could be performed in the afternoon, in case of necessity.

**Unit 1 (de 8): Computer Systems Overview**

| **Activities** | **Hours** |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 2 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 1 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 2 |
| Writing of reports or projects [AUTÓNOMA][Combination of methods] | 1.5 |

**Unit 2 (de 8): Operating systems: a brief introduction**

| **Activities** | **Hours** |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 2 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 1 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 2 |
| Writing of reports or projects [AUTÓNOMA][Combination of methods] | 1.5 |

**Unit 3 (de 8): Processes**

| **Activities** | **Hours** |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 3.5 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 3.5 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 2 |
| Writing of reports or projects [AUTÓNOMA][Combination of methods] | 2.5 |

**Unit 4 (de 8): Deadlocks**

| **Activities** | **Hours** |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 2 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 3 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 2 |
| Writing of reports or projects [AUTÓNOMA][Combination of methods] | 1.5 |

**Unit 5 (de 8): Scheduling**

| **Activities** | **Hours** |
|---|---|
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 3 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 2 |
| Writing of reports or projects [AUTÓNOMA][project-based learning] | 20 |

**Unit 6 (de 8): Memory management**

| **Activities** | **Hours** |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 2 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 3 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 2 |
| Writing of reports or projects [AUTÓNOMA][Combination of methods] | 1.5 |

**Unit 7 (de 8): File and directory management**

| **Activities** | **Hours** |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 2 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 3.5 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 2 |
| Writing of reports or projects [AUTÓNOMA][Combination of methods] | 1.5 |

**Unit 8 (de 8): Lab**

| **Activities** | **Hours** |
|---|---|
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 16.5 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 12 |
| Other off-site activity [AUTÓNOMA][Self-study] | 13 |

**Global activity**

| **Activities** | **hours** |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 16.5 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 18 |
| Progress test [PRESENCIAL][Assessment tests] | 3 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 16.5 |
| Progress test [PRESENCIAL][Assessment tests] | 3 |
| Final test [PRESENCIAL][Assessment tests] | 3 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 35 |
| Writing of reports or projects [AUTÓNOMA][project-based learning] | 20 |
| Study and Exam Preparation [AUTÓNOMA][Combination of methods] | 12 |
| Writing of reports or projects [AUTÓNOMA][Combination of methods] | 10 |
| Other off-site activity [AUTÓNOMA][Self-study] | 13 |
| **Total horas:** | 150 |

## 10. Bibliography and Sources

| Author(s) | Title/Link | Publishing house | Citv | ISBN | Year | Description |
|---|---|---|---|---|---|---|
| Andrew S. Tanembaum and Herbert Ros | Modern operating systems | Pearson Education | | 978-0-13-359162-0 | 2015 | |
| Gunnar Wolf, Esteban Ruiz, Federico Bergero y Erwin Meza | Fundamentos de Sistemas Operativos | Universidad Nacional Autónoma de México | | 978-607-02-6544-0 | 2015 | |
| | http://sistop.gwolf.org/ | | | | | |
| J. Carretero, F. García, P de Miguel, F. Pérez. | Sistemas operativos : una visión aplicada | McGraw-Hill | | 978-84-481-5643-5 | 2007 | |
| Milenkovic, Milan | Sistemas operativos : conceptos y diseño | McGraw-Hill | | 84-481-1871-5 | 1998 | |
| Pedro de Miguel Anasagasti, Fernando Pérez Costoya | Sistemas Operativos | Universidad Politécnica de Madrid | Madrid | | 2016 | |
| | http://www.elai.upm.es/moodle/pluginfile.php/3574/mod_resource/content/1/sistemasoperativosupm.pdf | | | | | |
| Stallings, William | Sistemas operativos : aspectos internos y principios de diseño | Prentice Hall | | 84-205-4462-0 | 2005 | |
| Tanenbaum, Andrew S. | Sistemas operativos modernos | Pearson Educación | | 978-607-442-046-3 | 2009 | |
| | | | | | | Referencia oficial del API Win32 |
| | http://msdn.microsoft.com/en-us/library/Aa383688 | | | | | |
| | | | | | | Linux Documentation Project (LDP) |
| | http://tldp.org/ | | | | | |
| Stallings, William. | Operating systems : internals and design principles | Pearson education, | | 978-1-292-21429-0 | 2018 | |
| Silberschatz, Abraham. | Operating system concepts | John Wiley & Sons, | | 0-471-69466-5 | 2005 | |