# UNIVERSIDAD DE CASTILLA - LA MANCHA

# GUÍA DOCENTE

## 1. General information

**Course:** CONCURRENT AND REAL TIME PROGRAMMING
**Code:** 42317
**Type:** CORE COURSE
**ECTS credits:** 6
**Degree:** 407 - DEGREE PROGRAMME IN COMPUTER SCIENCE ENGINEERING
**Academic year:** 2022-23
**Center:** 108 - SCHOOL OF COMPUTER SCIENCE OF C. REAL
**Group(s):** 20 21 22
**Year:** 2
**Duration:** C2
**Main language:** English
**Second language:** Spanish
**Use of additional languages:**
**English Friendly:** N
**Web site:**
**Bilingual:** Y

Lecturer: **MIGUEL ANGEL REDONDO DUQUE** - Group(s): **21**

| Building/Office | Department | Phone number | Email | Office hours |
|---|---|---|---|---|
| Fermín Caballero / A 1.2 | TECNOLOGÍAS Y SISTEMAS DE INFORMACIÓN | 926295245 | miguel.redondo@uclm.es | Available at https://esi.uclm.es/index.php/grado-en-ingenieria-informatica/profesorado/ |

Lecturer: **DAVID VALLEJO FERNANDEZ** - Group(s): **20 21 22**

| Building/Office | Department | Phone number | Email | Office hours |
|---|---|---|---|---|
| Fermín Caballero / 2.01 | TECNOLOGÍAS Y SISTEMAS DE INFORMACIÓN | 926052112 | david.vallejo@uclm.es | Available at https://esi.uclm.es/index.php/grado-en-ingenieria-informatica/profesorado/ |

Lecturer: **ARTURO JOSÉ VILLEGAS GÓMEZ** - Group(s): **21 22**

| Building/Office | Department | Phone number | Email | Office hours |
|---|---|---|---|---|
| | TECNOLOGÍAS Y SISTEMAS DE INFORMACIÓN | | ArturoJ.Villegas@uclm.es | |

## 2. Pre-Requisites

This subject relies on the competences and learning outcomes gained in the following courses:

- Programming Fundamentals I
- Programming Fundamentals II
- Operating Systems I

The course Operating Systems I represents the most important prerequisite.

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

Based on the evolution of modern operating systems and multi-processing, the course Concurrent and Real-Time Programming offers students the possibility of mastering the fundamental techniques of concurrency management, such as synchronization mechanisms and inter-process communication. Additionally, real-time programming is another relevant topic to be able to design and develop critical systems that plays an important role in our everyday's live.

## 4. Degree competences achieved in this course

### Course competences

Not established.

## 5. Objectives or Learning Outcomes

### Course learning outcomes

Not established.

## 6. Units / Contents

**Unit 1: Basic concepts**
- **Unit 1.1** The process concept
- **Unit 1.2** Foundations of concurrent programming
- **Unit 1.3** Foundations of real-time programming

**Unit 2: Semaphores and shared-memory**
- **Unit 2.1** Basic concepts
- **Unit 2.2** Implementation
- **Unit 2.3** Classical synchronization problems
- **Unit 2.4** Basic synchronization patterns

**Unit 3: Message passing**
- **Unit 3.1** Basic concepts
- **Unit 3.2** Implementation
- **Unit 3.3** Classical synchronization patterns

**Unit 4: Other synchronization mechanisms**

**Unit 4.1** Introduction
**Unit 4.2** Concurrency in Ada
**Unit 4.3** Protected objects
**Unit 4.4** Monitors

**Unit 5: Scheduling in real-time systems**

**Unit 5.1** Introduction
**Unit 5.2** The concept of real-time
**Unit 5.3** Scheduling schemes

**Unit 6: Reliability and fault tolerance**

**Unit 6.1** Basic concepts
**Unit 6.2** Prevention and fault tolerance
**Unit 6.3** Static and dynamic redundancy
**Unit 6.4** Safety, reliability and dependability

## ADDITIONAL COMMENTS, REMARKS

Labs

+ Process management

+ Semaphores and shared-memory

+ Message passing

## 7. Activities, Units/Modules and Methodology

| Training Activity | Methodology | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | Description |
|---|---|---|---|---|---|---|---|
| Class Attendance (theory) [ON-SITE] | Lectures | BA04 CO06 CO07 CO08 CO14 | 0.72 | 18 | N | - | Teaching of the subject matter by lecturer (MAG) |
| Individual tutoring sessions [ON-SITE] | | BA04 CO06 CO07 CO08 CO14 | 0.18 | 4.5 | N | - | Individual or small group tutoring in lecturer¿s office, classroom or laboratory (TUT) |
| Study and Exam Preparation [OFF-SITE] | Self-study | BA04 CO06 CO07 CO08 CO14 SIS01 SIS03 | 2.1 | 52.5 | N | - | Self-study (EST) |
| Other off-site activity [OFF-SITE] | Practical or hands-on activities | BA04 CO06 CO07 CO08 CO14 INS01 INS04 SIS03 | 0.6 | 15 | N | - | Lab practical preparation (PLAB) |
| Problem solving and/or case studies [ON-SITE] | Problem solving and exercises | BA04 CO06 CO07 CO08 CO14 INS04 PER01 PER04 PER05 SIS01 SIS03 | 0.6 | 15 | Y | N | Worked example problems and cases resolution by the lecturer and the students (PRO) |
| Writing of reports or projects [OFF-SITE] | Self-study | BA04 CO06 CO07 CO08 CO14 INS01 INS04 PER02 PER04 PER05 | 0.9 | 22.5 | Y | N | Preparation of essays on topics proposed by lecturer (RES) |
| Laboratory practice or sessions [ON-SITE] | Practical or hands-on activities | BA04 CO06 CO07 CO08 CO14 INS04 | 0.6 | 15 | Y | Y | Realization of practicals in laboratory /computing room (LAB) |
| Other on-site activities [ON-SITE] | Assessment tests | BA04 CO06 CO07 CO08 CO14 INS01 INS04 | 0.3 | 7.5 | Y | Y | Final test of the complete syllabus of the subject (EVA) |
| | | **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 (It will be essential to overcome both continuous and non-continuous assessment).

## 8. Evaluation criteria and Grading System

| Evaluation System | Continuous assessment | Non-continuous evaluation* | Description |
|---|---|---|---|
| Test | 50.00% | 50.00% | Compulsory activity that can be retaken (rescheduling) to be carried out within the planned exam dates of the final exam call (convocatoria ordinaria). |
| Theoretical papers assessment | 15.00% | 15.00% | Non-compulsory activity that can be retaken. To be carried out before end of teaching period |
| Laboratory sessions | 25.00% | 25.00% | Compulsory activity that can be retaken. To be carried out during lab sessions |
| Assessment of active participation | 10.00% | 0.00% | Non-compulsory activity that cannot be retaken. To be carried out during the theory/lab sessions |
| Oral presentations assessment | 0.00% | 10.00% | Non-compulsory activity that can be retaken. To be carried by students in the non-continuous assessment modality. |
| **Total:** | **100.00%** | **100.00%** | |

*According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).*

**Evaluation criteria for the final exam:**

**Continuous assessment:**

In compulsory activities, a minimum mark of 40% is required in order to pass that activity and have the possibility to therefore pass the entire subject. The evaluation of the activities will be global and therefore must be quantified by means of a single mark. In the case of the activities that may be retaken (i.e., rescheduling), an alternative activity or test will be offered in the resit/retake exam call (convocatoria extraordinaria).

The final exam will be common for all the theory/laboratory groups of the subject and will be evaluated by the lecturers of the subject in a serial way, i.e., each part of the final exam will be evaluated by the same lecturer for all the students.

A student is considered to pass the subject if she/he obtains a minimum of 50 points out of 100, taking into account the points obtained in all the evaluable activities, and also has passed all the compulsory activities.

For students who do not pass the subject in the final exam call (convocatoria ordinaria), the marks of activities already passed will be conserved for the resit/retake examcall convocatoria extraordinaria). If an activity is not recoverable, its assessment will be preserved for the resit/retake exam call (convocatoria extraordinaria) even if it has not been passed. In the case of the passed recoverable activities, the student will have the opportunity to receive an alternative evaluation of those activities in the resit/retake exam call and, in that case, the final grade of the activity will correspond to the latter grade obtained.

The mark of the passed activities in any call will be conserved for the subsequent academic year at the request of the student, provided that mark is equal or greater than 50% and that the activities and evaluation criteria of the subject remain unchanged prior to the beginning of that academic year.

The failure of a student to attend the final exam will automatically result in her/him receiving a "Failure to attend" (no presentado). If the student has not passed any compulsory evaluation activity, the maximum final grade will be 40%.

**Non-continuous evaluation:**

Students may apply at the beginning of the semester for the non-continuous assessment mode. In the same way, the student may change to the non-continuous evaluation mode as long as she/he has not participated during the teaching period in evaluable activities that together account for at least 50% of the total mark of the subject. If a student has reached this 50% of the total obtainable mark or the teaching period is over, she/he will be considered in continuous assessment without the possibility of changing to non-continuous evaluation mode.

Students who take the non-continuous assessment mode will be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences), through the assessment systems indicated in the column "Non-continuous assessment".

In the "non-continuous assessment" mode, it is not compulsory to keep the mark obtained by the student in the activities or tests (progress test or partial test) taken in the continuous assessment mode.

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

Evaluation tests will be conducted for all recoverable activities.

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

Same characteristics as the resit/retake exam call.

## 9. Assignments, course calendar and important dates

**Not related to the syllabus/contents**

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

**General comments about the planning:** The subject is taught in 3 x 1,5 hour sessions per week

## 10. Bibliography and Sources

| Author(s) | Title/Link | Publishing house | City | ISBN | Year | Description |
|---|---|---|---|---|---|---|
| Silberschatz, A., Galvin, P., Gagne, G. | Operating Systems Concepts | Mc Graw-Hill | | 978-1118093757 | 2013 | |
| Vallejo, D., González, C., Albusac, J.A. | Programación Concurrente y Tiempo Real (3ª Edición) http://www.libropctr.com/ | Amazon CreateSpace | | 978-1518608261 | 2016 | |
| Burns, A., Wellings, A. | Sistemas en tiempo real y lenguajes de programación | Addison-Wesley | | 978-8478290581 | 2003 | |
| Kernighan, B., Ritchie, D. | El lenguaje de programación C | Prentice-Hall | | 978-9688802052 | 1991 | |
| Rochkind, M. | Advanced Unix Programming | Prentice-Hall | | 978-0131411548 | 2004 | |