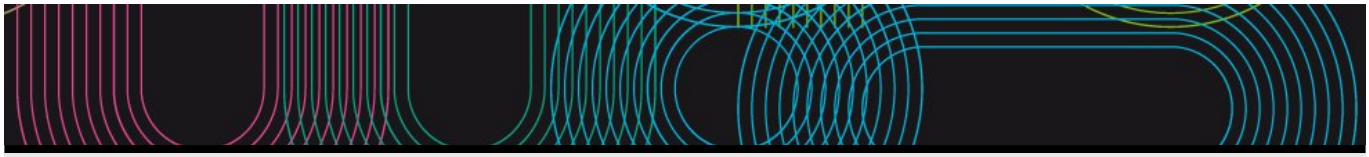

IDENTIFYING DATA				
Distributed and Concurrent Programming				
Subject	Distributed and Concurrent Programming			
Code	V05G301V01306			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	García Duque, Jorge			
Lecturers	García Duque, Jorge			
E-mail	jgd@det.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The main goal of this subject is to provide the foundations of the synchronisation and communication among processes in centralised and distributed systems.			

Training and Learning Results	
Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
B9	CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
C33	CE33/TEL7 The ability to program network and distributed applications and services.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.
D4	CT4 Encourage cooperative work, and skills like communication, organization, planning and acceptance of responsibility in a multilingual and multidisciplinary work environment, which promotes education for equality, peace and respect for fundamental rights.

Expected results from this subject	Training and Learning Results		
Ability to design and develop concurrent and distributed systems.	B4 B9	C33	
Understanding of the main theoretical concepts of the concurrent and distributed systems.	B3		D2 D3 D4
Knowledge of the main tools and surroundings for the development of concurrent and distributed systems.	B4 B9	C33	

Contents
Topic

Introduction to Concurrent Programming	Concepts of concurrence, parallelism and multitasking. Interleaving of atomic instructions. Precedence graphs.
The critical section problem	The definition of the problem. Busy waiting. Starvation Deadlock. Dekker´s algorithm. Peterson´s algorithm
Concurrent Programming Constructs	Semaphores. The problem of the producer-consumer. The problem of the philosophers. Monitors. Variables of Condition. The problem of the readers-writers.
Deadlock	Introduction and definition of deadlock. Necessary conditions. Deadlock prevention. Deadlock avoidance. Detection and Recovery
Communication among processes	Message Passing. Remote Procedure Call (RPC).
Distributed Programming	Introduction to Distributed Systems. Distributed mutual exclusion Ricart-Agrawala Algorithm. Token ring Algorithms. Consensus: Crash Failures. Byzantine Failures.

Planning			
	Class hours	Hours outside the classroom	Total hours
Workshops	5	30	35
Practices through ICT	13	26	39
Lecturing	20	46	66
Objective questions exam	0.25	0	0.25
Laboratory practice	1	0	1
Essay	2	6	8
Objective questions exam	0.25	0	0.25
Objective questions exam	0.25	0	0.25
Objective questions exam	0.25	0	0.25
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Workshops	Each group of students will tackle the design and implementation of a project software of half complexity. Said task will make in different successive steps, that will be discussed and validated in each one of the face-to-face sessions. This methodology of work has like aim provide a suitable *realimentación for, if it is timely, improve the solutions posed. This methodology is oriented to purchase the competitions *CG4, *CG9 and *CT4
Practices through ICT	The students will resolve under the supervision of the *profesorado the practical problems that pose in each session of laboratory. This methodology is oriented to purchase the competitions *CE33/*TEL7 and *CT3
Lecturing	Exhibition of the ideas, concepts, technical and algorithms of each lesson of the *temario. This methodology is oriented to purchase the competitions *CG3 and *CT2

Personalized assistance	
Methodologies	**Description**
Lecturing	By means of tutoring https://moovi.uvigo.gal/user/profile.php?id=11338
Workshops	Part of the sessions devote to resolve individual questions with each student by means of individual questions so much by part of the professor as of the student https://moovi.uvigo.gal/user/profile.php?id=11338

Practices through ICT	Of complete way for the students that do the practices of individual way, and by means of the resolution of individual questions with each student by means of questions *individualizadas so much by part of the professor as of the student https://moovi.uvigo.gal/user/profile.php?id=11338

Assessment

	Description	Qualification	Training and Learning Results		
Objective questions exam	Proof of theoretical contents exposed in the master classes.	12.5	B3 B4	C33	D2
Laboratory practice	Evaluation of the work carried out in each one of the sessions of laboratory For the individual evaluation of each student, personalised questions will be asked in each one of the sessions.	20	B3 B4	C33	D2 D3
Essay	In the last face-to-face session of workshop, students will deliver and will expose to their mates the design and the proposed solution for their project. This solution will be exposed to debate for students and professors For the individual evaluation of each student will realise personalised questions in each one of the sessions.	30	B9	C33	D3 D4
Objective questions exam	Proof of theoretical contents exposed in the master classes.	12.5	B3 B4	C33	D2
Objective questions exam	Proof of theoretical contents exposed in the master classes.	12.5	B3 B4	C33	D2
Objective questions exam	Proof of theoretical contents exposed in the master classes.	12.5	B3 B4	C33	D2

Other comments on the Evaluation

The subject can surpass by means of Continuous Assesment according to the criteria that indicate more advance, having opened the possibility to opt by the Exam-only assessment anytime until the beginning of the final examination to celebrate the day fixed to such effect in the official calendar of the *EET.

All those students that opt by the continuous evaluation will consider presented in the part of the work in Workshops.

Continuous assesment:

The final note will result of the sum of the corresponding notes to the three following components:

1. Four proofs of type Test to evaluate the contents given in the masterclasses. Each proof will take place in one of the sessions *magistrales, except the last that will carry out in one of the sessions of the Workshop.

Score: Until 1,25 points each proof.

2. Six Practical Proofs that will carry out when finalising each one of the sessions of laboratory and that will consist in the **validation of the results obtained during the said session.

Score: Until 1/3 points. Each proof.

3. Presentation of the Project proposed like work in the sessions of the Workshop.

Score: Until 3 points.

To approve the subject by Continuous Evaluation will have to give the three following conditions:

(*i) Obtain an equal or upper qualification to 2 points in the group of the tests.;
(*ii) Upper qualification to 0 points in, at least, four of the six practical proofs; and
(*iii) Assist to all the face-to-face sessions of workshop and obtain more than 0 points in the presentation of the project.

In case of not fulfilling any of said condition, the final note of the student will be limited to a maximum of 4 points.

Global assessment:

By means of an examination on 10 points fixed in the official calendar of the *EET.

Extraordinary exam and End-of-program exam:

It will govern by the indicated for the Global assessment.

Sources of information

Basic Bibliography

M. Ben-Ari, **Principles of Concurrent And Distributed Programming**, Second Edition,

Complementary Bibliography

George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, **Distributed Systems Concepts and Design**, Fifth Edition,

William Stallings, **Operating Systems: Internals and Design Principles, 6/E**, Eight Edition,

Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, **Operating system concepts**, Ninth Edition,

Lea, Douglas, **Programación concurrente en Java : principios y patrones de diseño**, Second Edition,

Recommendations

Subjects that it is recommended to have taken before

Programming I/V05G301V01105
Programming II/V05G301V01110