UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: HIGH PERFORMANCE COMPUTING
Code: 311049
Type: CORE COURSE
ECTS credits: 6
Degree: 2362 - MÁSTER UNIVERSITARIO EN INGENIERÍA INFORMÁTICA (CR) - (2020)
Academic year: 2023-24
Center: 108 - SCHOOL OF COMPUTER SCIENCE OF C. REAL
Group(s): 20
Year: 1
Duration: C2
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site: Virtual space of the course https://campusvirtual.uclm.es
Bilingual: N

Lecturer: **JESUS BARBA ROMERO** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Fermín Caballero/3.09	TECNOLOGÍAS Y SISTEMAS DE INFORMACIÓN	926052284	jesus.barba@uclm.es	Available at https://esi.uclm.es/categories/profesorado-y-tutorias

Lecturer: **FRANCISCO PASCUAL ROMERO CHICHARRO** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Fermin Caballero / 3.17	TECNOLOGÍAS Y SISTEMAS DE INFORMACIÓN	926051535	franciscop.romero@uclm.es	Available at https://esi.uclm.es/categories/profesorado-y-tutorias

2. Pre-Requisites

Not established

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

The field of High Performance Computing (HPC) and its application has become one of the most dynamic in the ICT world. Therefore, it is mandatory to know them, their features and posibilities. Starting from a basic nowledge of the infrastructure (nodes + network) supporting this computing facilities, we will dig into the techiques and methods to benchmark supercomputers, as well as the design and development of parallel applications. HPC is preset in a miriad of engineering (i.e. complex simulations of physical and chemical processes) applications and business processes (i.e. Big Data processing). So, mastering HPC is key for the ICT professionals of the future.

4. Degree competences achieved in this course

Course competences

Code	Description
CE09	Ability to design and assess operating systems and servers, plus applications and systems based on distributed computing.
CE10	Ability to understand a apply advanced knowledge on high performance computing and numerical or computational methods to engineering problems.
INS01	Analysis, synthesis and assessment skills.
INS04	Problem solving skills by the application of engineering techniques.
INS05	Argumentative skills to logically justify and explain decisions and opinions.
PER01	Team work abilities.
SIS03	Autonomous learning.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Manage tasks of all elements involved in the running of a high-performance distributed data processing system

Design and engineer high-performance and high-availability data processing equipment, including hardware, software and human resources

Evaluate and exploit the system, including socio-economic aspects

Additional outcomes

Provide the student with the ability to make professional and business decisions that will improve the performance and competitiveness of his organization's ICT infrastructure.

Teach the student in the diverse paradigms of parallel computer programming, influence software techniques for the design and implementation of efficient parallel algorithms and applications, and apply these techniques in a practical way for the programming of parallel computers with different architectures, using supercomputing resources

6. Units / Contents

Unit 1: Introduction to High Performance Computing

Unit 2: Performance Analysis and Benchmarking

Unit 3: Paralell Programming Models for HPC

Unit 4: Platforms and Model

Unit 5: Application Deployment

ADDITIONAL COMMENTS, REMARKS

The practical sessions will consist of adjusting a theoretical model of system runtimes, determining the performance of our systems and developing distributed applications using the MPI and OpenMP libraries

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]	Combination of methods	CE09 CE10	0.75	18.75	N	-	theory master classes
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CE09 CE10 INS04	0.57	14.25	Y	Y	Practices with HPC systems
Individual tutoring sessions [ON-SITE]	Self-study	INS05	0.16	4	N	-	
Study and Exam Preparation [OFF-SITE]	Self-study	SIS03	2.4	60	N	-	
Problem solving and/or case studies [ON-SITE]	Case Studies	CE09 CE10 INS04	0.6	15	Y	N	
Practicum and practical activities report writing or preparation [OFF-SITE]	Self-study	INS01 PER01	1.2	30	Y	N	Report Writing
Final test [ON-SITE]		CE09 CE10 INS01	0.32	8	Y	Y	
		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
Final test	40.00%	40.00%	Test to be carried out within the planned exam dates of the final exam call (convocatoria ordinaria).
Assessment of problem solving and/or case studies	20.00%	20.00%	Resolution of different practical cases proposed in class (INF)
Laboratory sessions	30.00%	30.00%	Carrying out practices and preparing a report on the laboratory worf. (LAB)
Oral presentations assessment	10.00%	10.00%	Presentation of solutions to problems and cases raised in class (PRES). Students who choose "non-continuous evaluation" must submit a video with the defence of the subject by telematic means.
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. A compulsory activity cannot be divided into eliminatory parts, nor can minimum marks be established for each of its parts. 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).

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). 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, except for the final exam, 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 evaluation 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 evaluation".

In the "non-continuous evaluation" 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.
The failure of a student to attend the final exam will automatically result in her/him receiving a "Failure to attend" (no presentado), except in the case that the student conserves the mark for the final exam from the final exam call (convocatoria ordinaria). In the latter case, the student's carrying out of any other evaluable activity in the resit/retake exam call (convocatoria extraordinaria) will result in a numerical mark.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**

General comments about the planning: This course will be taught in 1.5 hour sessions spread over the school calendar.

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Ananth Grama, George Karypis, Vipin Kumar y Anshul Gupta	Introduction to Parallel Computing	Addison Wesley		978-0201648652	2003	Acceso a la versión digital a través de la web de la biblioteca de la UCLM
Michael J. Quinn	Parallel Programming in C with MPI and OpenMP	McGraw Hill Higher Education		978-0072822564	2003	
Peter Pacheco	An Introduction to Parallel Programming	Morgan Kaufmann		978-0-12-374260-5	2011	
	http://proquest.safaribooksonline.com/book/programming/9780123742605					
Rohit Chandra Leonardo Dagum Dave Kohr Dror Maydan Jeff McDonald Ramesh Menon	Parallel Programming in OpenMP	Morgan Kaufmann Publishers	San Francisco	1-55860-671-8	2001	
Thomas Sterling	High Performance Computing: Modern Systems and Practices	Morgan Kauffman			2017	