COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Engineering		
ACADEMIC UNIT	Informatics and Computer Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE		**SEMESTER**	**5th**
COURSE TITLE	Introduction to Parallel Computing		
INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits		**WEEKLY TEACHING HOURS**	**CREDITS**
		4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE general background, special background, specialised general knowledge, skills development	Specialised general knowledge, skills development		
PREREQUISITE COURSES:	Computer Programming		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CS152/		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.
Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

It is the basic introductory course in parallel computing. The course material aims to introduce students to the basic concepts of parallel computing, models of parallel computation, parallel architectures and interconnection networks for parallel machines, as well as to the design and implementation of parallel algorithms in shared and distributed memory parallel machines.
Upon successful completion of the theoretical and laboratory part of the course, the student:

- will have become acquainted with the concept of parallel computing and the particular problems presented in the programming of parallel machines
- will be familiar with the models of parallel computation and the "parallel way of thinking" required in the design of parallel algorithms
- will be able to apply algorithm design techniques in a shared memory computing environment and will be able to design shared memory algorithms
- will have understood the basic techniques for designing algorithms in a distributed memory computing environment.
- will have understood and be able to apply the basic principles of parallel programming in a shared and distributed memory environment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the

course aim?	
Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Working independently Team work Working in an international environment Working in an interdisciplinary environment Production of new research ideas	Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking …… Others… …….

- Search for, analysis and synthesis of data and information, using the necessary technologies
- Autonomous work
- Team work
- Adaptation to new situations
- Work in an interdisciplinary environment
- Generating new research ideas
- Promotion of free, creative and inductive thinking

(3) SYLLABUS

Theory:

- Concepts in Parallel Computing.
- Fundamentals of Parallel Machine Architectures. Interconnection Networks Topologies for Parallel Machines.
- Parallel Computing Models, Simulations among Models, Brent's Scheduling Principle.
- Design of Shared and Distributed Memory Parallel Algorithms.
- Parallel Algorithms in a Shared Memory Environment (sorting and merging algorithms, calculation of prefixes, calculations in lists, etc.).
- Introduction to the Message Passing Parallel Computing Model. Parallel Algorithms in a Distributed Memory Computing Environment.

Lab:

Introduction to the parallel distributed memory programming using the Message Passing Interface (MPI) message library.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Face-to-face. Use of distance learning (if required)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Use of ICT in Course Teaching and Laboratory Education, Use of ICT in Communication with Students Post course material on the University's e-learning platform (e-class). Use of email and e-class in communication with students.
TEACHING METHODS The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each	

Activity	Semester workload
Lectures	26
Problem Solving in Class	13
Laboratory Education	13
Lab exercises	24
Non-guided study	49
Course total	125

learning activity are given as well as the hours of non-directed study according to the principles of the ECTS	
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	Final Grade = (70% * Grade of the Theory_Part) + (30% * Grade of the Laboratory Part) *Evaluation Process of Theory Part*: Final written exam at the end of the semester *Evaluation Process of Laboratory Part*: Preparation of laboratory exercises / assignments and oral or written examination The evaluation process is disclosed to the students in class and online, via e-class.

(5) ATTACHED BIBLIOGRAPHY

1. Γρ. Πάντζιου, Β. Μάμαλης, Α. Τομαράς "Εισαγωγή στον Παράλληλο Υπολογισμό: Πρότυπα, Αλγόριθμοι, Προγραμματισμός", Εκδόσεις Νέων Τεχνολογιών, 2013. (In Greek)
2. Παπαδάκης Σ., Διαμαντάρας Κ., Προγραμματισμός και Αρχιτεκτονική Συστημάτων Παράλληλης Επεξεργασίας, Εκδόσεις Κλειδάριθμος, 2012. (In Greek)
3. Peter S. Pacheco, Matthew Malensek, An Introduction to Parallel Programming, Second Edition, Elsevier, 2022.
4. M. Quinn, "Parallel Programming in C with MPI and OpenMP", Mc Graw Hill, 2003.
5. S. Rajasekaran and J. Reif, "Handbook of Parallel Computing: Models, Algorithms and Applications", Chapman and Hall/CRC, 2007.
6. A. Grama, G. Karypis, V. Kumar, A. Gupta, Introduction to Parallel Computing, 2nd Edition, Addison-Wesley, 2003.
7. F.T. Leighton, "Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes", Morgan Kaufmann, San Mateo, CA, 1992.
8. J. JáJá, "An Introduction to Parallel Algorithms", Addison-Wesley, 1992.
9. A. Gibbons and W. Rytter, "Efficient Parallel Algorithms", Cambridge University Press, Cambridge, 1990.
10. Δημακόπουλος, Β., 2015. Παράλληλα συστήματα και προγραμματισμός [ηλεκτρ. βιβλ.], Αθήνα: Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών. In Greek. Available in: http://hdl.handle.net/11419/3209
11. Lawrence Livermore National Laboratories MPI Tutorial, http://www.llnl.gov/computing/tutorials/mpi/