COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Department of Digital Industry Technologies		
LEVEL OF STUDIES	Postgraduate (MSc on Robotics and Industrial Control)		
COURSE CODE	**006**	**SEMESTER**	2nd
COURSE TITLE	Development of Supervisory Controllers in Industrial Environments		
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**
Lectures	3		8
Total	3		8
COURSE TYPE *special background, specialised general knowledge, skills development*	Specialization Course		
PREREQUISITE COURSES:	---		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek and/or English		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, under conditions		
COURSE WEBSITE (URL)	https://ric.dind.uoa.gr/programma/mathimata/b_examino/anaptyxi_epopton_elegkton_se_biomichanika_periballonta/		

(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*

Aim of the course is to familiarize the students with the description of rules regarding safe and desired operation of industrial systems of various categories, and the synthesis of dynamic supervisory schemes in various architectures like Modular Control, Decentralized Control, Hierarchical Control, and Distributed Control. The advantages of each architecture will be revealed through implementation in PLC programming languages and industrial SCADA environments. Upon successful completion of the course, students will be able to:

• Describe the desired operation in the form of rules that can be easily applied to systems of large scale and complex architecture, ensuring the implementability of the rules in industrial systems,

• Design supervisory control schemes, comprising large number of supervisors in the form of automata,

• Select the appropriate supervisory control architecture satisfying successful realization of safe and efficient performance,

• Implement supervisory control architectures in ladder logic, structured text, and function blocks for PLCs

• Implement supervisory control architectures in Visual Basic, C, or Python for SCADA systems,

• Emulate industrial system and the supervisory control schemes in PLC environments.

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, with the use of the necessary technology, Decision-making, Working independently, Team work, Project planning and management, Criticism and self-criticism, Production of free, creative and inductive thinking.

(3) SYLLABUS

Design of Supervisory Controllers for processes described with Discrete Event Systems: General, Static, and Dynamic Supervisors. Generalized Requirements for Safe and Efficient Operation in Supervisor Design. Supervisory Control Architectures: Modular Control, Decentralized Control, Hierarchical Control, Distributed Control. Simulation and Implementation of Supervisors: Implementation of Supervisors with Ladder, Structured Text and Function Block Diagrams, Industrial SCADA Systems, Implementation of Supervisors in SCADA systems, Representative applications of development of Supervisor Controllers in Industrial Processes using advanced technologies.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face, Synchronous and Asynchronous distance learning
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Supporting the learning process through • use of an electronic platform for interactive two-way communication and participation, • use of an electronic classroom platform for providing educational material, discussions, announcements, assignments, • e-mail communication, • use of projectors during lectures • use of software packages for simulation development • use of software packages for simulation and control of discrete event systems • use of SCADA software • use of software packages to collect and exchange data among industrial subsystems.
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 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,*	The evaluation of postgraduate students and their performance in the course takes place at the end of each semester with written or oral examinations or assignments throughout the semester or can be based on intermediate progress exams, written assignments, laboratory exercises or a combination of all the above. The method of evaluation is defined by the instructor of the course and

Activity	*Semester Workload*
Lectures	39
Literature study & analysis	70
Project / Essay writing	91
Course Total	200

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.*	announced to the students. The language for written and oral examinations is the same with that used for teaching. The assignments essays may be written in Greek and/or English language. When conducting written or oral examinations as assessment methods, the integrity of the procedure must be ensured. Scoring is done on a scale of 0-10. The results of the examinations are announced by the instructor and sent to the Secretariat of the Postgraduate Program within four weeks at the latest from the examination of the course. The participation rate of exercises, assignments, etc. The final grade of the course is determined by the course instructor and announced to students at the beginning of the semester. Alternative assessment methods may be applied, such as the conduct of written or oral examinations using electronic means, provided that the integrity of the evaluation process is ensured and the provisions of the relevant regulations of the MSc are met. Alternative methods may also be applied for the assessment of students with disabilities and special educational needs following a decision of the Board of Directors and the recommendation of the head of the Department for Disabled Persons and taking into account the relevant instructions of the Accessibility Unit for Students with Disabilities.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. W. M. Wonham, and C. Kai, Supervisory Control of Discrete-Event Systems, Springer Cham, Switzerland, 2019.
2. C. G. Cassandras, and S. Lafortune, Introduction to Discrete Event Systems, 3rd ed., Springer Cham, Switzerland, 2021.

- Relative academic journals:

1. Discrete Event Dynamic Systems, Springer.
2. Automatica, Elsevier.
3. Transactions on Automatic Control, Institute of Electrical and Electronics Engineers.
4. Control Systems Magazine, Institute of Electrical and Electronics Engineers.
5. Transactions on Systems, Man, and Cybernetics: Systems, Institute of Electrical and Electronics Engineers.
6. Systems, Man, And Cybernetics Letters, Institute of Electrical and Electronics Engineers.
7. Transactions on Industrial Informatics, Institute of Electrical and Electronics Engineers.
8. Transactions on Industrial Cyber-Physical Systems, Institute of Electrical and Electronics Engineers.
9. Transactions on Industry Applications, Institute of Electrical and Electronics Engineers.
   Industry Applications Magazine, Institute of Electrical and Electronics Engineers.