VNIVERSITAT DE VALÈNCIA

Course Guide
45005 Control de procesos en instalaciones ambientales

COURSE DATA

Data Subject	
Code	45005
Name	Control de procesos en instalaciones ambientales
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2250 - M.D. in Environmental Engineering	School of Engineering	2	First term

Subject-matter

Degree	Subject-matter	Character
2250 - M.D. in Environmental Engineering	28 - Control de procesos en instalaciones ambientales	Optional

Coordination

Name	Department
ROBLES MARTINEZ, ANGEL	245 - Chemical Engineering
RUANO GARCIA, MARIA VICTORIA	245 - Chemical Engineering

SUMMARY

Process control in environmental facilities is an elective course of 3 credits that is taught in the first semester of the second year of the Master in Environmental Engineering.

The aim of this course is to provide the necessary training related to the control of processes and facilities in the context of Environmental Engineering. This requires some of the knowledge acquired in different subjects taught during the first year of the Master in Environmental Engineering: Water Treatment, Control of air pollution, Assessment of environmental quality, Waste Management and Treatment, Advanced Modeling of Water Treatment, and Monitoring and Processing of Environmental Data. After taking these subjects, students will have the necessary knowledge about the operation and modeling of the different types of environmental facilities, as well as the different environmental quality parameters and monitoring methods. This course will introduce the importance of the control of these facilities for their correct operation in optimal conditions and the necessary skills to be able to design control systems for these facilities will be acquired.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

OUTCOMES

2250 - M.D. in Environmental Engineering

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Identify, formulate and solve complex environmental engineering problems by applying engineering, scientific and mathematical principles.
- Apply environmental engineering designs to produce solutions that meet specific needs addressing public health, safety and welfare taking account of global, cultural, social, environmental and economic factors.
- Recognise the ethical and professional responsibilities of environmental engineering and make informed judgements considering the impact of engineering solutions in global, economic, environmental and social contexts.
- Conduct appropriate experimentation, analyse and interpret data and use environmental engineering knowledge to draw conclusions.
- Learn and apply new knowledge, using appropriate learning strategies.
- Implement measures for preventing pollution and recovering, protecting and improving environmental quality.
- Develop and apply mathematical models for the simulation, optimisation or control of processes in the field of environmental engineering.
- Manage and operate treatment and/or purification systems in the field of environmental engineering

- Develop environmental solutions under the principles of circular economy and the sustainable development goals.

LEARNING OUTCOMES

1 To know and apply monitoring techniques in the control of industrial processes of gas, water and/or waste treatment.

2 To be aware of the importance of control systems to achieve the operation of a facility in optimal conditions.

3 To know the instrumentation used in treatment facilities and its basic properties for the automatic control of processes.

4 To know the communication systems used in industrial installations for the management and exchange of information.

5 To know the programmable logic controllers (PLC) used in industrial installations for the automation and control of processes.

6 To know the different types of software and SCADA systems used for advanced monitoring and control of industrial processes.

7 To know the different types of control structures and hierarchies used for the control of complex industrial installations.

8 To know the most used classical control algorithms and their implementation at the physical level.

9 To know and apply the fundamentals of advanced control algorithms, including artificial intelligence and expert knowledge, in the design of industrial process control systems.

10 Develop known process control systems.

DESCRIPTION OF CONTENTS

1. Instrumentation, automation and monitoring in environmental installations.

Instrumentation, control and automation (ICA) of environmental installations. Sensors, controllers and actuators. Programmable logic controllers (PLC). Supervisory control and data acquisition systems (SCADA). Monitoring techniques and their application to the statistical control of environmental processes.

2. Classical control systems

Control algorithms in environmental installations. On-off control. PID control.

3. Advanced control systems

Artificial intelligence applied to the control of environmental facilities. Control based on fuzzy logic. Control based on neural networks. Model-based control. Genetic algorithms. Other advanced control systems

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	10,00	100
Computer classroom practice	8,00	100
Classroom practices	8,00	100
Seminars	2,00	100
Theoretical and practical classes	2,00	100
Development of group work	15,00	0
Study and independent work	20,00	0
Resolution of case studies	10,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

- Theoretical activities.

In the theoretical classes the topics will be developed providing a global and integrative vision, analyzing in greater detail the key and more complex integrating, analyzing in greater detail the key and more complex aspects, encouraging, at all times, the student's participation.

- Practical activities.

They complement the theoretical activities with the objective of applying the basic concepts and expanding them with the knowledge and experience acquired during the realization of the proposed works. Learning through problem solving, exercises and case studies through which competences on the different aspects of the subject are acquired.

- Work in the computer classroom.

Learning through activities developed individually or in small groups and carried out in computer classrooms. Resolution of case studies through which competences on the different aspects of the subject are acquired.

- Personal work of the student.

Resolution of practical cases, and autonomous study and work. This task will be carried out individually and tries to promote autonomous work.

- Work in small groups.

Work in small groups (2-4 students), including problem solving outside the classroom. This task complements the individual work and promotes the capacity of integration in work teams.

- Evaluation.

Individual evaluation tests in the classroom with the teacher's presence.

- Use of resources.

The e-learning platform (Virtual Classroom of the University of Valencia) will be used as a support for communication with students. Through it, students will have access to the didactic material used in class, as well as the problems and exercises to be solved.

EVALUATION

To evaluate the students' learning, the objective test methodology will be used, consisting of one or several exams that will consist of both theoretical-practical questions and problems, with a weight in the final grade of 30%. The rest of the grade will be obtained from the evaluation of the practical activities based on the elaboration of papers, reports, case studies and/or oral presentations, with a weight in the final grade of 60%, as well as the continuous evaluation of each student, based on the participation and degree of involvement of the student in the teaching-learning process, taking into account the regular attendance to the scheduled classroom activities and the resolution of questions and problems proposed periodically, with a weight in the final grade of 10%.

The planned activities that the student must carry out outside the classroom attendance will be coordinated between the different subjects of the master's degree coordinated among the different subjects of the Master and under the supervision of the Academic Coordination Committee of the Master.

In any case, the evaluation system will be governed by the provisions of the Reglament de Avaluació i Qualificació de la Universitat de València per a títols de Grau i Màster (http://links.uv.es/7S40pjF).

REFERENCES

Basic

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- G. Olsson, M.K. Nielsen, Z. Yuan, A. Lynggaard-Jensen y J.P. Steyer (2005) Instrumentation, Control and Automation in Wastewater Systems. Scientific and Technical Report No. 15. IWA Publishing. London
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- Richard C. Dort, Robert H. Bishop; Sistemas de Control Moderno Pearson-Prentice Halll, Madrid 2005
- Stefano Marsili-Libelli. Environmental Systems Analysis with MATLAB®. CRC Press; 2016

Additional

- T.M. Palmer y colaboradores (2007) On-line nitrogen monitoring and control strategies. IWA publishing, London
- Water Environment Federation (2006) Automation of Wastewater Treatment Facilities. WEF Press
- J. Wilkie, M. Johnson, R. Katebi (2002) Control Engineering: An Introductory Course. Ed. Palgrave.
- W. Bolton; Programmable Logic Controllers 2nd Ed.; Newnes, Oxford 2000
- Leonid Reznik; Fuzzy Controllers; Newnes, Oxford 1997
- Stuart G. McCrady; Designing SCADA Application Software. A Practical Approach Elsevier, Amsterdam 2013 (ebook)