COURSE GUIDE SUBJECT: 2012-13

Subject:	Optimization and Simulation of Industrial Processes		
Code:	70643213	Plan:	Master in Advanced and Industrial Informatics
Academic year:	2012-13	Level:	Official Master
Course:	1	Type:	Elective
Semester:	Second		

TIME DISTRIBUTION OF SUBJECT BY LEGISLATION

	Credits:	6	Student presential hours:	45
			Student Non presential hours:	105
			Total Hours:	150

USING THE VIRTUAL PLATFORM:	Teaching support

TEACHER INFORMATION

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ORGANIZATION OF ACTIVITIES

Planned activities for learning and time distribution of workload by activity (estimated in hours)

I. STUDENT ACTIVITIES (On Campus / Online)	• Large Group	0,0
	• Teaching Group	25,5
	• Working Group / Small Group	19,5
	Total On Campus hours / On line ...	45,0
II. STUDENT ACTIVITIES NON ATTENDANCE (Autonomous work)	• (Group work, individual work)	105
	Total non-presential hours ...	105
TOTAL STUDENT WORKING HOURS		150,0

ITEMS OF INTEREST FOR LEARNING COURSE

Justification of contents

Block I. Identification and simulation of industrial processes (2.8 ECTS)

Unit 1. Introduction to simulation models, building models, random variables and analysis of outputs.

Unit 2. Introduction to the identification and modeling of processes

Unit 3. Object-oriented modeling of industrial processes

Unit 4. Identification of linear and nonlinear systems

Lab 1: Modeling and identification of a heat exchanger

Block II. Nonlinear optimization (1.5 ECTS)

Unit 5. Nonlinear optimization

Lab 2: Symbolic computation and algorithms in MATLAB. Examples of numerical search methods

Block III. Deterministic global optimization algorithms. (0.5 ECTS)

Unit 6. Deterministic global optimization algorithms.

Block IV. Metaheuristic algorithms in industrial processes (1.2 ECTS)

Unit 7: metaheuristics algorithms in problems of industrial processes

Lab 3: Optimization of real problems of industrial computing using evolutionary algorithms.

Relates subjects in the Curriculum

- Global optimization algorithms. Parallel strategies
- Advanced control of industrial processes
- Industrial Real-Time Systems
- Industrial Robotics
- Heuristic Optimization and Multiobjective
- Master's Thesis Final Work

Expertise to deal with the Subject

- No previous knowledge
- Blocks II, III and IV are taught in bilingual.
- Block I is taught in Spanish but makes use of written material in English. Could be given in English.

Prerequisites set out in the Degree

There are no prerequisites for taking this course

COMPETENCIES

General Competencies

Generic Competences at the University of Almería

- Knowledge of a second language
- Work into groups
- Ability to solve problems

Other Generic Competences

- • Application of knowledge

Developed Specific Competences

Capacity to:

1. Analyze the behavior of dynamic systems
2. Assess the data required for modeling of industrial systems.
3. Develop models of industrial systems.
4. Determine the type of optimization problem that can be found in the industry
5. Find the best optimization technique to every problem
6. Programming in MATLAB algorithms and problems
7. Distinguish the basic characteristics of optimization algorithms
8. Use and configure genetic algorithms to solve several real problems.

LEARNING OBJECTIVES / RESULTS

1.
2. 1. Acquire skills in developing useful models of dynamic systems for simulation and control, both based on physical principles and in data taken at the facility.
3. 2. Differentiate the various optimization problems appearing in industrial computing.
4. 3. Characterize the different models and frameworks for optimization such as dynamic linear programming, integer, nonlinear and heuristics.
5. 4. Analyze the internal workings of the algorithms, to evaluate the ease of resolution and facilitate the interpretation of their results
6. 5. Use and configure metaheuristic algorithms for solving global optimization problems.
7. 6. With examples in industrial optimization

THEMATIC BLOCK AND ORGANIZATIONAL ARRANGEMENTS

Block	I. Identification and simulation of industrial processes

Content / Unit

	Unit 1. Introduction to simulation models, building models, random variables and analysis of outputs.

Organizational Procedures and Working Methods

Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Teaching Group	Lectures / classes participatory		4,0
Working Group / Small Group	Problems		1,2
	Doing exercises		0,8

Description of the autonomous work of the student

- Individual study of theoretical concepts. - To assimilate knowledge from the subjects taught in the lectures, solving the problems

Content / Unit

	Unit 2. Introduction to the identification and modeling of Processes

Organizational Procedures and Working Methods

Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Teaching Group	Lectures / classes participatory		4,0
Working Group / Small Group	Doing exercises		0,8
	Problem resolution		1,2

Description of the autonomous work of the student

- Individual study of theoretical concepts. - To assimilate knowledge from the subjects taught in the lectures, solving the problems

Content / Unit

	Unit 3. Object-oriented modelling of industrial processes

Organizational Procedures and Working Methods

Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Teaching Group	Lectures / classes participatory		2,0
Working Group / Small Group	Doing exercises		1,0

Description of the autonomous work of the student

- Individual study of theoretical concepts. - To assimilate knowledge from the subjects taught in the lectures, solving the problems

Content / Unit

	Unit 4. Identification of linear and nonlinear systems

Organizational Procedures and Working Methods

Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Teaching Group	Lectures / classes participatory		2,0
Working Group / Small Group	Doing exercises		0,8

Description of the autonomous work of the student

- Individual study of theoretical concepts. - To assimilate knowledge from the subjects taught in the lectures, solving the problems

Content / Unit

	Lab 1: Modelling and identification of a heat exchanger

Organizational Procedures and Working Methods			
Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Working Group / Small Group	Laboratory tasks		3,2
Description of the autonomous work of the student			
- Searching for information to carry out the practice. - Resolution of the practical cases proposed			
Block	II. Nonlinear optimization		
Content / Unit			
	Unit 5. Nonlinear optimization		
Organizational Procedures and Working Methods			
Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Teaching Group	Lectures / classes participatory		6,7
Working Group / Small Group	Doing exercises		0,5
Description of the autonomous work of the student			
- Individual study of theoretical-solution of a set of problems related to the topic-Work			
Content / Unit			
	Lab 2: Symbolic computation and algorithms in MATLAB. Examples of numerical search methods		
Organizational Procedures and Working Methods			
Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Working Group / Small Group	Laboratory tasks		4,0
Description of the autonomous work of the student			
- Searching for information to carry out the practice. - Resolution of the practical cases proposed			
Block	III. Deterministic global optimization algorithms		
Content / Unit			
	Unit 6. Deterministic global optimization algorithms.		
Organizational Procedures and Working Methods			
Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Teaching Group	Lectures / classes participatory		3,8
Description of the autonomous work of the student			

- Individual study of theoretical concepts. - To assimilate knowledge from the subjects taught in the lectures, solving the problems

Block	IV. Metaheuristic algorithms in industrial processes

Content / Unit

	Unit 7: Metaheuristics algorithms in problems of industrial processes

Organizational Procedures and Working Methods

Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Teaching Group	Lectures / classes participatory		3,0
Working Group / Small Group	Group work		2,0

Description of the autonomous work of the student

- Individual study of theoretical concepts. - Learning through collaborative work.

Content / Unit

	Lab 3: Optimization of real problems of industrial computing using evolutionary algorithms.

Organizational Procedures and Working Methods

Organizational Procedure	*Procedures and Training Activities*	*Observations*	*Hours Pres./On line*
Working Group / Small Group	Laboratory tasks		4,0

Description of the autonomous work of the student

- Searching for information to carry out the practice. - Resolution of the practical cases proposed

PROCEDURE FOR THE EVALUATION OF COMPETENCIES

Evaluation Criteria

NOTE: EVALUATION CRITERIA FOR SPECIAL MEETINGS WILL BE THE SAME AS FOR THE ORDINARY AND AGREE TO SET FORTH IN THIS GUIDE.

1. Exercises relations considering theory or blocks.

- Ability to solve problems
- Determine and implement modeling and simulation techniques best suited to the industrial system under study.
- Determine the type of optimization problem that can be found in the industry
- Find the best optimization technique to every problem
- Distinguish the basic characteristics of optimization algorithms

2. Performing laboratory practice.

- Ability to solve problems
- Work in group
- Determine and implement modelling and simulation techniques best suited to the industrial system under study.
- Find the best optimization technique to every problem
- Scheduling problems and algorithms in MATLAB and SIMULINK
- Distinguish the basic characteristics of algorithms for modelling and optimization
- Use and configure genetic algorithms to solve several real problems.

3. Works: problem solving modelling, simulation and real industrial optimization using different techniques.

- Ability to solve problems
- Work in groups
- Determine and implement modelling and simulation techniques best suited to the industrial system under study.
- Determine the type of optimization problem that can be found in the industry
- Find the best optimization technique to every problem
- Scheduling problems and algorithms in MATLAB and SIMULINK
- Use and configure genetic algorithms for real problem solving techniques.

4. Activities through collaborative learning techniques

- Ability to solve problems
- Work in groups
- Distinguish the basic characteristics of optimization algorithms
- Use and configure genetic algorithms to solve several real problems.

Percentages of Assessment Activities to be undertaken by students

	Activity	*(Nº hours)*	*Percentage*
I. STUDENT ACTIVITIES (On Campus / Online)	• Large Group	(0)	0 %
	• Teaching Group	(25,5)	20 %
	• Working Group / Small Group	(19,5)	40 %
II. STUDENT ACTIVITIES NON ATTENDANCE (Autonomous work)	• (Group work, individual work)	(105)	40 %

Evaluation Instruments

- Tests, exercises, problems.
- Observations of the process.
- Final assessment of reports, papers, projects, etc..

Monitoring mechanisms

- Attendance at tutoring
- High and access to virtual classroom
- Participation in communication tools (discussion forums, e)
- Provision of mentoring activities
- Delivery of activities in virtual classroom

BIBLIOGRAPHY

Recommended bibliography

Existing bibliography in the Information System of the Library of UAL

You can view the currently existing bibliography on the Library Management System consultation at the following address:

http://almirez.ual.es/search/x?SEARCH=70643213

WEB ADDRESSES