Course guide
295117 - 295II232 - Mechatronics

Last modified: 27/05/2024

Unit in charge: Barcelona East School of Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.
712 - EM - Department of Mechanical Engineering.

Degree: MASTER'S DEGREE IN INTERDISCIPLINARY AND INNOVATIVE ENGINEERING (Syllabus 2019). (Optional subject).
MASTER'S DEGREE IN RESEARCH IN MECHANICAL ENGINEERING (Syllabus 2021). (Optional subject).
ERASMUS MUNDUS MASTER IN SUSTAINABLE SYSTEMS ENGINEERING (EMSSE) (Syllabus 2024). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: ALFONSO CONESA ROCA

Others: Primer quadrimestre:
ALFONSO CONESA ROCA - Grup: T10
RAMON JEREZ MESA - Grup: T10

PRIOR SKILLS

Basic analysis of mechanical systems, electrical and electronic circuits.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMUEII-15. Design and implement acquisition, actuation and control systems that integrate electronic, electrical and mechanical technology in the field of intelligent production systems. (Specific competence of the Advanced Manufacturing Systems specialty)

Generical:
CGMUEII-01. Participate in technological innovation projects in multidisciplinary problems, applying mathematical, analytical, scientific, instrumental, technological and management knowledge.
CGMUEII-05. To communicate hypotheses, procedures and results to specialized and non-specialized audiences in a clear and unambiguous way, both orally and through reports and diagrams, in the context of the development of technical solutions for problems of an interdisciplinary nature.

Transversal:
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

The methodologies used for the development of the subject are as follows:
- Lecture with multimedia support, in order to provide information to the student so synthesized and organized.
- Class participatory exhibition, in which and in order that the student is not merely a passive element in the learning process, the teacher performs direct questions or debates on points considered particularly relevant or conceptual difficulty proposed.
- Problem-based learning, either individually or in a group in which the teacher proposes solving exercises outside the classroom so that the student can assess the degree of understanding of the subject.
- In the experimental laboratory sessions the methodology adopted is that of small cooperative groups in which students acquire skills in simulation techniques and testing of circuits.

LEARNING OBJECTIVES OF THE SUBJECT

That the student will be able to:
- integrate in the design of a mechanical system the technologies of electricity, electronics, computers and communications,
- automate the operation of mechanical systems and communicate them with their environment,
- design mechatronic systems adapted to the needs of the product.

STUDY LOAD

Type	Hours	Percentage
Hours large group	21,0	14.00
Hours small group	21,0	14.00
Self study	108,0	72.00

Total learning time: 150 h

CONTENTS

T1.- Mechanical Systems Engineering

Description:
T1.- Introduction to mechanical systems engineering
T1.- Constructive structure of machines

Full-or-part-time: 21h
Theory classes: 6h
Self study : 15h

T2.- Electric Machines and Actuators

Description:
T2.- Electric machines and actuators. Revision of the machines
T2.- Equations and static and dynamic models
T2.- Dimensioning of electrical machines

Full-or-part-time: 21h
Theory classes: 6h
Self study : 15h

T3.- Sensor elements

Description:
T3.- Voltage and current sensor elements, and signal conditioning
T3.- Temperature sensors, force, position, limit switch, acceleration, encoders, ...

Full-or-part-time: 14h
Theory classes: 4h
Self study : 10h

T4.- Acquisition and Control Systems

Description:
T4.- Overview to acquisition systems and control strategies
T4.- Closed-loop control and Digital control

Full-or-part-time: 7h
Theory classes: 2h
Self study : 5h

T5.- PLCs systems

Description:
T5.- Introduction to small PLCs
T5.- Basic programming and input-output availability

Full-or-part-time: 7h
Theory classes: 2h
Self study : 5h

T6.- Basics communications

Description:
T6.- Basics communications
T6.- Differential transmissions and wireless transmissions

Full-or-part-time: 2h
Theory classes: 2h

T7.- Arduino and Raspberry Pi Boards

Description:
T7.- Introduction to Arduino and Raspberry Pi boards, and its programming
T7.- Accessories shields and its connectivity
T7.- Introduction to microcontrollers PIC and its programming

Related activities:
Laboratory sessions 1 to 5:
Session 1: Introduction to the Arduino board and its programming environment. Basic programming. Digital inputs-outputs, pushbuttons, leds, LCD, PWM, timers.
Session 2: Arduino board II. AD conversion programming and signal acquisition.
Session 3: Introduction to the Raspberry Pi board and its programming environment.
Session 4: Raspberry Pi board II. Control of a stepper motor or DC with its driver.
Session 5: Introduction to PIC microcontrollers and their programming environment. Basic programming and prototyping of the PIC microcontrollers.

Full-or-part-time: 33h
Laboratory classes: 10h
Self study : 23h

T8.- Small Applications Design

Description:
T8.- Introduction to Printed Circuit Board design software
T8.- Design and implementation of one application

Related activities:
Laboratory sessions 6 to 11:
Session 6: Introduction to basic PCB software.
Session 7: Introduction to advanced PCB software.
Session 8: Design an application for Arduino or Raspberry Pi (I Schematic).
Session 9: Design an application for Arduino or Raspberry Pi (II Layout).
Session 10: Design an application for Arduino or Raspberry Pi (III implementation of the board).
Session 11: Assembly and verification.

Full-or-part-time: 42h
Laboratory classes: 12h
Self study : 30h

GRADING SYSTEM

The evaluation system consists on the following ratings with the partial weights:
- A Partial Test: 25%.
- A Final test: 25%.
- Laboratory: 25%.
- Monitoring exercises: 25%.

EXAMINATION RULES.

The realization of the different tests consists of:
- The partial or final tests are individual written tests based on the theory and problems worked on in the course.
- Laboratory activities are compulsory assistance to students. Although they are worked in groups, they will be assessed individually, considering the cooperative work mode, the degree of involvement, the rate of progress and the degree of completion of the work carried out.
- The activities of follow-up exercises are individual. They will be carried out after school hours and will usually be delivered through the ATENEA application.

RESOURCES

Other resources:
Arduino boards. Raspberry Pi boards. Different commercial shields of this boards.
PC computer. Basic equipment of electronic laboratory.