Last update: 24-03-2017

230674 - BID - Biomedical Instrumentation Design

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 710 - EEL - Department of Electronic Engineering

Academic year: 2017

Degree: DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 1992). (Teaching unit Optional)
DEGREE IN ELECTRONIC ENGINEERING (Syllabus 1992). (Teaching unit Optional)
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: MIREYA FERNÁNDEZ

Others: JAVIER ROSELL, MIGUEL ANGEL GARCÍA

Degree competences to which the subject contributes

Transversal:

1. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.
2. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
3. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
4. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Teaching methodology

- Lectures
- Laboratory practical work
- Exercises
- Short answer test (Control)
- Extended answer test (Final Exam)

Learning objectives of the subject

The aim of this course is to train students in methods of design, and evaluation of biomedical systems covering all the design phases from conception to regulations compliance.

Learning results of the subject:

- Ability to understand the physical functions of sensors used to build biomedical equipment.
- Ability to design biomedical equipment ad-hoc to the field of utilization: low-noise systems, energy efficient systems, isolated systems, etc.
- Ability to understand the technical specifications of measurement equipment and electronic components used to design

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biomedical instrumentation.
- Ability to design biomedical devices based on mobile devices.
- Ability to understand the regulations concerning biomedical systems.
- Ability to understand the test required to verify EMC and safety issues concerning biomedical systems.
- Ability to design biomedical instrumentation from simple circuits to complex systems for any field of use (monitoring patients at home, hospital machines, biomedical devices for non-medical applications etc.)
- Ability to interpret and analyze the systems design restrictions imposed by the field of use (explosive areas, sterile atmospheres etc.)
- Ability to create biomedical systems using specific sensors and mobile devices
- Ability to interpret the requirements from the medical standards, in the fields of safey, electromagnetic compatibility and usability.

Study load

Total learning time: 125h	Hours large group:	13h	10.40%
	Hours medium group:	0h	0.00%
	Hours small group:	26h	20.80%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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Content

1. Introduction to biomedical systems

Learning time: 5h

Theory classes: 1h
Self study : 4h

Description:
- Aims of the subject
- Basic definitions
- historic review

2. Bioelectric signals

Learning time: 70h

Theory classes: 8h
Laboratory classes: 16h
Self study : 46h

Description:
- Electrobiological phenomena
- Biomedical electrodes
- Biopotential measurement systems
- Medical equipment for biopotential measurement
- Electrical bioimpedance measurement systems

3. Safety of electrical equipment

Learning time: 18h

Theory classes: 2h
Laboratory classes: 4h
Self study : 12h

Description:
- Safety of Electrical equipment
- Regulations and Standards

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4. Measurements in the cardiovascular and respiratory systems	Learning time: 32h Theory classes: 2h Laboratory classes: 6h Self study : 24h

Description:
- Blood pressure measurements
- Flux, flow and cardiac output measurements
- Impedance plethysmography and impedance cardiography
- Respiratory flux and respiratory volume
- Pulmonary ventilation monitors

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Planning of activities

Theoretical Classes	Hours: 13h Theory classes: 13h
Description: Theoretical Calsses	

LABORATORY	Hours: 26h Laboratory classes: 26h
Description: - Bioelectrical signals amplifier. - Safety evaluation. - Respiration measurement.	

EXERCISES	Hours: 26h Self study: 26h
Description: Exercises to strengthen the theoretical knowledge.	

SHORT ANSWER TEST	Hours: 1h Theory classes: 1h
Description: Mid term control.	

FINAL EXAMINATION:	Hours: 2h 30m Theory classes: 2h 30m
Description: Final examination.	

Self Study	Hours: 56h 30m Theory classes: 56h 30m

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Qualification system

Final examination: 30%
Partial examinations and controls: 5%
Exercises: 5%
Laboratory assessments: 60%

Bibliography

Basic:

Bronzino, J.D. (ed.). The biomedical engineering handbook: medical devices and systems [on line]. 3rd ed. Boca Raton [Fla.]: Taylor & Francis, 2006 [Consultation: 18/07/2013]. Available on: <http://librarytitles.ebrary.com/docDetail.action?docID=10143949>. ISBN 0-8493-2122-0.

Complementary:

Perez, R.J. Design of medical electronic devices [on line]. Academic Press, 2002 [Consultation: 18/07/2013]. Available on: <http://librarytitles.ebrary.com/docDetail.action?docID=10186469>. ISBN 9780080491097.

Fries, R.C. (ed.). Handbook of medical device design. New York: Marcel Dekker, 2001. ISBN 0-8247-0399-5.