Course guide
230674 - BID - Biomedical Instrumentation Design

Last modified: 24/05/2024

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2022). (Optional subject).

Academic year: 2024 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer:

Others:

PRIOR SKILLS

Graduate studies in Electronic Engineering or equivalent.
Analog and digital electronic design
Signal Processing

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
- 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 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

Type	Hours	Percentage
Hours large group	13,0	10.40
Self study	86,0	68.80
Hours small group	26,0	20.80

Total learning time: 125 h

CONTENTS

1. Introduction to biomedical systems

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

Full-or-part-time: 5h
Theory classes: 1h
Self study : 4h

2. Bioelectric signals

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

Full-or-part-time: 70h
Theory classes: 8h
Laboratory classes: 16h
Self study : 46h

3. Safety of electrical equipment

Description:
- Safety of Electrical equipment
- Regulations and Standards

Full-or-part-time: 18h
Theory classes: 2h
Laboratory classes: 4h
Self study : 12h

4. Measurements in the cardiovascular and respiratory systems

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

Full-or-part-time: 32h
Theory classes: 2h
Laboratory classes: 6h
Self study : 24h

ACTIVITIES

Theoretical Classes

Description:
Theoretical Calsses

Full-or-part-time: 13h
Theory classes: 13h

LABORATORY

Description:
- Bioelectrical signals amplifier.
- Safety evaluation.
- Respiration measurement.

Full-or-part-time: 26h
Laboratory classes: 26h

EXERCISES

Description:
Exercises to strengthen the theoretical knowledge.

Full-or-part-time: 26h
Self study: 26h

SHORT ANSWER TEST

Description:
Mid term control.

Full-or-part-time: 1h
Theory classes: 1h

FINAL EXAMINATION:

Description:
Final examination.

Full-or-part-time: 2h 30m
Theory classes: 2h 30m

Self Study

Full-or-part-time: 56h 30m
Theory classes: 56h 30m

GRADING SYSTEM

Final examination: 30%
Exercises: 10%
Laboratory assessments: 60%

BIBLIOGRAPHY

Basic:
- Bronzino, J.D. (ed.). The biomedical engineering handbook: medical devices and systems. 3rd ed. Boca Raton [Fla.]: Taylor & Francis, 2006. ISBN 0-8493-2122-0.

Complementary:

- Perez, R.J. Design of medical electronic devices [on line]. Academic Press, 2002 [Consultation: 21/04/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=294580. ISBN 9780080491097.
- Fries, R.C. (ed.). Handbook of medical device design. New York: Marcel Dekker, 2001. ISBN 0-8247-0399-5.