Course guide
820025 - EMDTB - Monitoring, Diagnostic and Therapeutic Equipment

Last modified: 04/06/2026

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

Degree: BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: GEORGINA COMPANY SE

Others: Segon quadrimestre:
GEORGINA COMPANY SE - Grup: M11, Grup: M12, Grup: M13, Grup: M14, Grup: M15
FRANCISCO JAVIER ROSELL FERRER - Grup: M11, Grup: M12, Grup: M13, Grup: M14, Grup: M15
GIOVANNI VESCIO - Grup: M11, Grup: M12, Grup: M13, Grup: M14

PRIOR SKILLS

To have passed the subject on Sensors, Conditioning and Acquisition of Biomedical Signals

REQUIREMENTS

ENGINYERIA CLÍNICA, SEGURETAT HOSPITALÀRIA - Irequisits
SENSORS I CONDICIONADORS DE SENYALS - Prerequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Identify, Understand and apply the principles of the equipment and systems used for monitoring, diagnosing and treating patients.

Transversal:
1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

Expository methodology, group work and learning through guided activities

LEARNING OBJECTIVES OF THE SUBJECT

To understand the concept of instrumentation systems. To know specific characteristics of biomedical systems and equipment. To understand and analyze monitoring, diagnostic and therapy biomedical systems and equipment datasheets

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Self study	90,0	60.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

Topic 1: Measurement systems introduction

Description:
Basic definitions. Biomedical instrumentation system general structure. Dynamic and static characteristics. Biomedical equipment definitory characteristics. Biomedical equipment classifications.

Specific objectives:
To understand the special characteristics of biomedical measurement systems.

Related activities:
Classroom activity: static and dynamic characterization of two measurement systems
Deliverable 1: Characterization of a measurement systems

Full-or-part-time: 11h
Theory classes: 6h
Self study : 5h

Topic 2: Bioelectric signals

Description:
Bioelectricity phenomena. Biopotentials. Electrodes. Theory, types and electrical models. Biopotential measurement systems. Biopotential amplifiers. Quantification and sampling. Isolation. Monitoring. Recording systems. Telemetry systems.

Specific objectives:
To know the characteristics of the most important bioelectric signals and how they are acquired

Related activities:
Lab 1: ECG measurement, QRS detection and heart rate variability
Classroom activities: Comparison of characteristics of biopotential amplifiers. Interference analysis in a biopotential measurement system.
Deliverable 2: Biopotential amplifier analysis.

Full-or-part-time: 25h
Theory classes: 9h
Laboratory classes: 3h
Self study : 13h

Topic 3: Measurements in the cardiovascular system

Description:
Blood pressure measurement. Phonomechanocardiography. Blood flow measurement. Plethysmography.

Specific objectives:
To know the signals to be measured and the measurement methods in the cardiovascular system.

Related activities:
Lab 2: Measurement of the pulse wave and transit time
Classroom activity: Hydrostatic pressure effect on blood pressure estimation
Deliverable 3: Fick's method

Full-or-part-time: 17h
Theory classes: 6h
Laboratory classes: 3h
Self study : 8h

Topic 4: Measurement in the respiratory system

Description:
Respiratory pressure and flow measurement. Lung volume measurement. Respiratory mechanics

Specific objectives:
To know the signals and measurement methods used to evaluate the respiratory system

Related activities:
Lab 3: Breathing measurement and respiratory rhythm
Classroom activity: Comparison of spirometers
Deliverable 4: Apnea detection

Full-or-part-time: 17h
Theory classes: 6h
Laboratory classes: 3h
Self study : 8h

Topic 5: Medical imaging equipment

Description:
X-ray. Nuclear medicine. Ultrasound. Magnetic resonance.

Specific objectives:
To know the measurement principles of medical imaging systems and their particular characteristics

Related activities:
Classroom activities: X-ray atenuation across tissues, resonant frequency on MRI
Deliverable 5: Transit time and Doppler shift in tissues

Full-or-part-time: 15h
Theory classes: 9h
Self study : 6h

Topic 6: Therapy equipment

Description:
Surgery, diathermy, cryotherapy and lithotripsy equipment

Specific objectives:
To know the functional principles of therapy equipment

Related activities:
Classroom activity: electrosurgical units comparison
Deliverable 6: Cardiac ablation systems

Full-or-part-time: 9h
Theory classes: 5h
Self study : 4h

Research project

Full-or-part-time: 56h
Theory classes: 4h
Laboratory classes: 6h
Self study : 46h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

Final exam: 40%
Midterm exam: 20%
Guided Lab: 20%
Research Project: 20%

EXAMINATION RULES.

The guided Lab and the Research Project are mandatory

BIBLIOGRAPHY

Basic:
- Medical instrumentation : application and design. 4th ed. Hoboken: J. Wiley, cop. 2009. ISBN 9780471676003.

Complementary:
- Encyclopedia of medical devices and instrumentation. New York: Wiley-Interscience, cop. 1988. ISBN 0471829366.
- Norton, Harry N. Biomedical sensors fundamentals and applications. New Jersey: Noyes Publications, 1982. ISBN 0815508905.
- Normann, Richard A. Principles of bioinstrumentation. New York: Wiley, cop. 1988. ISBN 047160514X.
- Northrop, Robert B. Noninvase instrumentation and measurement in medical diagnosis. Boca Raton: CRC, cop. 2002. ISBN 0849309611.