



# Course guide

## 820025 - EMDTB - Monitoring, Diagnostic and Therapeutic Equipment

Last modified: 14/06/2023

**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:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

### LECTURER

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**Coordinating lecturer:** FRANCISCO JAVIER ROSELL FERRER

**Others:** Primer quadrimestre:  
LEXA DIGNA NESCOLARDE SELVA - T11, T12  
FRANCISCO JAVIER ROSELL FERRER - T11, T12

Segon quadrimestre:  
LEXA DIGNA NESCOLARDE SELVA - M11, M12, M13, M14  
FRANCISCO JAVIER ROSELL FERRER - M11, M12, M13, M14

### PRIOR SKILLS

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

### REQUIREMENTS

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

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**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 INFORMATION 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

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Expository methodology, group work and learning through guided activities

### LEARNING OBJECTIVES OF THE SUBJECT

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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 attenuation 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

Final exam: 35 %

Midterm exam: 20%

Guided Lab: 20%

Research Project: 25%

## 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:

- Northrop, Robert B. Noninvasive instrumentation and measurement in medical diagnosis. Boca Raton: CRC, cop. 2002. ISBN 0849309611.

- 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.