# Course guide
# 205060 - 205060 - Biomedical Instrumentation

**Last modified:** 22/04/2021

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering
**Teaching unit:** 710 - EEL - Department of Electronic Engineering.

**Degree:** **Academic year:** 2021 **ECTS Credits:** 3.0
**Languages:** English

## LECTURER

**Coordinating lecturer:** Lexa Nescolarde Selva

**Others:**

## TEACHING METHODOLOGY

Expository methodology, group work and learning through guided activities

## LEARNING OBJECTIVES OF THE SUBJECT

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Self study | 48,0 | 64.00 |
| Hours large group | 27,0 | 36.00 |

**Total learning time:** 75 h

## CONTENTS

### Module 1: Basic Concepts of Medical Instrumentation

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

**Related activities:**
Classroom activity: Static and dynamic characterization of two measurement systems.

Deliverable 1: Characterization of a measurement systems.

**Full-or-part-time:** 14h
Theory classes: 5h
Self study : 9h

**Module 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.

**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:** 14h
Theory classes: 5h
Self study : 9h

**Module 3: Measurements of the cardiovascular system**

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

**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:** 14h
Theory classes: 5h
Self study : 9h

**Module 4: Measurement of the Respiratory System.**

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

**Related activities:**
Lab 3: Breathing measurement and respiratory rhythm.

Classroom activity: Comparison of spirometers.

Deliverable 4: Apnea detection.

**Full-or-part-time:** 11h
Theory classes: 4h
Self study : 7h

**Module 5: Medical Imaging System**

**Description:**
X-ray. Nuclear medicine. Ultrasound (US). Magnetic resonance imaging (MRI).

**Related activities:**
Lab 4: MRI and US in muscle assessment.

Classroom activities: X-ray attenuation across tissues, resonant frequency on MRI.

Deliverable 5: Transit time and Doppler shift in tissues.

**Full-or-part-time:** 11h
Theory classes: 4h
Self study : 7h

**Module 6: Therapy equipment**

**Description:**
Surgery, diathermy, cryotherapy and lithotripsy equipment

**Related activities:**
Classroom activity: electrosurgical units comparison.

Deliverable 6: Cardiac ablation systems.

**Full-or-part-time:** 11h
Theory classes: 4h
Self study : 7h

## GRADING SYSTEM

The course will be graded based on:

* Attendance to lessons: 30%
* Class participation and class exercices: 20%
* Final project: 50%

## BIBLIOGRAPHY

**Basic:**
- Webster, John G. (ed.). Medical instrumentation: application and design. 4th ed. Hoboken: Wiley, 2009. ISBN 9780471676003.

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