



Course guides

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: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Optional subject).

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
Hours large group	27,0	36.00
Self study	48,0	64.00

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 exercises: 20%
- * Final project: 50%

BIBLIOGRAPHY

Basic:

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

Complementary:

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