

205060 - Biomedical Instrumentation

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2018
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Teaching unit Optional)
ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: Lexa Nescolarde Selva

Teaching methodology

Expository methodology, group work and learning through guided activities

Learning objectives of the subject

Study load

Total learning time: 75h	Hours large group:	27h	36.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	48h	64.00%

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Content

Module 1: Basic Concepts of Medical Instrumentation

Learning time: 14h

Theory classes: 5h

Self study : 9h

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.

Module 2: Bioelectric Signals

Learning time: 14h

Theory classes: 5h

Self study : 9h

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.

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<p>Module 3: Measurements of the cardiovascular system</p>	<p>Learning time: 14h Theory classes: 5h Self study : 9h</p>
<p>Description: Blood pressure measurement. Phonomechanocardiography. Blood flow measurement. Plethysmography.</p> <p>Related activities: Lab 2: Measurement of the pulse wave and transit time.</p> <p>Classroom activity: Hydrostatic pressure effect on blood pressure estimation.</p> <p>Deliverable 3: Fick's method.</p>	
<p>Module 4: Measurement of the Respiratory System.</p>	<p>Learning time: 11h Theory classes: 4h Self study : 7h</p>
<p>Description: Respiratory pressure and flow measurement. Lung volume measurement. Respiratory mechanics.</p> <p>Related activities: Lab 3: Breathing measurement and respiratory rhythm.</p> <p>Classroom activity: Comparison of spirometers.</p> <p>Deliverable 4: Apnea detection.</p>	
<p>Module 5: Medical Imaging System</p>	<p>Learning time: 11h Theory classes: 4h Self study : 7h</p>
<p>Description: X-ray. Nuclear medicine. Ultrasound (US). Magnetic resonance imaging (MRI).</p> <p>Related activities: Lab 4: MRI and US in muscle assessment.</p> <p>Classroom activities: X-ray attenuation across tissues, resonant frequency on MRI.</p> <p>Deliverable 5: Transit time and Doppler shift in tissues.</p>	

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Module 6: Therapy equipment	Learning time: 11h Theory classes: 4h Self study : 7h
Description: Surgery, diathermy, cryotherapy and lithotripsy equipment	
Related activities: Classroom activity: electrosurgical units comparison.	
Deliverable 6: Cardiac ablation systems.	

Qualification 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:

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