COURSE DATA

Data Subject	
Code	44768
Name	Medical instrumentation
Cycle	Master's degree
ECTS Credits	4.5
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
2231 - M.D. in Biomedical Engineering	Faculty of Medicine and Odontology	0	First term

Subject-matter

Degree	Subject-matter	Character
2231 - M.D. in Biomedical Engineering	15 - Bridging courses	Optional

Coordination

Name	Department
CALPE MARAVILLA, JAVIER	242 - Electronic Engineering

SUMMARY

This module on Medical Instrumentation is devoted to acquire knowledge on biomedical instrumentation and to introduce the student to the design and use of medical instrumentation and equipment and show the state of the art of the field. The module includes 35 lecturing hours plus some lab exercises and the execution of a team project supervised by the instructors. Main topics to be covered are norms and legislation, monitoring systems, measurements in the cardiovascular and respiratory systems, clinical laboratory instrumentation, electric stimulation, and surgery and therapeutic instrumentation.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Not applicable.However, some basic knowledge in electronis and signal processing is advisable

OUTCOMES

LEARNING OUTCOMES

Concept:

The student must understand the importance of medical instrumentation systems in obtaining information relevant to medical diagnosis and treatment of the patient. After completing the course, the student will know what types of instrumentation are used for each clinical application, as well as their advantages and limitations of use.

***Practical*:**

The student will acquire knowledge to analyze or design medical instrumentation systems, allowing him/her to understand the specific characteristics of each system and compare between similar systems.

***Attitude*:**

Ability to analyze the characteristics of instrumentation systems, whereas the same specifications with a critical attitude.

Instrumental skills

- Capacity for critical analysis and synthesis.
- Ability to organize and plan.
- Appropriate use of scientific and technical terms.
- Ability to handle text on biomedical instrumentation.
- Oral and written communication skills.
- Information management capacity.
- Decision making.

Personal skills

- Ability to work in multidisciplinary team.
- Ability to work in international context.
- Ability to communicate with experts in other areas.
- Skills in interpersonal relationships.

Systemic skills

- Ability to apply knowledge in practice.
- Ability to learn and work independently.
- Adaptation to new situations.
- Creativity. The ability to explore new solutions.
- Leadership. Initiative and entrepreneurial spirit.
- Motivation for the quality.

DESCRIPTION OF CONTENTS

1. MEDICAL INSTRUMENTATION SYSTEMS

Introduction and general structure
Design criteria
General specifications of instrumentation systems
The health care industry State of the art
Patents

2. NORMS

Review of applicable normative
Electromagnetic compatibility (EMC)
Design techniques for EMC

3. INSTRUMENATATION SYSTEMS

Sensors
Noise. Origin, coupling and mitigation
Instrumentation amplifiers
Conditioning circuits and analog preprocessing of signals

4. MONITORINGS SYSTEMS

Electrocardiograph.
Vectocardiograph
High resolution electrocardiography
Cardiotacometer
Cardiac monitor
Holter Systems
Electroencephalography
Polysomnography equipment
Evoked potentials equipment
Electromyography

5. MEASUREMENTS IN THE CARDIOVASCULAR SYSTEM

Direct and indirect pressure measurements
Arterial blood pressure monitors
Cardiac sounds.Phonocardiography
Electromagnetic and ultrasound flux monitors
Plethysmography

6. MEASUREMENTS OF THE RESPIRATORY SYSTEM

Pressure and flux measurement for the respiratory system
Lung volume: Spirometry. Respiratory plethysmography
Ventilation and ventilators
Gas concentration measurement
Assisted ventilation systems

7. INSTRUMENTATION FOR A CLINICAL LABORATORY

Spectrophotometry
Automatic chemical analysis
Chromatography

8. SURGERY AND THERAPEUTIC SYSTEMS

Surgery instrumentation: ESU and laser
Pediatric incubators
Laser therapeutic applications

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	35,00	100
Classroom practices	10,00	100
Attendance at events and external activities	30,00	0
Development of group work	15,00	0
Development of individual work	5,00	0
Study and independent work	20,00	0
Readings supplementary material	20,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	10,00	0

TOTAL	**175,00**

TEACHING METHODOLOGY

The theoretical part of the course arises in the form of master class. Those lectures will be supported by audiovisual media. Prior to the class, students will have all the material that will be in that class.

There will be a laboratory session involving the use of a data acquisition system and the processing of a biological signal

One or more works will be required. These will be done in groups of 2 or 3. A memory of each work will be submitted and will be exposed in a joint session, where they will be discussed by all the students.

The lecturers will inform students about their tutoring schedule. This schedule shall be as broad as possible so that students may make use of them.

EVALUATION

A 50% of the final mark will be obtained from the evaluation of Works and/or lab/practical sessions. A 50% of the final mark will be obtained from a final written exam.

A minimum mark of 4/10 is required in each part.

REFERENCES

Basic

- Referencia b1: Principles of Bioinstrumentation. R.A. Norman. Ed. Wiley, 1988
  Referencia b2: Medical Instrumentation. Application and Design. J. Webster. Ed. Wiley, 1997
  Referencia b3: The Biomedical Engineering Handbook. J. Bronzino. CRC Press, 2000
  Referencia b4: Principles of Applied Biomedical Instrumentation. L.A. Geddes; L.E. Baker. Wiley 1989

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available