

**1. General information****Course:** AUDIOVISUAL EQUIPMENTS IN ELECTROMEDICINE**Code:** 59638**Type:** ELECTIVE**ECTS credits:** 6**Degree:** 385 - DEGREE IN TELECOMMUNICATIONS TECHNOLOGY ENGINEERING**Academic year:** 2022-23**Center:** 308 - SCHOOL POLYTECHNIC OF CUENCA**Group(s):** 30**Year:** 4**Duration:** First semester**Main language:** Spanish**Second language:****Use of additional languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** CESAR SANCHEZ MELENDEZ - Group(s): 30

| Building/Office | Department | Phone number | Email | Office hours |
|-----------------|--|--------------|-----------------------|--------------|
| 0.05 | INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES | 926053743 | cesar.sanchez@uclm.es | |

2. Pre-Requisites

It is necessary to know the contents related to the identification of components of a basic electrical circuit, basic experimental measurement techniques and the identification of the main audio and video components present in consumer electronic equipment.

3. Justification in the curriculum, relation to other subjects and to the profession

In this subject, students will acquire knowledge about the origin of bioelectric signals and the methods of measurement and registration of them. The different equipment present in a health center will be described and the role that technicians specialized in electromedicine play in the acquisition of non-implantable active medical devices, their implementation and the preventive and corrective maintenance of them.

This specialty of engineering is called to be one of the main economic growth engines in the coming years, with a high presence of techniques associated with audiovisual systems that are the subject of study in this curriculum.

4. Degree competences achieved in this course**Course competences**

| Code | Description |
|------|---|
| E21 | The ability to build, use and manage telecommunications services and applications, defined as capture, analogue and digital processing, coding, transport, representation, processing, storage, reproduction, management and presentation of audiovisual services and information multimedia systems. |
| G02 | Correct, oral and written, communication skills. |
| G06 | Knowledge of basic subjects and technologies, enabling students to learn new methods and technologies, as well as providing great versatility to adapt to new situations |
| G07 | The ability to tackle problems with initiative, making decisions, creativity, and to communicate and transmit knowledge, skills and abilities, including the ethical and professional responsibility of the activity of a Technical Telecommunications Engineer |
| G08 | Knowledge to perform measurements, calculations, assessments, appraisals, surveys, studies, reports, task planning and other similar work in their specific telecommunications field |
| G13 | The ability to look for and understand information, whether technical or commercial in different sources, to relate and structure it to integrate ideas and knowledge. Analysis, synthesis and implementation of ideas and knowledge. |

5. Objectives or Learning Outcomes**Course learning outcomes****Description**

Application of sound and image in other engineering areas, such as electromedicine.

Correct use of oral and written expression to convey ideas, technologies, results, etc.

Use of ICT to achieve the specific objectives set in the subject.

Knowledge and respect of professional ethics and deontology.

Analysis, synthesis and compression of technical documentation and mastery of specific vocabulary.

Synthesis of capacities of several telecommunications engineering areas.

6. Units / Contents**Unit 1: Introduction to Health Technology****Unit 1.1** Professional field and training**Unit 1.2** Health Technology Sector**Unit 1.3** Management and maintenance of Health Technology**Unit 1.4** Safety in Health Technology**Unit 1.5** Practice 1. Visit to health centers (subject to health situation)**Unit 1.6** Practice 2. Health Technology Management Software**Unit 1.7** Practice 3. Electrical safety in Health Technology

Unit 2: Diagnostic systems

- Unit 2.1** Physiology of the human body
- Unit 2.2** Registration systems and devices
- Unit 2.3** Diagnostic image systems
- Unit 2.4** Other diagnostic systems
- Unit 2.5** Practice 4. Functional verification of an electrocardiograph
- Unit 2.6** Practice 5. Functional verification of an ultrasound machine
- Unit 2.7** Practice 6. Functional verification of a centrifuge

Unit 3: Therapy and monitoring systems

- Unit 3.1** Systems and therapy devices
- Unit 3.2** Monitoring systems and devices
- Unit 3.3** Practice 7. Functional verification of a defibrillator
- Unit 3.4** Practice 8. Functional verification of an electrosurgery unit
- Unit 3.5** Practice 9. Functional verification of an infusion pump
- Unit 3.6** Practice 10. Functional verification of a respirator

7. Activities, Units/Modules and Methodology

| Training Activity | Methodology | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | Description |
|---|----------------------------------|---|---|------------|----|-----|---|
| Class Attendance (theory) [ON-SITE] | Lectures | E21 G02 G06 G08 | 0.89 | 22.25 | N | | Classroom presentation of theoretical content using the participatory lecture method. |
| Problem solving and/or case studies [ON-SITE] | Problem solving and exercises | E21 G02 G06 G07 G08 G13 | 0.18 | 4.5 | N | | Solving exercises and problems in the classroom. |
| Laboratory practice or sessions [ON-SITE] | Practical or hands-on activities | E21 G02 G06 G07 G08 G13 | 0.9 | 22.5 | N | | Laboratory practicals in small groups in which different health technology equipment will be analysed. |
| Practicum and practical activities report writing or preparation [OFF-SITE] | Self-study | E21 G02 G06 G07 G08 G13 | 1.5 | 37.5 | Y | Y | For each of the proposed practices, a report will be delivered in pdf format with the results obtained and the conclusions. The suspended deliveries will be recovered with a new delivery at a time and date agreed with the teacher and, if necessary, with the completion of a new practice session. Plagiarism is not allowed according to article 9 REE. |
| Final test [ON-SITE] | Assessment tests | E21 G02 G06 G07 G08 G13 | 0.35 | 8.75 | Y | Y | Individual written tests corresponding to the thematic blocks of the subject. It is assessed with an exam in ordinary exams, recoverable in extraordinary exams with a second exam. Plagiarism is not allowed according to article 9 REE. |
| Individual tutoring sessions [ON-SITE] | Self-study | E21 G02 G06 G07 G08 G13 | 0.08 | 2 | N | | Individual tutorials at the student's request to resolve doubts and supervise learning. |
| Study and Exam Preparation [OFF-SITE] | Self-study | E21 G02 G06 G07 G08 G13 | 2.1 | 52.5 | N | | Personal and autonomous study by the student. |
| Total: | | | 6 | 150 | | | |
| Total credits of in-class work: 2.4 | | | Total class time hours: 60 | | | | |
| Total credits of out of class work: 3.6 | | | Total hours of out of class work: 90 | | | | |

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

| Evaluation System | Continuous assessment | Non-continuous evaluation* | Description |
|---------------------|-----------------------|----------------------------|---|
| Test | 40.00% | 40.00% | Partial tests performed at the end of each thematic block |
| Laboratory sessions | 60.00% | 60.00% | Realization of practical cases in group |
| Total: | 100.00% | 100.00% | |

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:**Continuous assessment:**

The weightings indicated in the section on 'assessments' will be applied. Progress tests' and laboratory The weightings indicated in the 'assessments' section will be applied. The 'progress tests' and the practicals can be recovered by means of an exam on the date set by the center's management. Students who pass the laboratory will keep the grade for the following year, unless they voluntarily decide to repeat it. If the student does not pass the course in the following year, he/she will have to retake the laboratory practicals.

In order to pass the course, students will have to satisfy the following three conditions:

- All the laboratory practices will have to be handed in. No individual minimum grade is required for each one of them, but the average of all of them will have to exceed a grade of 4 points (out of 10).
- In the written theory tests a score higher than 4 points (out of 10) will be required.
- The final average grade of the course must be equal or higher than 5 points (out of 10).

Non-continuous evaluation:

The student who cannot or does not want to take the continuous evaluation must communicate it to the professor of the subject to change to non-continuous evaluation. This change must be made as soon as possible and never having completed 50% or more of the continuous evaluation tests, at which time this change can no longer be made. The weightings indicated in the 'assessments' section will be applied.

In order to pass the course, students will have to satisfy the following three conditions:

- All the laboratory practicals set out will have to be handed in. No individual minimum grade is required for each of them, but the average of all of them will have to exceed a grade of 4 points (out of 10).
- In the written theory tests a score higher than 4 points (out of 10) will be required.
- The final average grade of the course must be equal or higher than 5 points (out of 10).

Specifications for the resit/retake exam:

In this second opportunity to pass the course, 100% of the semester score could be achieved. Thus, two assessment activities will be conducted, i.e.:

- A single final written exam covering all theory concepts. This examination will be awarded with 40% of the semester score and a minimum score of 4 points (over 10) will be required to pass the course.
- New submission and oral defense of the technical informs for all or some hands-on experiments proposed along the course. These activities will be re-worked in a special timetable agreed with the instructor. In global terms, these activities will be awarded with 60% of the semester score and minimum mark of 4 points (over 10) will be required to pass the course.

Finally, to pass the course a final weighted score of 5 points (over 10) is required. In case of failing the course, global score for theory or laboratory (if it is higher than 4 points) will be maintained for the next offering, unless the student voluntarily decides to retake the corresponding set of assessment activities.

Specifications for the second resit / retake exam:

If students passed laboratory or theory activities in the preceding course, only an exam covering hands-on experiments or theory concepts will have to be tackled. Otherwise, students will have to take two exams, one covering theory concepts and another assessing laboratory skills. The grading scheme will award 40% of the final mark on the course for theory exam and 40% for laboratory test. For both examinations, a minimum mark of 4 points (over 10) will be required to pass the course. Moreover, the final weighted average mark will have to be equal or higher than 5 points (over 10).

| 9. Assignments, course calendar and important dates | |
|--|-------|
| Not related to the syllabus/contents | |
| Hours | hours |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 4.5 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 22.5 |
| Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] | 37.5 |
| Final test [PRESENCIAL][Assessment tests] | 8.75 |
| Individual tutoring sessions [PRESENCIAL][Self-study] | 2 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 52.5 |
| General comments about the planning: All theory and laboratory activities will be sequentially conducted along the semester. Moreover, a detailed schedule of the course containing deadlines for all assessment activities will be published in the learning platform (Campus Virtual) before the course starts. | |
| Unit 1 (de 3): Introduction to Health Technology | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 6.5 |
| Unit 2 (de 3): Diagnostic systems | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 9.25 |
| Unit 3 (de 3): Therapy and monitoring systems | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 6.5 |
| Global activity | |
| Activities | hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 22.25 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 4.5 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 22.5 |
| Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] | 37.5 |
| Individual tutoring sessions [PRESENCIAL][Self-study] | 2 |
| Final test [PRESENCIAL][Assessment tests] | 8.75 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 52.5 |
| Total horas: 150 | |

| 10. Bibliography and Sources | | | | | | |
|---|--|-------------------------|------|-------------------|------|-------------|
| Author(s) | Title/Link | Publishing house | Citv | ISBN | Year | Description |
| Carr, Joseph J. | Introduction to biomedical equipment technology | Prentice Hall | | 0-13-010492-2 | 2001 | |
| Dyro, Joseph | Clinical engineering handbook | Elsevier Academic Press | | 0-12-226570-X | 2004 | |
| Khandpur, Raghbir Singh (1942-) | Biomedical instrumentation : technology and applications | McGraw-Hill | | 0-07-144784-9 | 2005 | |
| Ruđiger Kramme, Klaus-Peter Hoffmann, Robert S. Pozos | Springer Handbook of Medical Technology | Springer | | 978-3-540-74657-7 | 2011 | |

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|---|--|-------------------------|-------------------|------|
| Street, Laurence J. | Introduction to biomedical engineering technology | CRC Press | 978-0-8493-8533-9 | 2008 |
| Sörnmo, Leif | Bioelectrical signal processing in cardiac and neurological applications | Elsevier Academic Press | 0-12-437552-9 | 2005 |
| A. Badnjevic, M. Cifrek, R. Magjarevic, and Z. Dzemic | Inspection of Medical Devices for Regulatory Purposes https://www.springer.com/gp/book/9789811066498 | Springer | 978-981-10-6650-4 | 2018 |