



IDENTIFYING DATA

(*)Robótica médica

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|---------------------|--|----------|------|------------|
| Subject | (*)Robótica médica | | | |
| Code | V04M192V01206 | | | |
| Study programme | Máster Universitario en Ingeniería Biomédica | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 4.5 | Optional | 1st | 2nd |
| Teaching language | Spanish | | | |
| Department | | | | |
| Coordinator | Paz Domonte, Enrique | | | |
| Lecturers | Armesto Quiroga, José Ignacio López Fernández, Joaquín Paz Domonte, Enrique | | | |
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| Web | | | | |
| General description | The main elements of robotic systems in the field of biomedical engineering are presented. Concepts related to the architecture, modeling, programming and operation of robots, both manipulator arms and mobile robots, in the field of medicine, healthcare and hospital environments. | | | |

Training and Learning Results

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|------|---|
| Code | |
| A5 | Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous. |
| B3 | Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations. |

Expected results from this subject

| Expected results from this subject | Training and Learning Results |
|---|-------------------------------|
| Knowledge of the principles of medical robotics and its main systems | B3 |
| Ability to apply techniques for the representation of spatial location: position and orientation | A5 B3 |
| Ability to analyze kinematically and dynamically robotic equipment | A5 B3 |
| Applied knowledge of robotics programming and control techniques. | B3 |
| Knowledge of the principles of human-machine interaction, healthcare robotics, robotic applications in surgery and auxiliary techniques (augmented-virtual reality, image-guided simulators-trainers) | B3 |

Contents

| | |
|---|---|
| Topic | |
| 1. Introduction to medical robotics | (*)Introducción á robótica médica Robótica asistencial. Próteses e órtesis. Asistencia muscular. Rehabilitación. Exoesqueletos. *obótica en cirurxía. Cirurxía guiada por imaxe. Endoscopios |
| 2. Morphology of robots | (*)Morfoloxía do robot |
| 3. Representation of spatial localization: position and orientation | (*)Representación de la localización espacial: posición y orientación |
| 4. Robot kinematics: direct, reverse, and differential | (*)Cinemática: directa, inversa, modelo diferencial |
| 5. Introduction to robot dynamics | (*)Introducción a la dinámica |

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|---|--|
| 6. Robot programming and control techniques | (*)Control e programación de robots. Interacción home-máquina. Teleoperación. Sistemas hápticos. Percepción háptica en cirugía. Simuladores/adestradores Realidade virtual e aumentada. |
| 7. Mobile and service robotics | (*)Robótica móvil y de servicios |
| Practices 1 to 3. Simulation in CoppeliaSim | Introduction to the simulation with CoppeliaSim Modelling and simulation of a medical robot. Simulation of a robotics surgery environment. |
| Practice 4. Robot programming | Programming of industrial robots. Security aspects. |
| Practice 5 and 6. Mobile and service robotics | Modelling and simulation. Localization and mapping. Route planning. |

Planning

| | Class hours | Hours outside the classroom | Total hours |
|--------------------------|-------------|-----------------------------|-------------|
| Lecturing | 20 | 40 | 60 |
| Problem solving | 4 | 8 | 12 |
| Laboratory practical | 12 | 18 | 30 |
| Objective questions exam | 3 | 0 | 3 |
| Essay | 0 | 7.5 | 7.5 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

| | Description |
|----------------------|--|
| Lecturing | Lectures in classroom with the help of technical means: blackboard, computer and projector |
| Problem solving | Resolution of problems in classroom with the help of technical means: blackboard, computer and projector. |
| Laboratory practical | Laboratory practices in the technological laboratories of the Department of Systems Engineering and Automation or in the computer laboratories of the School of Industrial Engineering |

Personalized assistance

| Methodologies | Description |
|----------------------|--|
| Lecturing | Attention to queries and answers to doubts and questions asked while teaching lecture lessons |
| Problem solving | Attention to queries and answers to doubts and questions asked while solving problems in classroom |
| Laboratory practical | Attention to the queries and answer to the questions made during the practices in laboratory |

Assessment

| | Description | Qualification | Training and Learning Results |
|--------------------------|---|---------------|-------------------------------|
| Problem solving | The resolution of problems in the classroom can serve for the continuous evaluation of the students. Maximum 1 point out of 10. | 10 | A5 B3 |
| Laboratory practical | Laboratory practices are considered mandatory. The work done in the laboratory practices, as well as the previous work or the subsequent deliverables (when requested), constitute the fundamental part of the continuous evaluation. | 20 | A5 B3 |
| Objective questions exam | Written exam on the date established by the official exam calendar. It may consist of multiple choice questions, short answer questions, development questions, and problem solving questions. It will be necessary to achieve a minimum in each part (typically 40%), in order to pass the exam. | 40 | A5 B3 |
| Essay | Voluntary work to improve grades. Maximum 3 point out of 10 | 30 | A5 B3 |

Other comments on the Evaluation

Laboratory practices are considered mandatory.

To pass the subject in the first call, it is necessary to have attended at least 80% of the laboratory practices, and to have obtained an average grade of practices (including deliverables) greater than or equal to 5.

In case of not passing the practices in continuous evaluation, and for the students who renounce the continuous evaluation, it will be necessary to submit to an additional laboratory exam, once the official exam has been passed.

Sources of information

Basic Bibliography

Barrientos, Peñin, Balaguer, Aracil, **Fundamentos de Robótica**, Mc-Graw-Hill, 2007

Achim Schweikard, Floris Ernst, **Medical Robotics**, Springer, 2015

Complementary Bibliography

Varios, **Latest Developments in Medical Robotics Systems**, Colección de artículos, Intechopen, September 15, 2021

Recommendations

Subjects that are recommended to be taken simultaneously

(*)Control e regulación das funcións corporais/V04M192V01202

Subjects that it is recommended to have taken before

(*)Modelado e simulación sistemas biomédicos/V04M192V01103

(*)Simulación biomecánica/V04M192V01308