Robotics

Academic Year: (2022 / 2023) **Review date: 12-05-2022**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: CASTILLO MONTOYA, JOSE CARLOS

Type: Electives ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

C++ programming skills. C++ will be used in the lab sessions.

OBJECTIVES

CORE COMPETENCES

Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context.
Students are able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
Students are able to integrate knowledge and deal with the complexity of making judgements based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgements.
Students are able to communicate their conclusions and the ultimate knowledge and rationale behind them to specialist and non-specialist audiences in a clear and unambiguous way.
Students should possess the learning skills that will enable them to continue studying in a largely self-directed or autonomous manner.

GENERAL COMPETENCES

Ability to manage works and installations of computer systems, complying with current regulations, ensuring the quality of the service.
Ability to direct, plan and supervise multidisciplinary teams.
Capacity for mathematical modelling, calculation and simulation in technological and engineering centres of companies, particularly in research, development and innovation tasks in all areas related to Computer Engineering and related multidisciplinary fields.
Capacity for the elaboration, strategic planning, direction, coordination and technical and economic management of projects in all areas of Computer Engineering following quality and environmental criteria.
Capacity for general management, technical management and management of research, development and innovation projects in companies and technology centres in the field of computer engineering.
Ability to apply the knowledge acquired and to solve problems in new or unfamiliar environments within broader and multidisciplinary contexts, with the ability to integrate knowledge.
Ability to apply the principles of economics and human resources and project management, as well as the legislation, regulation and standardisation of computer science.
Ability to communicate (orally and in writing) conclusions - and the knowledge and rationale underpinning them - to specialist and non-specialist audiences in a clear and unambiguous manner.

SPECIFIC COMPETENCES

Capacity for the integration of technologies, applications, services and systems specific to Computer Engineering, with a generalist character, and in broader and multidisciplinary contexts.
Ability for strategic planning, elaboration, direction, coordination, and technical and economic management in the fields of Computer Engineering related, among others, to: systems, applications, services, networks, computer infrastructures or installations and software development centres or factories, respecting the appropriate compliance with quality and environmental criteria and in multidisciplinary work environments.
Ability to manage research, development and innovation projects in companies and technology centres, guaranteeing the safety of people and goods, the final quality of the products and their approval.
Ability to model, design, define the architecture, implement, manage, operate, administer and maintain computer applications, networks, systems, services and contents.
Ability to understand and know how to apply the functioning and organisation of the Internet, new generation network technologies and protocols, component models, middleware and services.

Ability to design, develop, manage and evaluate certification and security guarantee mechanisms in the processing of and access to information in a local or distributed processing system.
Ability to analyse the information needs that arise in an environment and carry out all stages of the construction process of an information system.
Ability to design and evaluate operating systems and servers, and applications and systems based on distributed computing.
Ability to design and develop computer systems, applications and services in embedded and ubiquitous systems.
Ability to apply mathematical, statistical and artificial intelligence methods to model, design and develop applications, services, intelligent systems and knowledge-based systems.
Capacity for the integration of technologies and systems specific to Computer Engineering, with a generalist character, and in broader and multidisciplinary contexts such as transport and logistics, product sales (in-store and on-line), social robotics, health services, tourism, education, environment, banking or business development.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to robotics
2. Perception in robotic
3. Actuation in robotics
4. Navigation
5. Processing elements
6. Decision-making in robotics
7. Human-Robot Interaction
8. Novel applications

LEARNING ACTIVITIES AND METHODOLOGY

Learning activities and methodology:
· Theoretical lessons and doubts solving sessions, tutorial support sessions and student personal work; this is aimed at the acquisition of theoretical knowledge.
· Practical sessions, tutorial support sessions and student personal work; this is aimed at the acquisition of practical abilities.

ASSESSMENT SYSTEM

- Continuous assessment: 100%.
  - o Partial 1 (30%, if passed the content will be removed for the final exam).
  - o Midterm 2 (30%, if passed the content is removed for the final exam)
  - o Final practical project: 30%.
  - o Class participation: 10%.

- Final exam
  - o 0%: if the student follows the continuous assessment, this exam will be taken only with the part(s) not passed in the midterm(s).
  - o 100%: if the student has not followed the continuous assessment, he/she will sit the final exam with all the content and the final mark will be worth 60% of the mark obtained.

- Extraordinary exam: 100% with all the content.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- Barrientos, A. ., & Balaguer Bernaldo de Quirós, C. Fundamentos de robótica (2ª ed.), McGraw-Hill Interamericana, 2007
- Craig, J. J. Robótica (3ª ed.), Pearson Educación, 2006
- Mataric, M. J. The robotics primer., The MIT Press., 2007
- Mordechai Ben-Ari, Francesco Mondada Elements of Robotics, Springer Nature, 2017
- Roland Siegwart, Illah Reza Nourbakhsh and Davide Scaramuzza. Introduction to autonomous mobile robots., MIT Press., 2011
- Siciliano, B., & Khatib, O. Springer Handbook of Robotics (2nd ed. 2016.), Springer, 2016

ADDITIONAL BIBLIOGRAPHY

- Kajita, Shuuji, Hirukawa, Hirohisa, Harada, Kensuke, & Yokoi, Kazuhito. Introduction to Humanoid Robotics (2014th ed., Vol. 101), Springer Berlin Heidelberg, 2014
- Mihelj, et al. Robotics (2nd ed. 2019.), Springer, 2019
- Roland Siegwart, Illah Reza Nourbakhsh and Davide Scaramuzza Introduction to autonomous mobile robots, MIT Press., 2011

BASIC ELECTRONIC RESOURCES

- . Web de ROS: https://www.ros.org
- . Documentación de Webots: https://cyberbotics.com/doc/guide/index
- . A gentle introduction to ROS: http:// https://cse.sc.edu/~jokane/agitr/agitr-letter.pdf