COURSE OUTLINE

GENERAL

SCHOOL	Sciences and Engineering		
ACADEMIC UNIT	Computer Science		
LEVEL OF STUDIES	1st Cycle		
COURSE CODE	COMP-345	**SEMESTER**	Fall
COURSE TITLE	Robot Programming		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	2.5	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	COMP-221
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	

LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After completion of the course students are expected to be able to:

1. Analyse fundamental robot components (sensors, actuators, controllers) and describe how they fit into a ROS-based system.
2. Develop Python scripts to control and monitor robots via ROS, including publishing/subscribing to topics.
3. Implement simple motion control algorithms (e.g., differential-drive) and evaluate odometry data in simulation.
4. Apply path-planning algorithms (e.g., BFS/A*) in 2D grid-based navigation tasks, demonstrating an understanding of how robots find and follow a path.

5. Integrate sensor data (e.g., LIDAR, camera) to enable obstacle avoidance or basic reactive behaviors in a simulated environment.
6. Employ elementary computer vision techniques (OpenCV) for line-following or object detection tasks in robotics.
7. Critically evaluate conceptual knowledge of advanced topics (e.g., SLAM, sensor fusion, or advanced navigation) by running or configuring existing ROS packages.
8. Design and test a small-scale robot "mini-project" using Python, ROS, and Gazebo, showcasing autonomous functionalities learned in the course.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

Search for, analysis, and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Production of new research ideas
Project planning and management
Criticism and self-criticism
Production of free, creative, and inductive thinking

SYLLABUS

1. Introduction to Python and ROS
2. Gazebo / Webots simulators overview
3. Robot motion and control (differential- drive, odometry)
4. Sensors and reactive behaviors (e.g., obstacle avoidance)
5. Path- planning fundamentals (BFS, A*, Dijkstra's)
6. Computer vision with OpenCV (line- following, object detection)
7. SLAM and advanced navigation; sensor fusion
8. Ethical and safety standards for autonomous systems (ISO 3691- 4)
9. Capstone integration and mini- project demonstration

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	*Use of ICT in teaching / Χρήση ΤΠΕ* *Communication with students / Επικοινωνία με Φοιτητές*

TEACHING METHODS

The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	***Semester workload***
Lectures	35
Preparation, homework, quizzes	45
Projects	35
Exam preparation	33
Final Exam	2
Course total	***150***

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.

Homework, Projects, Mid-Term, Final Exam

ATTACHED BIBLIOGRAPHY

Required Textbooks:

Authors	Title	Publisher	Year	ISBN
Quigley, M., Gerkey, B., & Smart, L.	Programming Robots with ROS: A Practical Introduction to the Robot Operating System.	O'Reilly Media	2015	978-1449323899
Joseph, L.	Mastering ROS for Robotics Programming - Third Edition	Packt Pub Ltd	2021	978-1801071024

Recommended Textbooks / Readings:

Authors	Title	Publisher	Year	ISBN
Fairchild, C., & Harman, T	ROS Robotics By Example - Second Edition	Packt Publishing	2017	978-1788479592
Siegwart, R., Nourbakhsh, I. R., & Scaramuzza, D.	Introduction to Autonomous Mobile Robots (Intelligent Robotics and Autonomous Agents) 2nd Edition	MIT Press	2011	978-0262015356
Lynch, K. M., & Park, F. C.	Modern Robotics: Mechanics, Planning, and Control 1st Edition	Cambridge University Press	2017	978-1107156302