DeCAIR

Developing Curricula for Artificial Intelligence and Robotics (DeCAIR)
618535-EPP-1-2020-1-JO-EPPKA2-CBHE-JP

Co-funded by the
Erasmus+ Programme
of the European Union

Course title	**Introduction to Robotics**
Course number	COMP474
Credit hours (lecture and lab)	3 (2 + 1)
ECTS (weekly contact and self-study load)	6 (3 + 3)
Prerequisites/co-requisites by course number and name	COMP325 or COMP326 or COMP328
Prerequisites by topic (other than the formal prerequisites above)	None
Level and type (compulsory, elective)	BE core course
Year of study and semester	Any
Catalogue description	Kinematics and dynamics for mobile and articulated robots. Description models applicable for robot system, such as homogeneous transforms etc Sensors, actuators and other robot hardware Algorithms for calculation of inverse kinematics, robot dynamics, trajectories and planning. Software architectures for robot systems and simulators Ethical and industrial aspects
Objectives	The purpose of this course is to introduce the students to basics of modeling, design, planning, and control of robot systems. In essence, the material treated in this course is a brief survey of relevant results from geometry, kinematics, statics, dynamics, control, and real-life field study.
Intended learning outcomes	Upon successful completion of this course, students will be able to:

No	Intended learning Outcome (ILO)	PLO*
1	Know the goal, applications, ethical and industrial aspects	2,3,4,7
2	Use basic theoretical tools from robotics to describe and calculate kinematics and dynamics for robot systems with several degrees of freedom	1,2,5,6,7
3	Sensing and acting	1,2,5,6,7
4	Decision making and path planning	1,2,5,6,7
5	account for different methods for navigation and localization	1,2,5,6,7
6	use modern software architectures for development of robot applications	1,2,5,6,7

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7	summarize the included subject areas in robotics including software and hardware		All

(*) The Program learning outcome (PLOs) are listed in the appendix

Teaching and learning methods	Development of ILOs is promoted through the following teaching and learning methods: • The Programming Lab. is open for the students to practice the practical aspects and solve the programming homework assignments. • The student attends the class presentations and participates in the discussions. • The student joins the related online team/group and participates in its discussions. • The student studies the reference material, including books and videos. • The student solves the programming assignments. • The student carries out a term project. • The student develops a professional report for the term report. • The student presents the term project in class.
Learning material type	Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.
Resources and references	A- Required book(s), assigned reading and audio-visuals: 1. Michael Wilson, "Implementation of Robot Systems: An Introduction to Robotics, Automation, and Successful Systems Integration in Manufacturing", BH, 2014 B- Recommended book(s), material and media: 2. Ferat Sahin, Pushkin Kashro, "Practical and experimental Robotics", CRC Press,2007 3. John J. Craig, "Introduction to Robotics Mechanics and Control", Pearson, 2005 4. Bruno Siciliano, Oussama Khatib, "Handbook of Robotics", Springer, 2008 5. Mark W. Spong, Seth Hutchinson, And M. Vidyasagar,"Robot Modeling And Control", John Wiley & Sons, Inc.,2020

Topic outline and schedule	Week	Topic	ILO	Resources
	1	Definition: • Goal • Applications	1,6	1
	2	Field Study: • Ethical and environmental impact • Industrial and financial study	1	1
	3-8	Design: • Body: Actuators, sensors, motors,	2,3	1

	joints, manipulators • Science Background: Mechanics: Kinematics and kinetics • Modeling: MATLAB, 3D design		
9-14	Implementation: • Control System • Decision making • Probability • Modeling and tools	4,5,6	1
15	Testing: • Projects	All	
	Further reading: • 3D printing • Networked and parallel robots • Human computer interface		

Evaluation tools	Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:

Assessment tool	Mark	Topic(s)	Time
Homework assignments	10%	Programming, designing,	W1-W14
Midterm exam	30%	Goal, design	W8
Term project report and presentation	20%	Practical and presentation aspects	W3-W15
Final exam	40%	All material	W16
Total	**100%**		

Student requirements	The student should have a computer and internet connection.

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Course policies	A- Attendance policies:
	• Attendance is required. Class attendance will be taken every class and the university polices will be enforced in this regard.
	B- Absences from exams and not submitting assignments on time:
	• A makeup exam can be arranged for students with acceptable absence causes. • Assignments submitted late, but before announcing or discussing the solution can be accepted with 25% penalty. • The project report must be handed in in time.
	C- Health and safety procedures:
	• All health and safety procedures of the university and the school should be followed.
	D- Honesty policy regarding cheating, plagiarism, misbehavior:
	• Open-book exams • All submitted work must be of the submitting student. • Other text or code must be properly quoted with clear source specification. • Cheating will not be tolerated.
	E- Available university services that support achievement in the course:
	• Moodle course page • Programming Lab for practicing the practical aspects and solving the programmingassignments. • Program announcements Facebook group
Additional information	None