ECTS Info Package

Türkçe

Syllabus (ME 434)

Basic information

Course title: Introduction to Robotics

Course code: ME 434

Lecturer: Assist. Prof. Saeed LOTFAN

ECTS credits: 5

GTU credits: 3 ()

Year, Semester: 4, Spring

Level of course: First Cycle (Undergraduate)

Type of course: Elective

Language of instruction: English

Mode of delivery: Face to face

Pre- and co-requisites: none

Professional practice: No

Purpose of the course: The study of robotics concerns itself with the desire to synthesize some aspects of human function by the use of mechanisms, sensors, actuators, and computers. Obviously, this is a huge undertaking, which necessitates the use of fields including mechanics, control engineering, and computer science. This course mainly covers topics from mechanical engineering and emphasizes computational aspects of the problems. Moreover, it is aimed that students from different disciplines come together and carry out team work.

Learning outcomes

Upon successful completion of this course, students will be able to:

1. Describe the basic concepts and theory governing the mechanics of robots that perform tasks such as manipulation.

   Contribution to Program Outcomes
   1. Ability to identify, formulate and solve complex engineering problems; ability to select and apply appropriate analysis and modeling methods for this purpose.
   2. Ability to select and use modern techniques and tools necessary for the analysis and solution of complex problems encountered in engineering practice; ability to use information technologies effectively.
   3. Ability to work effectively in disciplinary and multi-disciplinary teams; individual working skills.
   4. Ability to communicate effectively orally and in writing; knowledge of at least one foreign language; ability to write effective reports and understand written reports, to prepare design and production reports, to make effective presentations, to give and receive clear and understandable instructions.

   Method of assessment
   1. Written exam
   2. Homework assignment
   3. Seminar/presentation
   4. Term paper

2. Modeling the kinematics and dynamics of robots.

   Contribution to Program Outcomes
   1. An ability to design and conduct experiments, collect data, analyze and interpret results for the study of complex engineering problems or discipline-specific research topics.
   2. Ability to work effectively in disciplinary and multi-disciplinary teams; individual working skills.
   3. Ability to communicate effectively orally and in writing; knowledge of at least one foreign language; ability to write effective reports and understand written reports, to prepare design and production reports, to make effective presentations, to give and receive clear and understandable instructions.
   4. Awareness of the necessity of lifelong learning; the ability to access information, follow developments in science and technology, and constantly renew oneself.

   Method of assessment
   1. Written exam
   2. Homework assignment
   3. Seminar/presentation

4. Term paper

3. Obtain the knowledge and analysis skills associated with robot designing.

Contribution to Program Outcomes

1. Ability to select and use modern techniques and tools necessary for the analysis and solution of complex problems encountered in engineering practice; ability to use information technologies effectively.
2. Ability to communicate effectively orally and in writing; knowledge of at least one foreign language; ability to write effective reports and understand written reports, to prepare design and production reports, to make effective presentations, to give and receive clear and understandable instructions.
3. Awareness of the necessity of lifelong learning; the ability to access information, follow developments in science and technology, and constantly renew oneself.

Method of assessment

1. Written exam
2. Homework assignment
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Contents

Week 1:	Introduction: history, growth, applications, and laws of robotics.
Week 2:	Configuration space: robot components, degrees of freedom, joints, robot coordinates, and frames.
Week 3:	Topology, Representation, and Constraints.
Week 4:	C-space and Velocity Constraints.
Week 5:	Frames, Rigid body rotations, and Rotation matrices.
Week 6:	Homogeneous transformation matrices.
Week 7:	Spatial velocity: Twists, Screws, and Wrenches.
Week 8:	Forward kinematics of robots; D-H and PoE methods. Midterm exam
Week 9:	Universal robot description and Programming example.
Week 10:	Velocity kinematics: Body and Space Jacobians.
Week 11:	Velocity kinematics and Statics
Week 12:	Analytical Inverse Kinematics
Week 13:	Numerical Inverse Kinematics
Week 14:	Inverse Velocity Kinematics
Week 15*:	--
Week 16*:	Final Exam
Textbooks and materials:	Craig J. J., Introduction to Robotics: Mechanics and Control, Prentice Hall, 2004. Lynch, Kevin M., and Frank C. Park. Modern Robotics: Mechanics, Planning, and Control, Cambridge University Press, 2017.
Recommended readings:	Vukobratovic, M., Introduction to Robotics. Springer Science & Business Media, 2012. Bajd, T., Matjaz M., and Marko M., Introduction to Robotics. Springer Science & Business Media, 2013.

* Between 15th and 16th weeks is there a free week for students to prepare for final exam.

Assessment

Method of assessment	Week number	Weight (%)
Mid-terms:	8	30
Other in-term studies:	-	-
Project:	10	40
Homework:	-	-
Quiz:	-	-
Final exam:	16	30
	Total weight:	100 (%)

Workload

Activity	Duration (Hours per week)	Total number of weeks	Total hours in term

Courses (Face-to-face teaching):	3	14	42
Own studies outside class:	3	14	42
Practice, Recitation:	-	-	-
Homework:	-	-	-
Term project:	1	10	10
Term project presentation:	-	-	-
Quiz:	-	-	-
Own study for mid-term exam:	1	10	10
Mid-term:	1	1	1
Personal studies for final exam:	1	10	10
Final exam:	1	10	10
		Total workload:	125
		Total ECTS credits:	5*

* ECTS credit is calculated by dividing total workload by 25.

(1 ECTS = 25 work hours)

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