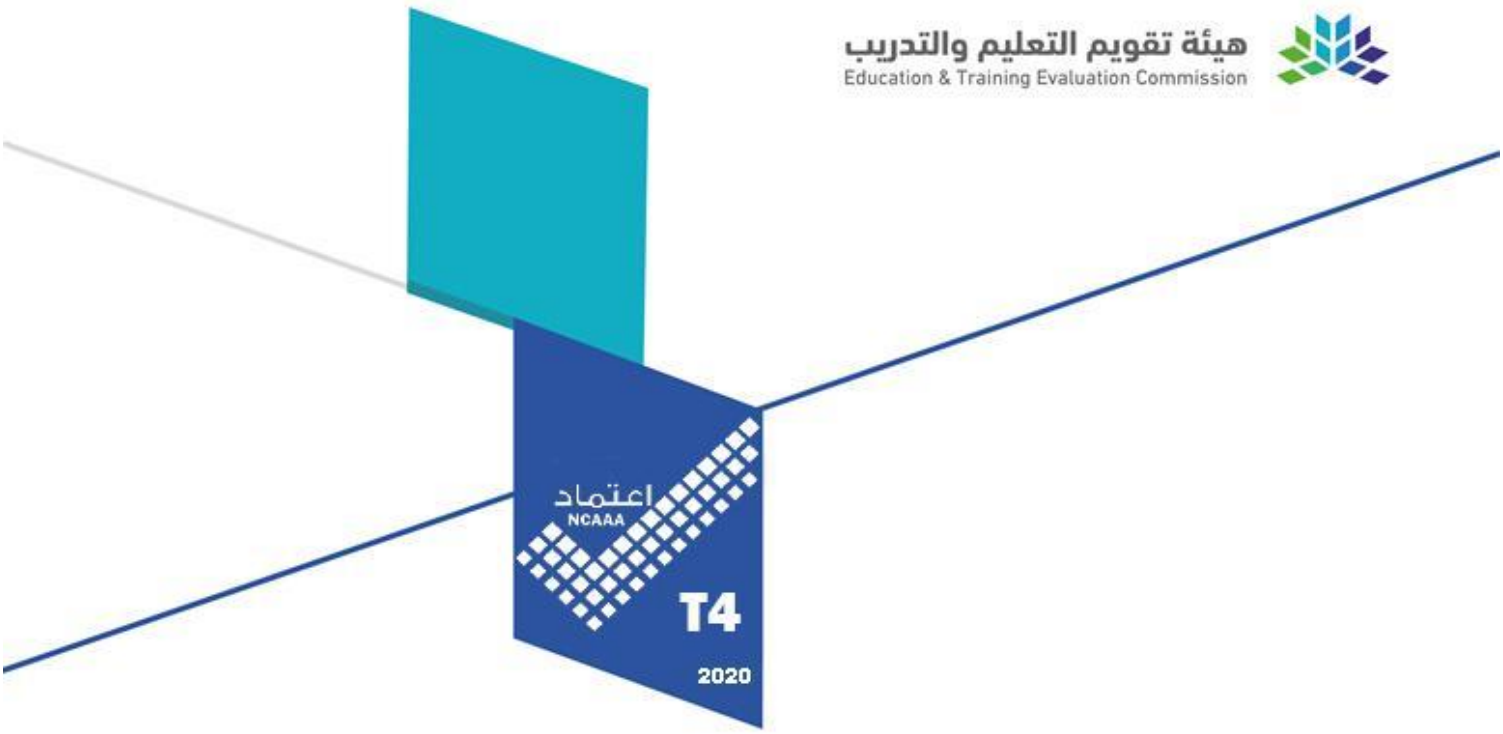
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	Robotics
Course Code:	503578-3
Program:	Bachelor in Computer Engineering
Department:	Department of Computer Engineering
College:	College of Computers and Information Technology
Institution:	Taif University

Table of Contents

A. Course Identification

1. Credit hours:3
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ☐ Elective ■
3. Level/year at which this course is offered: 10th level/5th year
4. Pre-requisites for this course (if any)**:** Embedded Systems (503432-3)
5. Co-requisites for this course (if any)**:** None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	8	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	45
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	75

B. Course Objectives and Learning Outcomes

1. Course Description

The objective of this course is to introduce students to the field of robotics. The course is organized in two main parts: (i) Foundations of robot motion. (ii) Robot kinematics. In the first part, foundations of robot motion, students will learn the fundamentals of robot configurations for serial robot mechanisms. These include learning about configuration space (C-space), degrees of freedom, and implicit/explicit representations of configurations. In the second part, robot kinematics, students will learn to solve the forward kinematics using the product-of-exponentials formula. This is followed by learning about velocity kinematics and statics relating joint velocities and forces/torques to end-effector twists and wrenches as well as inverse kinematics. The students' understanding of the aforementioned topics will be solidified by writing robotics software using a free state-of-the-art cross-platform robot simulator.

2. Course Main Objective

1. Understand the basic theory underlying modern robotics.
2. Understand a robot's configuration space.
3. Understanding of rigid-body motions and forward/invers kinematics.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Identify the degree of freedom of both rigid bodies and robots	K1
1.2	Recognize the configuration and spatial motion of rigid bodies	K1
2	**Skills :**	
2.1	Perform rigid body transformation	S1
2.2	Solve forward and inverse kinematics of Robots.	S1
	Solve Manipulator Jacobian	S1
3	**Values:**	
3.1		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction; Degrees of freedom for rigid bodies and robots; Configuration space	5
2	3D frame transformation	5
3	Rigid body motion in the plane; Rotations and angular velocities	5
4	DH-parameters	5
5	Forward Kinematics, Product of exponential formula	5
6	Midterm Exam	2
7	Analytic inverse kinematics; Numerical inverse kinematics	5
8	Manipulator Jacobian	5
9	Singularity analysis; Manipulability	5
10	Mini project	3
11	Lab	30
Total		75

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Identify the degree of freedom of both rigid bodies and robots	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments
1.2	Recognize the configuration and spatial motion of rigid bodies	Lecture Discussion Problem Solving Lab	Written Exams Quizzes Assignments Practical test
2.0	**Skills**		
2.1	Perform rigid body transformation	Lecture Discussion Problem Solving Lab	Written Exams Quizzes Assignments Practical test

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	Solve forward and inverse kinematics of Robots.	Lecture Discussion Problem Solving Lab	Written Exams Quizzes Assignments Practical test
2.3	Solve Manipulator Jacobian	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments
3.0	**Values**		
3.1			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Lab Exam	15	15%
2	Midterm Exam	8	20%
3	Assignments	Continues	5%
4	Quizzes	Continues	10%
5	Project	Continues	10%
6	Final Exam	16	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:
Teaching staff provide at least 6 office hours for students to help them in the course as well as in any other academic issues.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	S K Saha, Introduction to Robotics, MacGraw Hill, 2008
Essential References Materials	
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms; Laboratories

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	Students	Indirect (Survey)
Effectiveness of teaching and assessment	Students	Indirect (Survey)
Extent of achievement of course learning outcomes	Faculty	Course Report (Includes Direct and Indirect Assessment results)

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

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