2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Robotics**
Course Code:	**CEN 1409**
Program:	**Bachelor in Computer Engineering**
Department:	**Computer Engineering**
College:	**Faculty of Computers and Information Technology**
Institution:	**University of Tabuk**
Version:	**1.0**
Last Revision Date:	**27 July 2022**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (9/5)					
4. Course general Description:					
Robotics course covers the fundamentals of robotics including position, actuators, and robot coordinate system. Manipulator configuration including axis, angles, and frames are also investigated. Moreover, understanding forward and inverse kinematics as well as Denavit-Hartenberg convention.					
5. Pre-requirements for this course (if any)**:**					
MATH 1205					
6. Co-requisites for this course (if any)**:**					
N/A					
7. Course Main Objective(s):					
In this course, students will learn how to design and control an industrial arm manipulator from scratch that can be programmed to achieve a specific task. Moreover, students will be able to apply AI ideas to improve the functionality of the arm manipulator with integrated embedded systems.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**45**	**100%**
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	-
3.	Field	-
4.	Tutorial	-
5.	Others (specify)	-
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Define robotics basic concepts.	K1	Lectures, textbooks, provided handouts, references.	Exams, quizzes, assignments, and the project.
1.2	Recognize the different types of arm manipulator.	K3		
1.3	Specify and describe forward and inverse kinematics.	K3		
1.4	Demonstrate and identify frames rotations and homogeneous transformation.	K5		
2.0	Skills			
2.1	Design links and joints of an arm manipulator.	S3	Lectures, textbooks, provided handouts, references.	Exams, quizzes, assignments, and the project.
2.2	Develop a functional arm manipulator.	S3		
2.3	Evaluate an arm manipulator performance.	S2		
2.4	Analyze an arm manipulator using Denavit Hartenberg (DH).	S4		
3.0	Values, autonomy, and responsibility			

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
3.1	The ability to demonstrate work within a team.	V2	Lectures, textbooks, provided handouts, references.	Exams, quizzes, assignments, and the project.
3.2	The ability to follow safety engineering guidelines.	V2		

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction	3
2.	Forward Kinematics (part 1)	3
3.	Forward Kinematics (part 2)	3
4.	Inverse Kinematics (part 1)	3
5.	Inverse Kinematics (part 2)	3
6.	Inverse Kinematics (part 3)	3
7.	Rigid Motions (part 1)	3
8.	Rigid Motions (part 2)	3
9.	Rigid Motions (part 3)	3
10.	Homogeneous Transformation (part 1)	3
11.	Homogeneous Transformation (part 2)	3
12.	Homogeneous Transformation (part 3)	3
13.	Denavit Hartenberg (DH) (part 1)	3
14.	Denavit Hartenberg (DH) (part 2)	3
15.	Denavit Hartenberg (DH) (part 3)	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Two Assignments	5,14	10%
2.	Two Quizzes	4,9	10%
3.	Two Midterm Exam	7,12	20%
4.	Project	15	20%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
5.	Final Exam	16	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Spong, Mark W., Seth Hutchinson, and Mathukumalli Vidyasagar. *Robot modeling and control*. John Wiley & Sons, 2020.
Supportive References	Provided Handouts
Electronic Materials	-
Other Learning Materials	-

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	Students should have laptops

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Teaching	Faculty, Program Leaders, and Advisory Board	Both Direct and Indirect
	Students	Indirect
Effectiveness of Students Assessment	Faculty, Program Leaders, Advisory Board, and Independent Opinion	Both Direct and Indirect
Quality of Learning Resources	Faculty, Students, and Advisory Board	Indirect
The Extent to which CLOs have been Achieved	Faculty, Program Leaders, Advisory Board, and Independent Opinion	Direct (as in section B) and Indirect/Surveys

Assessment Areas/Issues	Assessor	Assessment Methods
	Students	Indirect
Other	-	-

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	