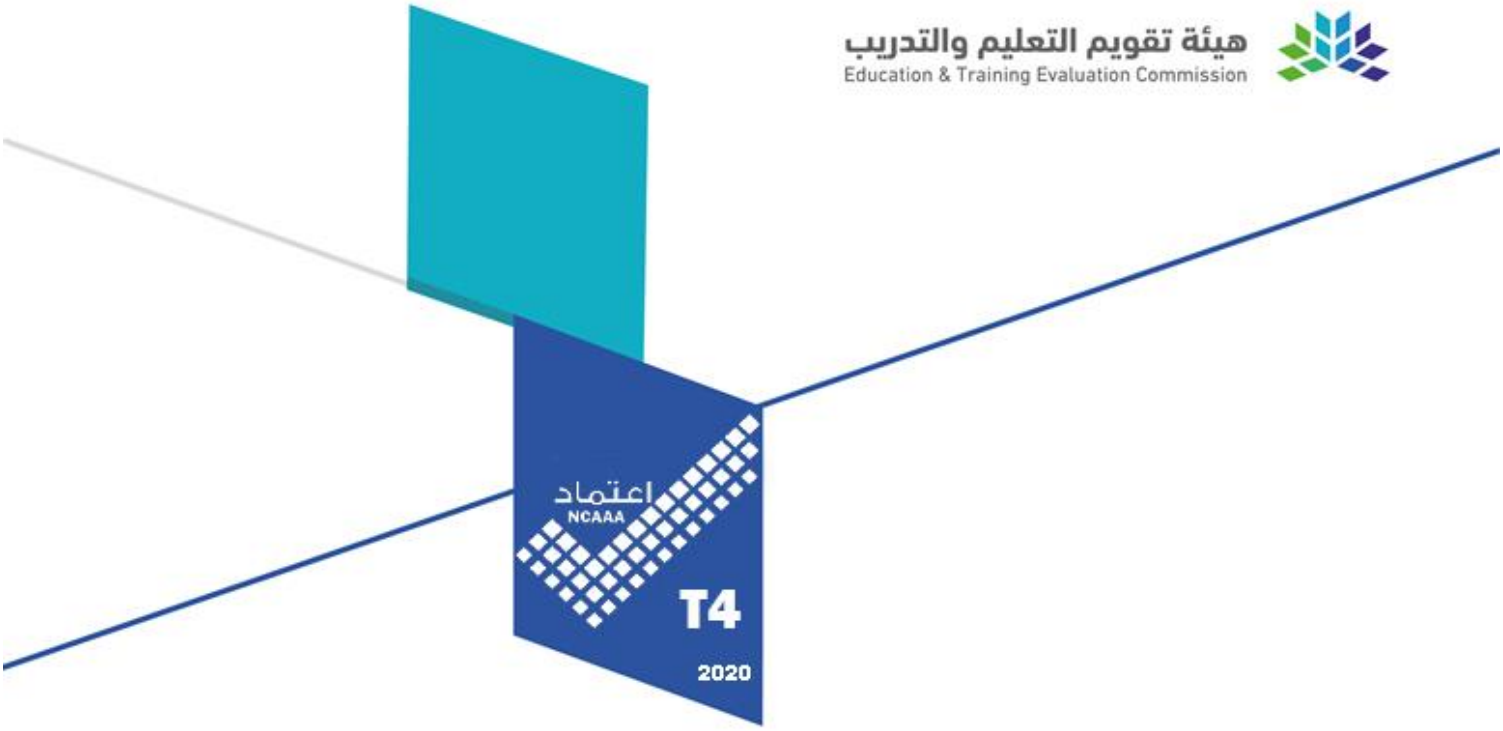
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	Introduction to Robotics
Course Code:	CSI-442
Program:	Computer Science and Information Technology
Department:	**Computer Science and Information**
College:	**College of Science at AL Zulfi**
Institution:	Majmaah University

Table of Contents

A. Course Identification

1. Credit hours:
2. Course type **a.** University ☐ College ☐ Department ☒ Others ☐ **b.** Required ☐ Elective ☒
3. Level/year at which this course is offered: Elective
4. Pre-requisites for this course (if any)**:** • Artificial Intelligence CSI 411
5. Co-requisites for this course (if any)**:**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	48	80 %
2	**Blended**	3	5%
3	**E-learning**	3	5 %
4	**Distance learning**		0 %
5	**Other**	6	10%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	
3	**Tutorial**	30
4	**Others** (specify)	
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides an overview of robot mechanisms, dynamics, and intelligent controls. Topics include planar and spatial kinematics, and motion planning; mechanism design for manipulators and mobile robots, multi-rigid-body dynamics, control design, actuators, and sensors; wireless networking, task modeling, human-machine interface, and embedded software.

2. Course Main Objective

The purpose of this course is to 1. Provide students with the basic concepts of Robotics. 2. Acquaint students with basic robot components, how to interface a computer with the real world, different types of sensors and their use, different types of actuators and their use, and forward and inverse kinematics of simple two link robotic manipulators. 3. Introduce students to the relationships between Robotics and Artificial Intelligence. 4. Enable students to be efficient in their work.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	The know-how of the fundamentals of robotics in the core areas of mechanics, control, perception, artificial intelligence, and autonomy.	K3
1.2	Perform spatial transformations associated with rigid body motions.	K2
1.3	Perform kinematics analysis of robot systems.	K2
2	**Skills :**	
2.1	Understand concept of sensors and actuators and Identify sensors and actuators required for specific applications.	S4
2.2	Perform basic calculation associated with trajectory planning.	S4
3	**Values:**	
3.1	Learn how to search for information through library and internet.	C1
3.2	Present a short report in a written form and orally using appropriate scientific language.	C1
3.3	Function effectively on teams to accomplish a common goal, and communicate effectively with a range of audiences.	C1
3.4	Present and discuss case studies in relate to cloud services and models	C1

C. Course Content

No	List of Topics	Contact Hours
1	Introduction: background, the mechanics and control of mechanical manipulators, notation	4
2	Spatial descriptions and transformations: descriptions, mappings, operators, transformation arithmetic, transform equations, transformation of free vectors.	8
3	Manipulator kinematics: link description, link-connection description, convention for affixing frames to links, manipulator kinematics, actuator space, joint space, and Cartesian space.	8
4	Inverse manipulator kinematics: solvability, the notion of manipulator subspace when n <6, algebraic vs. geometric, algebraic solution by reduction to polynomial, Pieper's solution when three axes intersect, the standard frames, solving a manipulator.	8
5	Velocities and static forces: notation for time-varying position and orientation, linear and rotational velocity of rigid bodies, more on angular velocity, motion of the links of a robot, velocity "propagation" from link to link, Jacobean's, singularities.	8
6	Manipulator dynamics: acceleration of a rigid body, mass distribution, newton's equation, Euler's equation, the structure of a manipulator's dynamic equations, Dynamic simulation.	8
7	Trajectory generation: general considerations in path description and generation, joint-space schemes, Cartesian-space schemes, geometric problems with Cartesian paths, path generation at run time.	8
9	Manipulator-mechanism design: kinematic configuration, quantitative measures of workspace attributes, redundant and closed-chain structures, actuation schemes.	8

Total	60

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	The know-how of the fundamentals of robotics in the core areas of mechanics, control, perception, artificial intelligence, and autonomy.	**Direct Teaching:** Lectures, PowerPoint slides and discussion. **Aimed Teaching** Discovery and Oral Questions.	Written Exam • Homework tasks • Quiz • Midterms • Final Exam
1.2	Perform spatial transformations associated with rigid body motions.		
1.3	Perform kinematics analysis of robot systems		• E-learning • Internet search • Oral Exam
2.0	**Skills**		
2.1	Understand concept of sensors and actuators and Identify sensors and actuators required for specific applications.	**Indirect Teaching:** Brainstorming - Free Discovery – Inquiry	• HW Exercises • Lab Exam • Oral Exam • Presentations
2.2	Perform basic calculation associated with trajectory planning.		
3.0	**Values**		
3.1	Learn how to search for information through library and internet.	**Course Project: (Work group)** critical thinking and ability to seek solutions	Introduce group project and case study approaches to enable students to have an experience in problem solving situations.
3.2	Present a short report in a written form and orally using appropriate scientific language.		
3.3	Function effectively on teams to accomplish a common goal, and communicate effectively with a range of audiences.		
3.4	Present and discuss case studies in relate to cloud services and models		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	First written mid-term exam	6	20%
2	Second written mid-term exam	12	20%
3	Class activities, group discussions, Presentation	Every 2 weeks	5%
4	Homework + Assignments	After every Chapter	5%
5	Electronic exam	14	5%
6	Lab activities	15	5%
7	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 :

- Determine meeting appointments for the weak' students to solve their problems and give them academic advices.
- One office hour daily
- Dealing a workshops.
- Motivate students

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	John J. Craig, Introduction to Robotics: Mechanics and Control, Third Edition. Prentice Hall, 2004
Essential References Materials	• Saeed B. Niku, Introduction to Robotics: Analysis, Control, Applications, Wiley; 2nd edition, 2010.
Electronic Materials	•http://see.stanford.edu/see/courseinfo.aspx?coll=86cc8662-f6e4-43c3-a1beb30d1d179743 •http://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-torobotics-fall-2005
Other Learning Materials	• Video and presentation are available with me

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom – Laboratory + Blackboard System
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show – Smart Board + Blackboard System
Other Resources	

Item	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
Questionnaires (course evaluation) filled by the students and acquired electronically by the University	Students	Indirect Assessment
Students-faculty management meetings		
Departmental internal review of the course.	Department Council	Questionnaires
Discussion with the industrial partners to enhance the courses in order to meet their needs.	Stockholders	Meetings
Midterms and Final Exam	Course Coordinator Staff	Direct Assessment
Project Evaluation		

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	**Dr Fayez AlFayez** **Dr. Theljeoui Adel**
Reference No.	
Date	25-01-2021