جامعة المجمعة
Majmaah University

Course Specifications

Institution:	**College of Science at Az Zulfi**
Academic Department :	**Computer Science and Information**
Programme :	CSI
Course :	**Introduction to Robotics**
Course Coordinator :	**Noureldin Laban**
Programme Coordinator :	Dr. Yosry Azzam.
Course Specification Approved Date :	22 ./ 12 / 1435 H

This form compatible with NCAAA 2013 Edition

A. Course Identification and General Information

1 - Course title : **Introduction to Robotics** Course Code: **CSI 442**			
2. Credit hours : 3 (2 Lecture + 2 Lab)			
3 - Program(s) in which the course is offered: CSI			
4 – Course Language : English			
5 - Name of faculty member responsible for the course: **Noureldin Laban**			
6 - Level/year at which this course is offered : **Elective level**			
7 - Pre-requisites for this course (if any) : • **Artificial Intelligence CSI 411**			
8 - Co-requisites for this course (if any) : • **N/A**			
9 - Location if not on main campus **:** • **N/A**			
10 - Mode of Instruction (mark all that apply)			
A - Traditional classroom	√	What percentage?	**80 %**
B - Blended (traditional and online)	√	What percentage?	**5 %**
D - e-learning		What percentage?	**5 %**
E - Correspondence		What percentage?	**……. %**
F - Other	√	What percentage?	**10 %**
Comments : One-tenth of the course is presented mainly inside video lectures of other instructors worldwide. They illustrate the same topics that I introduced in my lectures with a different presentation.			

B Objectives

What is the main purpose for this course?

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.

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.

Briefly describe any plans for developing and improving the course that are being implemented :

1. Using group discussion Updating the materials of the course to cover the new topics of the field.
2. Encourage students to design and develop some Robotic applications.

C. Course Description

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
1. Introduction: background, the mechanics and control of mechanical manipulators, notation.	1	4
2. Spatial descriptions and transformations: descriptions, mappings, operators, transformation arithmetic, transform equations, transformation of free vectors.	2	8
3. Manipulator kinematics: link description, link-connection description, convention for affixing frames to links, manipulator kinematics, actuator space, joint space, and Cartesian space.	2	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.	2	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.	2	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.	2	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.	2	8
8. Manipulator-mechanism design: kinematic configuration, quantitative measures of workspace attributes, redundant and closed-chain structures, actuation schemes.	2	8

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	30	30	-	-	-	60
Credit	30	15	-	-	-	45

3. Additional private study/learning hours expected for students per week.

5 **Hours**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	**The know-how of the fundamentals of robotics in the core areas of mechanics, control, perception, artificial intelligence, and autonomy.**	Lectures. Lab demonstrations. Case studies. Individual presentations.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
1.2	**Perform spatial transformations associated with rigid body motions.**		
1.3	**Perform kinematics analysis of robot systems**		
2.0	**Cognitive Skills**		
2.1	**Understand concept of sensors and actuators and Identify sensors and actuators required for specific applications.**	Lectures. Lab demonstrations. Case studies. Individual presentations. Brainstorming.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
2.2	**Perform basic calculation associated with trajectory planning.**		
3.0	**Interpersonal Skills & Responsibility**		
3.1	**Understand basic issues and programming principles associated with robot control.**	Small group discussions. Whole group discussions. Brainstorming. Presentations.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
3.2	**Implement hardware and software to build a robot that can perform a task.**		

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
4.0	**Communication, Information Technology, Numerical**		
4.1	**work cooperatively in a small group environment.**	Small group discussions. Whole group discussions. Brainstorming. Presentations.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
4.2	**Save time and space in each task.**		
5.0	**Psychomotor**		
5.1	**N/A**		

5. Schedule of Assessment Tasks for Students During the Semester:

	Assessment task	Week Due	Proportion of Total Assessment
1	First written mid-term exam	6	15%
2	Second written mid-term exam	12	15%
3	Presentation, class activities, and group discussion	Every week	10%
4	Homework assignments	After Every chapter	10%
5	Experiment of presented designs	Every two weeks	10%
6	Final written exam	16	40%

D. Student Academic Counseling and Support

Office hours: Sun: 10-12, Mon. 10-12, Wed. 8-10
Office call: Sun. 12-1 and Wed 12-1

Email: n.laban@mu.edu.sa

E. Learning Resources

1. List Required Textbooks :

- John J. Craig, Introduction to Robotics: Mechanics and Control, Third Edition. Prentice Hall, 2004

2. List Essential References Materials :

- Saeed B. Niku, Introduction to Robotics: Analysis, Control, Applications, Wiley; 2nd edition, 2010.
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3. List Recommended Textbooks and Reference Material :

- IEEE Robotics & Automation Magazine.

4. List Electronic Materials :

- **http://see.stanford.edu/see/courseinfo.aspx?coll=86cc8662-f6e4-43c3-a1be-b30d1d179743**
- **http://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/**

5. Other learning material :

- Video and presentation are available with me

F. Facilities Required

1. Accommodation

- Classroom and Lab, as those that are available at college of science at AzZulfi.

2. Computing resources

- Smart Board

3. Other resources

- **N/A**

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching:

- Questionnaires (course evaluation) achieved by the students and it is electronically organized by the university.
- Student-faculty management meetings.

2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor :

- Discussion within the staff members teaching the course
- Departmental internal review of the course.

3 Processes for Improvement of Teaching :

- Periodical departmental revision of methods of teaching.
- Monitoring of teaching activates by senior faculty members.
- Training course.

4. Processes for Verifying Standards of Student Achievement

- Reviewing the final exam questions and a sample of the answers of the students by others.
- Visiting the other institutions that introduce the same course one time per semester.
- Watching the videos of other courses by international institutions.
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5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement :

- Course evaluation
- Exam evaluation
- Improvement plan

Course Specification Approved
Department Official Meeting No (6) Date 22 / 12 / 1435 *H*

Course's Coordinator		Department Head	
Name :	**Noureldin Laban**	***Name :***	Dr. yosry Azzam
Signature :	.....	***Signature :***	.....
Date :	17/ 12 / 1435 *H*	***Date :***	22 ./ 12 / 1435 *H*