University/Academy: Arab Academy for Science, Technology & Maritime Transport
Faculty/Institute: College of Engineering & Technology
Program: B.Sc Computer Engineering

Form no. (12): **Course Specification**

1- Course Data

Course Code: **CC525**	Course Title: **Intelligent Robotics**	Academic Year/Level: year **4,5** / semester **7,8,9,10**
Specialization: **Computer Engineering**	**Credit Hours**: 3 **Lecture**: 2 **Tutorial:** 2 **Lab:** 2	**Prerequisite**

2- Course Aim

To teach students the principles and techniques of designing intelligent robotic systems

3- Intended Learning Outcomes

a- Knowledge and Understanding	[a5] Engineering principles in the fields of logic design, circuit analysis, machine and assembly languages, computer organization and architectures, memory hierarchy, advanced computer architectures, embedded systems, signal processing, operating systems, real-time systems and reliability analysis. • Define robot concepts. • Identify robot types . • Describe the main features that distinguish intelligent robots. • Describe various robot methodologies to locate objects. • Find the joint rotations and orientations to place the end effectors in a desired position and orientation. • Describe a specific type of robots: autonomous mobile robots (Case Study) • Describe a specific type of robots: trajectory planning for robot (Case Study)
b- Intellectual Skills	[b1] Select/Apply appropriate mathematical and computer-based methods for modeling and analyzing problems and select appropriate solutions for engineering problems based on analytical thinking. • Describe how to apply Artificial Intelligence in robotics field. • Explain the cognitive component of the robot. [b2] Think in a creative and innovative way in problem solving and design using the latest technologies and solve engineering problems, often on the basis of limited and possibly contradicting information while identifying symptoms in problematic situations. • Describe the transformation matrices especially for translation. • Examine the position, velocity and acceleration of all the links that are calculated without considering the forces that cause this motion. [b4] Assess and evaluate the characteristics and performance of components, systems and processes and investigate their failure. • Conclude the transformation matrices. • Calculate the position of Robot links.

	• Calculate the joints rotations and orientations [b7] Integrate computer objects running on different system configurations. • Concentrate on the specific cognitive component type (Machine Vision) • Detailed description of Machine Vision. • Describe the automatic control system that controls the robot.
c- Professional Skills	[c2] Create and/or re-design a process, component or system, and carry out specialized engineering designs with neatness and aesthetics in design and approach. • Design of vision based robot. [c3] Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment, wide range of analytical tools, techniques, and software packages pertaining to the computer engineering to design experiments, collect, analyze and interpret results and develop required computer programs. • Draw a flow chart of Trajectory planning algorithm. • Design automatic control system to control the velocity and acceleration of robot.
d- General Skills	[d1] Collaborate effectively within multidisciplinary teams. [d2] Work in stressful environment and within constraints, communicate effectively, lead and motivate individuals and effectively manage tasks, time, and resources. • Verify theory with practice.

4- Course Content

Week No.1	Introduction.
Week No.2	Object location.
Week No.3	General transformation.
Week No.4	Kinematics: Homogenous Transformation.
Week No.5	Kinematics: Forward / Inverse kinematics.
Week No.6	Introduction to AI.
Week No.7	7th Week Exam
Week No.8	Robot Sensors.
Week No.9	Image Processing.
Week No.10	Pattern recognition and computer vision.
Week No.11	Autonomous Mobile Robots.
Week No.12	12th Week Exam
Week No.13	Trajectory planning for Robot.
Week No.14	Robot Control.
Week No.15	Revision.
Week No.16	Presentation of projects and Final Exam.

5- Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

6-Teaching and Learning Methods for Students with Special Needs

• Lectures • Tutorials • Reports & sheets • Laboratories • Seminars The academic advisors of each student, as well as dedicated department TAs monitor the students' progress and solve any problem he/she may encounter.

7- Student Assessment

a-Procedures used	1-Written Examinations to assess The Intended Learning Outcomes. 2-Class Activities (Reports, Discussions, ------) to assess The Intellectual Skills.	
b- Schedule:	Assessment 1 Assessment 2 Assessment 3 Assessment 4	7th Week Written Exam 12th Week Written Exam Continuous Assessments 16th Week Final Written Exam
c- Weighing of Assessment	7th Week Examination 12th Week Examination Final-term Examination Oral Examination Practical Examination Semester Work Total	30 % 20 % 40 % 0 % 0 % 10 % 100%

8- List of References:

a- Course Notes	
b- Required Books (Textbooks)	Spong, Mark W, "Robot Dynamics and Control", Wiley 0ED
c- Recommended Books	• Introduction to Robotics Mechanics and Control By: J.J. Craig • Robot manipulators: Mathematics, Programming, and Control By: R. Paul • Fundamentals for Control of Robotic Manipulators By: A.J. Koivo Hill, New Jersey, 1998
d- Periodicals, Web Sites, etc.	N/A

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