Hall Ticket No | | | | | | | | | | | Question Paper Code: AME553

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - I

B.Tech VI Semester End Examinations (Regular), April – 2020

Regulations: R16

INTRODUCTION TO ROBOTICS

(**AERONAUTIICAL ENGINEERING**)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1.	a)	Sketch and explain the four basic robot configurations classified according to the coordinate system.	**[7M]**
	b)	Differentiate CAD/CAM and robotics.	**[7M]**
2.	a)	Discuss in detail the architecture of robot system.	**[7M]**
	b)	Discuss about vacuum grippers along with their advantages and disadvantages.	**[7M]**

UNIT – II

3.	a)	Define homogenous transformation matrix and explain four sub matrices.	**[7M]**
	b)	Determine the transformation matrix T that represents a translation of ‘a’ units along x-axis, followed by a rotation of β about x-axis and followed by a rotation of θ about z-axis.	**[7M]**
4.	a)	Describe about D-H Transformation for a forward Kinematics problems of planar 3 dot manipulator.	**[7M]**
	b)	Determine the translated vector for the given vector v = 25i+10j+20k perform a translation by a distance of 8 units in “x” direction, 5 units in “y” direction and 0 units in “z” direction.	**[7M]**

UNIT – III

5.	a)	Determine the manipulator jacobian matrix and singularities for the 3-DOF articulated arm.	**[7M]**
	b)	Explain the Potential energy as applied to robot arm dynamics analysis.	**[7M]**
6.	a)	Derive Newton-Euler formulation of joining force/torque for single link manipulator of given length and mass.	**[7M]**
	b)	Explain the joint velocities as applied to robot arm dynamics analysis.	**[7M]**

UNIT – IV

7.	a)	Describe the common types of motion that a robot manipulator can make in travelling from point to point.	**[7M]**
	b)	Explain the various drive system used with an industrial robot and compare their features, merits and demerits.	**[7M]**
8.	a)	A single cubic trajectory given by q(t)= 30+t2-6t3 is used for a period of 3 seconds.Determine starting and final position, velocity and acceleration of endeffector.	**[7M]**
	b)	Explain the steps involved in Trajectory planning.	**[7M]**

UNIT – V

9.	a)	Describe the various considerations taken into account for material handling.	**[7M]**
	b)	Explain use of robot in assembly operation.	**[7M]**
10.	a)	Describe the Spray coating operation with robot system.	**[7M]**
	b)	Define material transfer application and explain about simple pick and operation with neat sketch.	**[7M]**

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COURSE OBJECTIVES:

The course should enable the students to:

I	Develop the knowledge in various robot structures and their workspace.
II	Develop the skills in performing kinematics analysis of robot systems.
III	Provide the knowledge of the dynamics associated with the operation of robotic systems.
IV	Provide the knowledge and analysis skills associated with trajectory planning.
V	Understand material handling and robot applications in industries.

COURSE OUTCOMES (COs):

CO 1	Understand characteristic features of robots and usage of different grippers for industrial applications.
CO 2	Understand direct and inverse kinematics of robot structure.
CO 3	Illustrate Differential Kinematics of planar and spherical manipulators.
CO 4	Understand classification of robot actuators and trajectory planning.
CO 5	Remember material handling and applications in manufacturing.

COURSE LEARNING OUTCOMES (CLOs):

AME553.01	Differentiate between automation and robotics.
AME553.02	Classify robots and describe its anatomy.
AME553.03	Specify various types of industrial sensors.
AME553.04	Classify various grippers.
AME553.05	Discuss about motion analysis of robot.
AME553.06	Understand methods for calculating the kinematics and inverse kinematics of a robot manipulator.
AME553.07	Describe D-H notations, joint coordinates and. world coordinates.
AME553.08	Discuss about homogeneous transformation.
AME553.09	Describe the differential kinematics of planar manipulators.
AME553.10	Illustrate Lagrange-Euler formulation.
AME553.11	Discuss jacobian and robot dynamics.
AME553.12	Illustrate Newton-Euler formulation.
AME553.13	Describe Joint space scheme.
AME553.14	Illustrate cubic polynomial fit.
AME553.15	Classify types of motion.
AME553.16	Explain actuators and classify them.
AME553.17	Illustrate various robot applications in manufacturing.
AME553.18	Discuss the role of robots in material handling.
AME553.19	Explain work cell design.
AME553.20	Discuss the role of robots in assembly and inspection,

Mapping of Semester End Examinations to Course Outcomes:

SEE Question No.		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	AME553.02	Classify robots and describe its anatomy.	CO 1	Understand
	b	AME553.01	Differentiate between automation and robotics.	CO 1	Understand
2	a	AME553.02	Classify robots and describe its anatomy.	CO 1	Understand
	b	AME553.04	Classify various grippers**.**	CO 1	Understand
3	a	AME553.08	Discuss about homogeneous transformation.	CO 2	Understand
	b	AME553.08	Discuss about homogeneous transformation.	CO 2	Remember
4	a	AME553.06	Understand methods for calculating the kinematics and inverse kinematics of a robot manipulator.	CO 2	Remember
	b	AME553.06	Understand methods for calculating the kinematics and inverse kinematics of a robot manipulator.	CO 2	Remember
5	a	AME553.11	Discuss jacobian and robot dynamics.	CO 3	Understand
	b	AME553.12	Illustrate Newton-Euler formulation.	CO 3	Understand
6	a	AME553.12	Illustrate Newton-Euler formulation.	CO 3	Understand
	b	AME553.11	Discuss jacobian and robot dynamics.	CO 3	Understand
7	a	AME553.13	Describe Joint space scheme.	CO 4	Understand
	b	AME553.16	Explain actuators and classify them.	CO 4	Remember
8	a	AME553.14	Illustrate cubic polynomial fit.	CO 4	Remember
	b	AME553.14	Illustrate cubic polynomial fit.	CO 4	Remember
9	a	AME553.18	Discuss the role of robots in material handling.	CO 5	Remember
	b	AME553.20	Discuss the role of robots in assembly and inspection.	CO 5	Understand
10	a	AME553.17	Illustrate various robot applications in manufacturing.	CO 5	Understand
	b	AME553.18	Discuss the role of robots in material handling.	CO 5	Remember

Signature of Course Coordinator **HOD, ME**