PAPER ID-310880

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM V) THEORY EXAMINATION 2023-24
ROBOTICS

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2x10 = 20**

Qno	Questions	Marks	CO
(a)	What is meant by robot anatomy?	2	1
(b)	Classify the word Manipulator.	2	1
(c)	Write Asimov's laws of robotics?	2	2
(d)	What are the types of automation?	2	2
(e)	Define the term power to weight ratio in robotics.	2	3
(f)	What is repeatability of robot?	2	3
(g)	What is meant by work envelop?	2	4
(h)	What is meant by pay load capacity of robot?	2	4
(i)	Discuss the applications of Tactile sensors.	2	5
(j)	Describe the PUMA robot configuration.	2	5

SECTION B

2. Attempt any *three* of the following: **10x3 = 30**

(a)	Define a robot. With help of sketch describe pitch, yaw and roll motion of a robot wrist.	10	1
(b)	Frame {2} is rotated w.r.t frame {1} about X axis by an angle of 60°. Position of origin frame {2} as seen from frame {1} is $D_2^1 = [3.0\ 2.0\ 2.0]^T$ obtain the transformation matrix T_2^1 which describes frame {2} relative to frame {1}. Find description of point P in frame{1} if $P^2 = [3\ 7\ 2]^T$	10	2
(c)	What are the various types of joints used in robots? Sketch the following robots indicating the joints and degree of freedom. i) SCARA robot. ii) Gantry robot.	10	3
(d)	Sketch and explain the four basic robot configurations classified according to the coordinate system.	10	4
(e)	What are the advantages of hydraulic actuator systems over electrical motors? Sketch and explain a pneumatic power drive used for robots.	10	5

SECTION C

3. Attempt any *one* part of the following: **10x1 = 10**

(a)	Validate given two points $a_{uvw} = (2, 1, 2)^T$ with respect to the rotated OUVW coordinate system, determine the corresponding point a_{xyz} with respect to the reference coordinate system if it has been rotated 45° about the OZ axis followed by a rotation of 75° about the OY axis.	10	1
(b)	Differentiate hard automation and flexible automation with neat and clean diagram.	10	1

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4. Attempt any *one* part of the following: 10x1 = 10

(a)	Illustrate the role of sensor. What are the different classifications of sensor? Discuss about the different functions of sensor in industry.	10	2
(b)	What are the basic components of Robot? Explain them briefly with sketch	10	2

5. Attempt any *one* part of the following: 10x1 = 10

(a)	Explore Denavit and Hartenberg criterion in detail.	10	3
(b)	What is robot vision? Describe a vision sensor used to take the image of an object.	10	3

6. Attempt any *one* part of the following: 10x1 = 10

(a)	Explore hydraulic, pneumatic and electric actuating systems with neat and clean diagram.	10	4
(b)	Explore using D-H criterion. Assign frames to each joint and find out DH table for given robotic system. Given $\theta_1 = 600°, d_1 = 3, d_2 = 5$ 	10	4

7. Attempt any *one* part of the following: 10x1 = 10

(a)	Discuss about the Gear terminology used in robotics. Explain different types of gear with neat sketch.	10	5
(b)	Distinguish between tactile and non-tactile sensors. Sketch and explain the working of an acoustic sensor.	10	5