

Printed Pages – 4

Roll No. : .....

**337831(37)**

**B. E. (Eighth Semester) Examination, April-May 2021**

**(New Scheme)**

**(Mechanical Engg. Branch)**

**ROBOTICS**

***Time Allowed : Three hours***

***Maximum Marks : 80***

***Minimum Pass Marks : 28***

***Note : Attempt all questions. Part (a) of each question is compulsory. Attempt any two parts from (b), (c) and (d).***

**Unit-I**

1. (a) Write down laws of Robotics. 2
- (b) Write short note on Robot Anatomy. Explain progressive advancement in robots. 7

**337831(37)**

**PTO**

[ 2 ]

- (c) Briefly describe two basic configurations of arm in robotic manipulator. 7
- (d) What are the control issues in robotic control? Explain briefly. 7

### Unit-II

2. (a) What is Mapping? 2
- (b) The coordinates of point  $P$  in frame  $\{1\}$  are  $\{3.0 \ 2.0 \ 1.0\}^T$ . The position vector  $P$  is rotated about the  $z$ -axis by  $45^\circ$ . Find the coordinate of point  $Q$ , the new position of point  $P$ . 7
- (c) Frame  $\{2\}$  is rotated with respect to frame  $\{1\}$  about the  $x$ -axis by an angle of  $60^\circ$ . The position of the origin of frame  $\{2\}$  as seen from frame  $\{1\}$  is  ${}^1D_2 = [7.0 \ 5.0 \ 7.0]^T$ . Obtain the transformation matrix  ${}^1T_2$ , which describes the frame  $\{2\}$  relative to frame  $\{1\}$ . Also find the description of point  $P$  in frame  $\{1\}$  if  $P = [2.0 \ 4.0 \ 6.0]^T$ . 7
- (d) Derive the fundamental rotation matrices and  $x$ ,  $y$  and  $z$  from rotational transformation matrix. 7

337831(37)

[ 3 ]

### Unit-III

3. (a) What is Forward Kinematics? 2
- (b) Explain Description of Link and Joint in direct Kinematics. 7
- (c) Discuss the mechanical structure and notation for modeling of robots. 7
- (d) Give brief introduction of inverse kinematic model. 7

### Unit-IV

4. (a) What is the meaning of Sensing? 2
- (b) Explain types of sensors in robotics based on their function. 7
- (c) What are the components of robotic vision system? Discuss industrial applications of vision controlled robotic systems. 7
- (d) Explain process of imaging in brief. 7

### Unit-V

337831(37)

PTO

5. (a) What are the possible stages in peg-in-hole mating? 2
- (b) What characteristics an arm welding robotic system must have? 7
- (c) Write short notes on : 7
- (i) Robot safety
  - (ii) Material handling applications of robot
- (d) Explain in brief non-industrial application of robots. 7