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GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, December – 2020

(Seventh Semester)

**BMEPE 7043 – ROBOTICS AND ROBOT APPLICATIONS**

(Mechanical Engineering)

Time: 3 hrs

Maximum: 50 Marks

**The figures in the right hand margin indicate marks.****PART – A: (Multiple Choice Questions)****(1 x 10 = 10 Marks)**

- Q.1. Answer *ALL* questions** [CO#] [PO#]
- a. Robot is derived from Czech word [CO1] [PO1]  
 (i) Rabota (ii) Rebota  
 (iii) Robota (iv) Ribota
- b. The main objective(s) of Industrial robot is to [CO1] [PO1]  
 (i) To minimise the labour requirement (ii) To increase productivity  
 (iii) To enhance the life of production machines (iv) All of the above
- c. Drives are also known as [CO4] [PO1]  
 (i) Controller (ii) Sensors  
 (iii) Manipulator (iv) Actuators
- d. Radial movement (in & out) to the manipulator arm is provided by [CO1] [PO1]  
 (i) Wrist bend (ii) Wrist swivel  
 (iii) Wrist yaw (iv) Elbow extension
- e. Industrial Robots are generally designed to carry which of the following [CO2] [PO1]  
 coordinate system(s).  
 (i) Cartesian coordinate systems (ii) Polar coordinate systems  
 (iii) Cylindrical coordinate system (iv) All of the above
- f. The Robot designed with Polar coordinate systems has [CO1] [PO1]  
 (i) Three linear movements (ii) Three rotational movements  
 (iii) Two linear and one rotational movement (iv) Two rotational and one linear movement
- g. \_\_\_\_\_ drive is used for lighter class of Robot [CO4] [PO1]  
 (i) Pneumatic drive (ii) Hydraulic drive  
 (iii) Electric drive (iv) All of the above
- h. Internal state sensors are used for measuring \_\_\_\_\_ of the end effector [CO4] [PO1]  
 (i) Position (ii) Position & Velocity  
 (iii) Velocity & Acceleration (iv) Position, Velocity & Acceleration
- i. \_\_\_\_\_ is not a programming language for computer controlled robot? [CO3] [PO1]  
 (i) VAL (ii) RAIL  
 (iii) HELP (iv) AMU
- j. \_\_\_\_\_ is not one of the advantages associated with a robotics [CO4] [PO1]  
 implementation program?  
 (i) Robots work continuously around the clock (ii) Quality of manufactured goods can be improved  
 (iii) Low costs for hardware and software (iv) Reduced company cost for worker fringe benefits

**PART – B: (Short Answer Questions)**

**(2 x 5 = 10 Marks)**

Q.2. Answer ALL questions

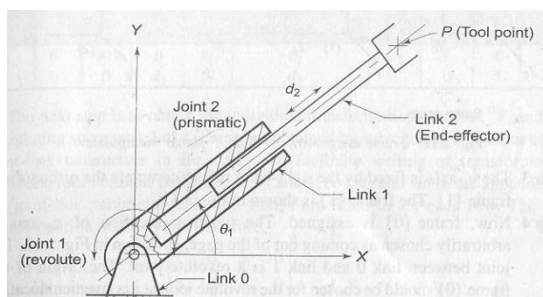
	[CO#]	[PO#]
a. Differentiate CAD/CAM and robotics	CO1	PO1
b. How many DOFs are required to position and orientation of an end effector at any point in 3-D space?	CO1	PO1
c. What is homogenous transformation matrix?	CO2	PO1
d. What are the different types of actuators used for robots?	CO4	PO1
e. State the situation when you will prefer Newton-Euler and when you will prefer Lagrange Euler formulation.	CO3	PO1

**PART – C: (Long Answer Questions)**

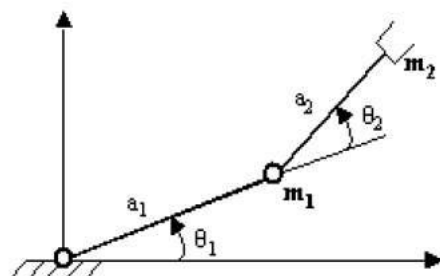
**(6 x 5 = 30 Marks)**

Answer ANY FIVE questions

	Marks	[CO#]	[PO#]
3. With a neat sketch explain the three degrees of freedom associated with the robot wrist	(6)	CO1	PO1
4. Discuss in detail the selection and design considerations of grippers in robot	(6)	CO1	PO1
5. For the point [3, 7, 5] perform the following operations: a) Rotate 30° about X-axis b) Translate 8 units along y-axis c) Rotate 30° about x then translate 6 units along Y- axis. d) Rotate 90° about z-axis.	(6)	CO2	PO1
6. Obtain the position and orientation of tool point 'P'	(6)	CO2	PO1 PO2



7. Determine the dynamic equations for the two-link manipulator shown in Figure, using Lagrange-Euler formulation. Assume that the whole mass of the link can be considered as a point mass located at the outermost end of each link. The masses are $m_1$ and $m_2$ and the link lengths are $a_1$ and $a_2$ .	(6)	CO3	PO1 PO2
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8. Determine the manipulator jacobian matrix and singularities for the 3-DOF articulated arm	(6)	CO3	PO1,2
9. How do you classify Tactile sensor? Explain them briefly with neat sketch	(6)	CO4	PO1
10. Discuss the performance characteristics of actuators. Compare electrical, pneumatic and hydraulic actuators for their characteristics	(6)	CO4	PO 1

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