

B.E./B.TECH. Degree Examination, December 2020

Fifth Semester

EE16010-Robotics and Automation

(Regulation 2016)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions**PART A - (8 X 2 = 16 marks)**

1. Spatial manipulators with more than _____ number of DOF are known as Redundant manipulators.

(a) 4	(c) 6
(b) 5	(d) None of the above
2. Basic resolution of incremental encoder if disc have 1500 number of sectors is

(a) 0.12 degrees	(c) 0.24 degrees = 360 deg/1500
(b) 0.48 degrees	(d) None of the above
3. Magnetic grippers

(a) cannot handle metal parts with any holes	(c) requires only one surface for gripping
(b) picks up only single object from its stack	(d) residual magnetism doesn't play any major role
4. If position and orientation of end effector are derived from the given joint angles and link parameters, the scheme is called

(a) robot statics	(c) robot dynamics
(b) robot forward kinematics	(d) robot forward kinematics
5. Relate configuration and degrees of freedom with workspace of a manipulator.
6. Distinguish incremental encoder and absolute encoder.
7. Identify any four applications in such a way to cite the usage of gripper and tool.
8. For the vector $v = 18i + 5j + 16k$, perform a translation by a distance of 6 in the x direction, 4 in the y direction, 0 in the z direction to get translated vector.

PART B - (4 X16 = 64 marks)

09. (a) Choose any application and show the importance of resolution, accuracy and repeatability with diagrams. **(16)**

(OR)

- (b) Identify any industrial applications to apply the four basic robot configurations and demonstrate with neat diagram. **(16)**

10. Apply the different stages involved in machine vision system in any of current trend application. (16)

(OR)

- (b) (i) Choose any one sensor each for touch sensor and tactile array sensor and explain their principle of operation with supporting diagrams. (12)
- (ii) Also distinguish touch sensor and tactile array sensor. (4)

11. (a) (i) Derive dynamic equation of motion from Newton-Euler formulation. (12)
- (ii) Compare advantages and disadvantages of electronic and pneumatic controllers usable for robotic movements. (4)

(OR)

- (b) (i) List out the possible types of mechanical grippers based on gripper mechanisms to activate finger movements and explain them with support of diagrams. (12)
- (ii) You, as a design engineer, list out the consideration in gripper selection and about its design. (4)

12. (a) (i) Choose any suitable approach to solve an inverse kinematic problem and its equations. (10)
- (ii) Justify the applicability of hill climbing techniques to robotics. (6)

(OR)

- (b) (i) Relate the mathematical Jacobian matrix to the work envelope of manipulators and explain in detail. (8)
- (ii) Among teach pendant and lead through programming, choose a correct choice for drilling with precise dimension at four corners of metal sheets that run on a moving track and Justify your choice in detail. (8)