

B.E. DEGREE EXAMINATIONS: APRIL / MAY 2010

Sixth Semester

MECHANICAL ENGINEERING

U07ME605: Industrial Robotics

Time: Three Hours

Maximum Marks: 100

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. In the type of _____ joint the axis of rotation is perpendicular to the to the axes of two connecting links
a) Linear joint b) Rotating joint c) Twisting joint d) Revolving joint
2. What is the work volume for a polar coordinate robot
a) Partial sphere b) Parallelogram jointed c) Cubical d) Spherical
3. What is the type of drive system used in Unimate 2000 series
a) Hydraulic drive b) Pneumatic drive c) Electric drive d) All
4. What is the type of gripper used to lift car glass panels
a) Adhesive gripper b) Mechanical gripper c) Vacuum gripper d) Magnetic gripper
5. Name the analog device whose output is proportional to the angle of rotating element with respect to the fixed element.
a) Tachometer b) Potentiometer c) Encoder d) Resolver
6. _____ is used to provide a parallel beam of light on the subject during image capturing.
a) Condenser Projector b) Collimator c) Imager d) Spot projector.
7. In robot kinematic analysis the origin of the Cartesian axis system is often located in
a) World space b) Joint space c) Robot's base d) End effector base
8. VAL stands for
a) Visual Assisted Language b) Victory Assembly Language
c) Visual Automated Language d) Victor's Assembly language
9. EUAC stands for
a) Equivalent Uniform Annual Cost b) Equivalent Union Annual Cost
c) Equivalent Unit Audit Cost d) Equalized Uniform Arbitrary Cost
10. A _____ device located on the teach pendant which requires active pressure to be applied to the device in order to drive the robot manipulator.
a) Panic button b) Fail safe hazard detector c) Dead man switch d) Emergency stop switch.

PART B (10 x 2 = 20 Marks)

11. Define Industrial Robot as per RIA
12. What is accuracy of robot?
13. What is an End effector?
14. What are the advantages of Stepper motor?
15. What are the desirable features of sensors used in a robot?
16. For an image digitized at 128 points per line and 128 lines, determine the total number of bits to represent the gray level values required if an 8 bit A/D converter is used to indicate various shades of gray.
17. For a vector $v = 5i + 3j + 8k$. Perform a rotation transformation by an angle of 90° about the X axis.
18. What are the two types of lead through programming methods?
19. What are the three levels of safety sensor systems in robotics?
20. List the general characteristics that will usually make a potential robot application technically practicable and economically feasible.

PART C (5 x 14 = 70 Marks)

21. (a) Explain in detail about the various industrial robot configurations.
(OR)
(b) (i) With a suitable sketch explain the various degrees of freedom associated with a robot wrist. (7)
(ii) Describe the various types of controls used in commercially available industrial robot. (7)
22. (a) (i) Explain in detail about stepper motor. (7)
(ii) Explain the two modes of operation of a DC servo motor along with the transfer functions. (7)
(OR)
(b) (i) Explain the various factors defined by Engelberger in assessing gripping requirements. (7)
(ii) How mechanical grippers can be classified according to the type of kinematic device used to actuate finger movement? Explain any two with suitable sketch. (7)
23. (a) (i) Discuss in detail about rotary optical encoder (7)
(ii) Explain proximity and range sensors in detail. (7)

(OR)

(b) Enumerate the various techniques used in Image data analysis.

24. (a) (i) Explain Forward transformation and Reverse transformation of a 2 Degree of Freedom arm, shown in figure 1. (7)

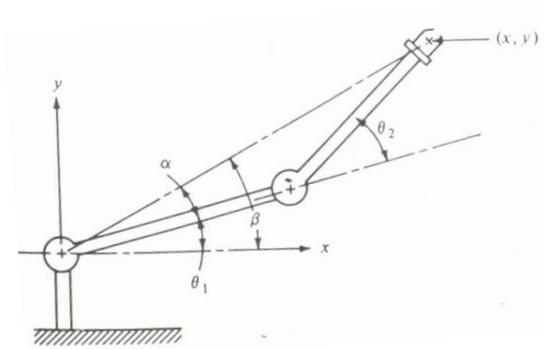


Figure 1

- (ii) Derive Denavit Hartenberg Matrix. (7)

(OR)

- (b) (i) Explain in detail about the robot language structure. (7)
(ii) Explain end effector and sensor commands with suitable examples. (7)

25. (a) (i) A company producing automotive components mostly by manual labor and is considering to replace it by a new robot. There are two alternative robot models 'M' and 'N' suitable for the purpose. The details of the robot models are given in the table below. Ignore taxation. Determine the pay back period of each robot and determine which model can be purchased based on pay back period. (7)

	Robot 'M'	Robot 'N'
Estimated life of robot	4 Years	5 years
Cost of robot	Rs.9000	Rs.18000
Estimated saving in scrap	Rs.500	Rs.800
Estimated saving in direct wages	Rs.6000	Rs.8000
Additional cost for maintenance	Rs.800	Rs.1000
Additional cost for supervision	Rs.1200	Rs.1800

- (ii) A company wish to purchase a robot for its fabrication shop. The cost of the robot is Rs 60000 and has a scrap value of Rs. 20000. The cash inflow before depreciation and tax for the next five years has been forecasted and shown in table

below. If the tax rate is 50% and the depreciation is based on straight line method, determine ARR for the project proposal. (7)

Year	1	2	3	4	5
Cash flow	12000	13000	15000	17000	22000

(OR)

(b) Enumerate the logical sequence of steps to be followed by a company to implement robotics in its operations.
