

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Ph.D Course work Examination November 2020

03 ME 6482 PRINCIPLES OF ROBOTICS AND APPLICATIONS

Duration: 3 Hours

Max. Marks: 60

(Answer all Questions)

PART A

(4x5=20 Marks)

- I. Write short notes on velocity sensors used in robots.
- II. Differentiate between the use of tools and grippers as end effectors in a robot arm with its applications
- III. Explain the generations in robot programming languages.
- IV. Identify the elements of cost in an industrial robot installation and explain the concept of payback period.

PART B

- V. A.) A stepper motor is used to drive a linear axis of a robot. The joint advances 5 mm in one rotation. The control resolution of the axis is 1mm. (a) to achieve this control resolution how many step angles are required for the stepper motor? (b) What is the corresponding step angle? (c) Determine the pulse rate that will be required to drive the joint at a velocity of 10 cm/sec. (7)

OR

- B.) Explain the importance of resolution of an optical encoder. Determine the resolution of an encoder with 12 tracks. (7)

- VI. A) It is desired to design a robot for material handling applications in a manufacturing plant. Suggest two suitable mechanical type grippers. Explain them with sketches and show the forces acting on them. (13)

OR

- B) i) Illustrate the procedure used to determine the distance of object from a robot using an optical sensor. (7)

- ii) A continuous video voltage signal is to be converted into a discrete signal. The range of the signal after amplification is 0 to 7 V. The A/D converter has an 8 bit

capacity. Determine the number of quantization levels, the quantization level spacing, the resolution and the quantization error. (6)

- VII. A) Consider a two axis servo controlled Cartesian robot with eight addressable points for each axis. Plot the robot workspace. Show the path taken by the robot if it is directed to move between the following sets of points in the grid using linear interpolation:
- (i) Point (1,1) and point (8,3)
 - (ii) Point (2,2) and point (7,5) (7)

OR

B). Explain the concept of branching in robot programming with a suitable example. (7)

- VIII. A) i) Explain the processing applications of a robot with any two applications. (8)
ii) Economic details about a robot installation are shown in the table.

| Sl No | Particulars | Amount (Rs) |
|-------|------------------------------|-------------|
| 1 | Cost of installation | 60,00,000 |
| 2 | Annual Labour cost | 11,00,000 |
| 3 | Annual maintenance cost | 2,50,000 |
| 4 | Cost of utilities per year | 1,00,000 |
| 5 | Anticipated revenue per year | 36,00,000 |

Calculate the payback period if interest of investment is 10 % per annum. (5)

OR

- B) i) Explain about any two future applications of robot. (6)
ii) A robot is installed in a welding shop. Identify the elements of cost associated with the installation. Classify the cost. (7)