

BACHELOR OF VOCATION
Robotics and Automation
Subject: Robotic Design and Control
Subject Code: DBME-305
Semester: Fifth
January 2021
Theory (External): 35 Marks
Time: 03 Hours

Instructions to the Students

1. This Question paper consists of two Sections. All sections are compulsory.
2. Section A comprises 10 questions of objective type in nature. All questions are compulsory. Each question carries 1 mark.
3. Section B comprises 8 essay type questions out of which students need to do any 5. Each question carries 5 marks.
4. Read the questions carefully and write the answers in the answer sheets provided.
5. Do not write anything on the question paper.
6. Wherever necessary, the diagram drawn should be neat and properly labelled

Roll Number									

SECTION –A (SHORT/OBJECTIVE TYPE QUESTIONS)

(10x1=10 Marks)

- A. What are manipulators.
- B. What is a coordinate system?
- C. What are higher order derivatives of position variables.
- D. Define 3D Cartesian space.
- E. Why is force control of a manipulator important?
- F. What is a robot programming language?
- G. How will we represent a point P using a vector \hat{P} in 3D coordinate system [A] diagrammatically.
- H. Represent a unit vector giving the principal directions of coordinate system [B] in terms of coordinate system [A].
- I. Write the equation for model based portion of control system.
- J. Which type of control is used to adjust servo errors in model based control law.



SECTION – B (ESSAY TYPE QUESTIONS)

(5×5 = 25 Marks)

1. A linear system is represented by $\dot{X} = AX + Bu$, where u is the forcing input. When the system is unforced, u becomes zero and the system is represented by $\dot{X} = AX$. Check whether the system is stable or not.
2. Design a control system for the system
 $f = 5x\dot{x} + 2\ddot{x} - 12$.
3. The gripper of an end – effector holding a bolt head, with the shank hanging vertically downward, has to insert it into a threaded hole whose axis is parallel to the axis of the bolt but offset by some distance. Describe the subtasks involved in this operation.
4. Explain the linear and angular acceleration in manipulator dynamics.
5. Draw and explain high level block diagram of a robot-control system.
6. Discuss the properties of dynamic model of Robotics systems.
7. Explain the position control system of robot with neat diagrams.
8. What is a frame. How will you describe a frame?

END OF PAPER