

M.E. ELECTRICAL ENGINEERING FIRST YEAR SECOND SEMESTER - 2025
ROBOTICS AND MECHATRONICS ENGINEERING

Time : Three hours

Full Marks : 100

Answer Any Five Questions.

Answer all parts of a question in the sequential order.

1.a) Write down appropriate definition of “mechatronics”. Hence, give real-life example of few mechatronic devices.

b) What are the basic building blocks of a generic mechatronic system that is intended to operate in automatic mode? Give your answer with suitable block diagram and then briefly describe their functionality.

[(3+3)+(4+10)=20]

2. a) What factors should be considered while selecting an actuator for a particular mechatronic design?

b) Write a brief note on hydraulic actuator in mechatronic applications.

c) What is the role of the actuator drivers in mechatronic applications?

[7+8+5=20]

3. a) What are the different factors that should be considered for the selection of appropriate sensors during the mechatronic design?

b) What are the basic motion sensors in mechatronics?

c) Write a brief note on the application of vision sensors in mechatronics.

[8+6+6=20]

4. Explain with suitable diagrams, the various aspects of the computer interfacing circuit design for a mechatronic system. State the assumptions, if any.

[20]

[Turn over

5. a) Explain the forward kinematics and inverse kinematics solution of robotic systems. How are they utilized to perform mechatronic design of robotic systems?

b) Derive the kinematic equation of motion of a serial link manipulator in terms of homogeneous transformation matrices.

[6+14=20]

6. What type of dynamic response is expected from a robotic system? – give your justification. Hence design such a control law for position control of robot manipulator employing the feedback linearization principle.

[5+15=20]

7. Describe the various steps for smooth trajectory planning of industrial manipulator traversing through obstacles employing cubic polynomials.

[20]

8. Write short note **on any two** from the following:

[10x2=20]

- a) Merits and demerits of employing pneumatic actuators in mechatronics.
- b) Role of software in mechatronics.
- c) Role of mechatronics in Robotics.
- d) Electric powered actuators in mechatronics.