Instructions: (1) All Questions are compulsory.
(2) Answer each next main Question on a new page.
(3) Illustrate your answers with neat sketches wherever necessary.
(4) Figures to the right indicate full marks.
(5) Assume suitable data, if necessary.
(6) Use of Non-programmable Electronic Pocket Calculator is permissible.
(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
(8) Use of Steam tables, logarithmic, Mollier’s chart is permitted.

Marks

1. Attempt any FIVE:
   (a) Draw block diagram of mechatronic system and explain the key elements of mechatronics system.
   (b) Define: (i) Sensor (ii) Transducer with examples of each.
   (c) List any four advantages of mechatronic system.
   (d) State and elaborate the importance of mechatronics in various field of engineering.
   (e) Draw and explain the block diagram of fuzzy logic controller.
   (f) List the types of belt and give one application of each.
   (g) Explain in brief Spherical Robot. Why it is called as spherical robot?

2. Attempt any FOUR:
   (a) List any four applications of Hall Effect Sensor.
   (b) Draw practical ABS system. List any four advantages of it.
   (c) Draw and explain MEMS microactuator.
   (d) Draw PI controller using Op-Amp and explain in brief.
   (e) Draw block diagram of pneumatic system. What is the role of filter in pneumatic system?
   (f) Draw and explain the working principle of Inductive and Capacitive sensor.
3. **Attempt any FOUR :**
   (a) Draw block diagram of pick and place Robot. List the required movements of it.
   (b) Draw and explain pneumatic PID controller.
   (c) State the types of Actuators. Draw and explain single acting cylinder.
   (d) How MEMS accelerometer is used as air bag sensors for car safety? Describe in brief.
   (e) Define degree of freedom. What is the significance of degree of freedom in robot?
   (f) Draw schematic of PLC based automatic car park barrier system.

4. **Attempt any FOUR :**
   (a) Explain CNC drilling machine with neat diagram.
   (b) How Torque is calculated using Torsion-bar torque transducer? Explain.
   (c) Draw and explain DC motor speed control using microcontroller.
   (d) List out the types of gears & give their applications. (One each)
   (e) State any four applications of stepper motor.
   (f) Draw and explain the PLC ladder diagram for ON-OFF control of lamp.

5. **Attempt any FOUR :**
   (a) How the piezoelectric effect is used to measure acceleration? List the features of piezoelectric accelerometer.
   (b) State the functions of (1) Isolators (2) Filters (3) Amplifiers and (4) Data converters in Mechatronic system.
   (c) List the advantages of PLC based car parking system. (Any four)
   (d) Draw block diagram of Robot system. List functions of an end effector.
   (e) With neat block diagram explain the various components of MEMS.
   (f) Draw and explain Gear type rotary actuator.

6. **Attempt any FOUR :**
   (a) Explain the implementation of proportional type hydraulic controller.
   (b) Compare pneumatic and hydraulic system (four points).
   (c) Draw and explain LVDT accelerometer.
   (d) List various photoelectric sensors. Explain any one of them in detail.
   (e) Explain fuzzy logic control in fully automatic washing machine.
   (f) Explain the working principle of solenoid valve. List the applications of solenoid valve.