Instructions: (1) All questions are compulsory.
(2) Answer each next main Question on a new page.
(3) Figures to the right indicate full marks.
(4) Assume suitable data, if necessary.

1. Attempt any five:
   1) Draw block diagram of mechatronics system and explain the key elements of mechatronics system. 4
   2) Distinguish between a transducer and a sensor. (any four point) 4
   3) Give advantages and disadvantages of electronic controller. 4
   4) Explain implementation of proportional hydraulic controller. 4
   5) State applications of rack and pinion. 4
   6) List any four application of robot. 4
   7) Give the block diagram of CNC based drilling machine. 4

2. Attempt any four:
   a) What is “mechatronics”? State its importance in engineering with suitable example. 4
   b) What is the significance of signal conditioner? 4
   c) Draw block diagram of pneumatic system. What is the role of filter in pneumatic system? 4
   d) State the working principle of ‘solenoid valve’ with neat sketch. 4
   e) Draw and explain MEMS microactuator. 4
   f) Describe the working of PLC based automatic carport barrier system with block diagram. 4

3. Attempt any four:
   a) Draw block diagram of pick and place robot. List the required movement of it. 4
   b) Draw and explain electronics PID controller. 4
   c) State the types of actuators. Draw and explain single acting cylinder. 4
   d) How MEMS accelerometer is used as air bag sensors for car safety? Describe in brief. 4
   e) Draw and explain fuzzy logic controller. 4
   f) Explain microcontroller based antilock brake system. 4

Marks

20

P.T.O.
4. Attempt any two of the following:
   a) Explain with sketch torque measurement using
      i) stroboscope method
      ii) capacitive method.
   b) Describe with sketch basic details of
      i) poppet valve
      ii) shuttle valve.
   c) Draw construction of Cartesian and cylindrical robots and explain briefly their degree of freedoms.

5. Attempt any four:
   a) Draw and explain PLC ladder diagram of ON-OFF control of lamp.
   b) How the piezoelectric effect is used to measure acceleration? List the features of piezoelectric accelerometer.
   c) Draw and explain gear type rotary actuator.
   d) State the characteristics of PD and PI controller with their control equation.
   e) Write note on evolution of mechatronics.
   f) State function of
      i) Isolator
      ii) Filter
      iii) Amplifier
      iv) Data convertor in mechatronics system.

6. Attempt any four:
   a) Compare pneumatic and hydraulic system (4 point).
   b) Draw and explain LVDT accelerometer.
   c) Explain hall effect proximity sensor with diagram.
   d) Describe the principle of operation of DC motor.
   e) Give general configuration of CNC system. Give advantages of CNC (any two).
   f) Draw and explain block diagram of Robot.