Unit-I

Mechatronics, Sensors and Transducers

1. *Define the term "Mechatronics" and give four examples of mechatronic systems.*
2. Enumerate and define the elements of a control system.
3. How are control systems classified?
4. What is an 'open-loop' control system?
5. State the advantages and disadvantages of open-loop control system.
6. What is 'closed-loop' control system?
7. State the advantages and limitations of a closed-loop control system.
8. What is an 'automatic control system'? What are its advantages and limitations?
9. What is a block diagram?
10. *Explain briefly a 'pneumatic control system'. State its advantages and disadvantages.*
11. Describe briefly a 'hydraulic control system'. State its advantages and disadvantages.
12. What is transducer?
13. What are the advantages of electromechanical transducers?
14. *Explain briefly with diagrams important transducer actuating mechanisms.*
15. Give the classification of variable inductance transducers.
16. What is the principle on which a capacitive transducer works?
17. What are the advantages, disadvantages and applications of capacitive transducers?
18. What is a piezo-electric transducer? List the advantages and disadvantages of piezo-electric transducers.
19. Explain briefly the following:
    (i). Photo emissive cell
    (ii). Photoconductive cell
    (iii). Photovoltaic cell.
20. What is a strain gauge?
21. What is a tactile sensor? How does it work?
22. What are smart sensors?
23. *What are digital encoders? Explain magnetic type encoder briefly.*
24. What factors need to be considered for selecting a sensor for a particular application?
25. What is a load cell?
26. Explain briefly the different types of light sensors.

Unit-II

Actuators

1. What is an 'actuator'? List the various types of actuators.
2. What are the advantages and disadvantages of toothed gearing?
3. *What is a 'bearing'? How are bearings classified?*
4. What is an 'electrical actuator'?
5. What are the mechanical switches? Explain.
6. *Explain briefly any two of the following solid-state devices which can be used to electronically switch circuits:*
   (i). Diodes   (ii). Thyristors   (iii). Bipolar Junction Transistors (iv). Power MOSFETs
7. State the advantages and applications of stepper motor.
8. What are servo-motors? Explain briefly.
9. Explain briefly the working of following mechanical switching devices:
   (i). Solenoids   (ii). Relays

10. What is an 'hydraulic actuator'?
11. What are the advantages and disadvantages of hydraulic system?
12. What are the components of an hydraulic system? Explain.
13. How are hydraulic pumps classified?
14. Describe briefly a pressure regulator.
15. What are hydraulic valves? How are these classified?
16. What is fluid power / hydraulic cylinder? Explain briefly
17. How are hydraulic cylinders classified?
18. What are the applications of hydraulic cylinders?
19. List some common cylinder problems.
20. What is an 'hydraulic motor'?
21. State the advantages and applications of hydraulic motors.
22. Give the comparison between pneumatic systems and hydraulic systems.
23. Explain with the help of a neat diagram the components of a pneumatic system.
24. Enumerate various types of pneumatic valves.
25. What is the function of a pneumatic cylinder?
26. How are pneumatic cylinders classified?
27. What is the function of an air motor?
28. Name the various types of air motors.
29. What are the special features which pneumatic actuators should possess?
30. List the applications of air motors.

Unit-III

System Models and Controllers

1. Explain briefly the following basic building blocks of a mechanical system: (i). Springs; (ii). Dashpots; (iii). Masses.
2. Enumerate an explain briefly the three building blocks of a rotational system.
3. Explain briefly the following building blocks of an electrical system: (i). Resistors; (ii). Inductors; (iii). Capacitors.
4. How can Kirchhoff's laws be used for combining building blocks of an electrical system? Explain briefly.
5. Discuss briefly the various fluid systems building blocks.
6. What is a hydraulic inertance? Explain briefly.
7. What is a pneumatic inertance? Explain briefly.
8. Explain briefly building up models for the following systems: (i). Mechanical system; (ii). Hydraulic system; (iii). Pneumatic system.
9. Explain briefly the following thermal system building blocks: (i). Resistance; (ii). Capacitance.
10. How is the model for a thermal system built up? Explain.
11. Explain briefly the following: (i). Rotational-translational systems; (ii). Electromechanical systems; (iii). Hydro-mechanical systems.
12. Explain briefly any two of the control modes: (i). Two-step mode; (ii). Proportional mode (P); (iii). Derivative mode (D).
13. Discuss briefly the following controllers: (i). PI controllers; (ii). PD controllers; (iii). PID controllers.
14. What are digital controllers? Explain briefly.
15. What are the advantages of microprocessors as controllers over analog controllers?
16. Discuss briefly 'Adaptive control system'.

Unit-IV

Microprocessors And Programmable Peripheral Interface

1. Draw and explain the internal architecture of 8085 microprocessor?
2. What do you mean by Flag register? What are all the flags available in 8085 microprocessor? Explain.
3. Draw and explain the PIN details of 8085 IC.
4. What are the types of instructions that can be executed by the microprocessor 8085?
5. Explain the four instructions given below: i). MOV rd, rs   ii). LDA addr.   iii). XCHG   iv). LHLD addr.
6. Explain the four instructions given below: i). ADD M   ii). ACI data(8)   iii). SBB r   iv). DAA
7. Explain the four instructions given below: i). DCR r   ii). JMP   iii). JZ data(16)   iv). CM data(16)
8. Explain the four instructions given below: i). CMP M   ii). ANI data(8)   iii). ORA r   iv). RAR
9. Explain the four instructions given below: i). CMC   ii). NOP   iii). HLT   iv). EI
10. Discuss the various types of addressing modes of 8085 microprocessor.
11. Explain the concept of 8051 microcontroller with a neat block diagram.
12. Draw and explain the architecture of PPI 8255 IC.
13. Explain the concept of identifying a pressed key in a 4X4 matrix keyboard which has been interfaced with the microcontroller.
14. Explain in detail about the interfacing of seven segment LED display with the microcontroller 8051.
15. Draw a neat sketch of interfacing diagram of Analog to Digital converter (ADC) with the microcontroller and explain.
16. Draw a neat sketch of interfacing diagram of Digital to Analog converter (DAC) with the microcontroller and explain.
17. Explain any one of the following interfacing techniques used for a specific purpose:
    i.   Temperature control
    ii.   Stepper motor control
    iii.   Traffic control

Unit-V
Programmable Logic Controller and Mechatronic Systems

1. What are programmable logic controllers (PLCs)?
2. What are the advantages of PLCs?
3. State the special features of PLCs.
4. Explain briefly with a neat diagram, the basic structure of a programmable logic controller (PLC).
5. Explain briefly the programming of a PLC.
6. What are all the criteria that must be considered for the proper selection of a PLC.
7. Discuss briefly any two of the following mechatronic systems:
    i.   Engine management system
    ii.   Automatic camera
    iii.   Automatic washing machine
    iv.   Uninterruptible power supply.