Question Paper Code : **Q 2781**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Seventh Semester

Electronics and Instrumentation Engineering

MH 1031 — MECHATRONICS

(Common to Instrumentation and Control Engineering)

(Regulation 2004)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Mechatronics system and sketch the graphical representation of Mechatronics system.

2. What are the stages in designing a mechatronics system?

3. Suggest a sensor that could be used for a furnace to monitor the rate at which the heating oil flows along a pipe. The output from the measurement system is to be an electrical signal which can be used to adjust the speed of the oil pump.

4. What is the role of signal processing in a mechatronics set up?

5. If a stepper motor has a step angle of 6.5°, what digital input rate is required to produce a rotation of 15 rev/s?

6. What is meant by hydraulic resistance and pneumatic capacitance?

7. Device a PLC timing circuit that will switch an output on for 20 seconds and then switch it off.

8. What happens when DAA instruction is executed in 8085 microprocessor?

9. How does a microcontroller differ from a microprocessor?

10. Enumerate the different mechatronics systems used in automobiles.

Q 2778

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the various elements of a closed loop control system with an example of speed control of a shaft. (8)

    (ii) Compare the traditional approach and Mechatronic approach to process control and manufacturing. (8)

Or

    (b) (i) Identify the various elements of a closed-loop control system in an automatic domestic washing machine and describe their functions. (8)

    (ii) How has Mechatronics discipline been evolved? Briefly explain the evolution stages. (8)

12. (a) A CNC lathe is fitted with motion and position control sensors for spindle motion and tool position detection. A force sensor for the measurement of cutting force is mounted on the tool. Explain the type of sensors used and discuss any one type of sensor. (6 + 10)

Or

    (b) (i) Explain an incremental (optical) encoder. What are their applications? (8)

    (ii) Discuss with a neat sketch, the principle and working of LVDT and Pyroelectric sensors. (8)

13. (a) (i) Explain the specification and working of a stepper motor with an aid of a sketch. (8)

    (ii) Discuss the working of the following actuation systems : (2 × 4)

        (1) Self-excited wound field shunt DC motor.

        (2) Hydraulic actuator.

Or

    (b) (i) Describe the working principle of ball and journal bearings with near sketches. (8)

    (ii) Discuss the working of a pneumatic actuator with a neat diagram. (8)

Q 2781

14. (a) (i) Sketch a ladder diagram and explain for temperature alarm. Alarm has to be sounded if a sensor indicates a temperature above 80 and remain sounding until the temperature falls below 60. (8)

(ii) Briefly explain how arithmetic and code conversion operation is executed in PLC. (8)

Or

(b) (i) Discuss the various requirements for development of interfaces in mechatronics devices. (8)

(ii) Write a note on PID controller used in PLC. (8)

15. (a) Discuss the features of a mechatronic based car engine management system with necessary sketch. (16)

Or

(b) Design a 3-axes pick and place robot as a mechatronics device. Discuss the various issues associated with this device. (16)

3