Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 91668

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Seventh Semester

Mechanical Engineering

ME 2401/ME 71/ME 1402/10122 ME 702 — MECHATRONICS

(Common to Production Engineering)

(Regulation 2008/2010)

(Common to PTME 2401/10122 ME 702 – Mechatronics for B.E. (Part-Time) Fifth Semester Mechanical Engineering – Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What do you understand by the term static and dynamic characteristics of transducers?

2. Difference between absolute encoder and incremental encoder.

3. Write down any four primary functions of mechanical actuation systems.

4. What are the factors to be considered for selecting solenoids?

5. Write the values of the voltage across the building blocks of an electrical system.

6. What are the classifications of composite mode electronic controllers?

7. List down the input and output modules interface.

8. What are the logic functions that can be obtained by using switches in series?

9. Write the basic steps of the program to run a stepper motor.

10. Compare traditional and mechatronics approaches of engine management system.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the relationship between temperature and resistance for the RTD with temperature resistance curve. What are the advantages and disadvantages of RTDs? (10)

(ii) Explain the functions of a capacitive sensor in a robot end effector. (6)

Or

(b) (i) Write short notes on :

(1) Photovoltaic transducer

(2) Incremental encodes. (8)

(ii) Explain the control system for the domestic central heating system involving a bimetallic thermostat and that involving a microprocessor. (8)

12. (a) (i) An equal percentage plug process control valve is used to control the fluid flow in the system. The pneumatic diaphragm actuator used in the system has a stem movement of 50 mm at its full travel. The valve element has a minimum and maximum flow rate of 0.3 and $5.0 m^3 / s$ respectively. Calculate the rate of flow when the stem movement is

(1) 15 mm

(2) 25 mm. (6)

(ii) Discuss about the following actuation systems :

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

(2) Self-excited wound field series configuration DC motor. (10)

Or

(b) (i) Difference between SCR and TRIAC. (4)

(ii) What is a stepper motor? Explain the working principles of stepper motor in half step mode. (12)

13. (a) (i) What are the types of basic control modes? Explain the control system performance for a system with proportional control and a system with integral control (8)

(ii) Derive the mathematical model for the wheel and its suspension for a car or truck and can be used for the study of the behaviour that could be expected of the vehicle when driven over the rough road. (4)

(iii) Compare 1's complement and 2's complement of numbers. (4)

Or

(b) (i) Derive the differential equation governing the mechanical system of an electric motor. (8)

(ii) Derive the equation for a translational mechanical system model with spring and mass. (4)

(iii) What are the advantages and disadvantages of open loop system? (4)

14. (a) (i) Create a ladder diagram for the following application : A pneumatic system with double solenoid valve controls two double acting cylinders A and B. The sequence of cylinder operations are as follows : Cylinder A extends followed by cylinder B extending, then the cylinder B retracts and finally the cycle is completed by the cylinder A retracting. Explain the logic of the PLC circuit used. (8)

(ii) Draw delay ON and delay OFF timer ladder diagrams. (4)

(iii) Explain latching with ladder diagram. (4)

Or

(b) (i) Explain in detail about jump control used in PLC using a ladder diagram. (8)

(ii) What are the factors to be considered for selecting PLC? (3)

(iii) Explain the basis of ladder programming used in PLC's. (5)

15. (a) (i) What is the role of sensors in car engine management system? Explain with block diagram. (10)

(ii) Explain with various mechatronics elements required to design an automated guided vehicle. (6)

Or

(b) (i) What are the advantages of using a microprocessor in the place of a mechanical controller for a carburettor of an automobile? (4)

(ii) Explain the mechatronics systems used in an automatic camera with a neat block diagram. (12)

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