

Total No. of Questions : 12]

SEAT No. :

[Total No. of Pages : 4

P1601**[5058]- 18****T.E. (Mechanical)****MECHATRONICS****(2008 Course) (Semester - II) (302050)***Time : 3 Hours]**[Max. Marks : 100**Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam tables are allowed.*
- 6) *Assume suitable data, if necessary.*

SECTION - I

- Q1)** a) Explain in brief Sensitivity, Accuracy and Precision with suitable example for each. [8]
- b) Explain different dynamic characteristics of measurement system such as [4]
- i) Response time
 - ii) Rise time
 - iii) Settling time.
- c) Sensitivity of a thermocouple is $0.01 \text{ V}/^\circ\text{C}$. Find the output voltage if the temperature is 200°C . Also find temperature for 3.5V output. [4]

OR

- Q2)** a) An electrical resistance strain gauge of resistance 120Ω & gauge factor 2.0 is bonded to a specimen of steel. What will be the resistance change of the gauge due to stress of 60 MN/mm^2 tensile in the specimen (modulus of elasticity $E = 180 \text{ GN/mm}^2$). [6]
- b) What is meant by Temperature Compensation in Strain Gauges and how it is done? [6]
- c) Explain capacitive type level measuring transducer. [4]

P.T.O.

- Q3)** a) Write Construction, working, applications, advantages and disadvantages of LVDT. [8]
 b) A potentiometer with a total range of 350° is supplied with a voltage of 8 Vdc. The voltage at the wiper is 3.7 Vdc. What is the present angle of the pot? [4]
 c) Describe proximity sensor with application. [4]

OR

- Q4)** a) What is meant by variable reluctance sensor? And write down its applications. [6]
 b) Explain basic operation of rotary encoder? And its applications in CNC machine. [5]
 c) Explain capacitive and inductive principles used in position sensing. [5]

- Q5)** a) Write a short note on SCADA system and its applications in industrial environment. [10]
 b) Use block diagram reduction to simplify the block diagram shown in figure Q 5 (b) below into a single block relating $C(s)$ to $R(s)$. [8]

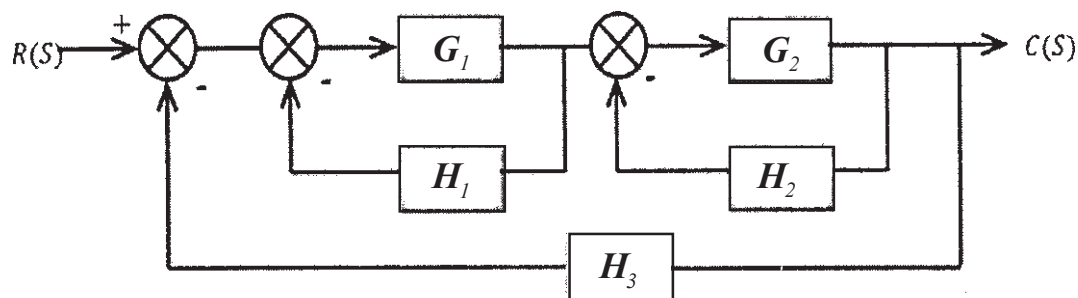


Figure Q 5 (b)

OR

- Q6)** a) Explain any one analog to digital converter. [6]
 b) Explain Sample and hold circuit. [6]
 c) Describe in brief mathematical model of translational Mechanical System. [6]

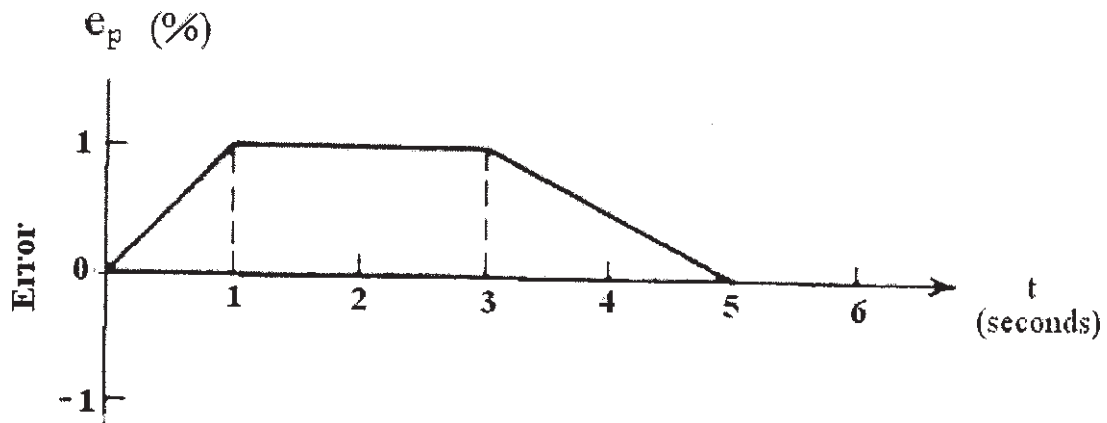
SECTION - II

- Q7)** a) Explain terms [4]
- i) Process load
 - ii) Dead Time
- b) Differentiate between open loop and closed loop system. [6]
- c) A closed - loop system consists of three elements in series, the elements having transfer functions of 5, $1/s$ and $1/(s+1)$ with negative feedback element transfer function 5. What is the overall transfer function of the system? [6]

OR

- Q8)** a) Explain the terms: [4]
- i) Process Variable
 - ii) Process Error
- b) Give an example of the following: [6]
- i) Feed forward control system.
 - ii) Feedback control system.
 - iii) Regulator control system.
- c) In a certain system, an electric heating element was found to increase the temperature of a piece of metal 10° for each ampere of current. The metal expands 0.001 inch/deg and pushes on a load sensor which outputs 1 V/0.005 inch of compression. [6]
- i) Find the transfer functions of the three components and draw the block diagram.
 - ii) Calculate the overall transfer function of this system.

- Q9) a)** What are the major disadvantages of two position controller? [4]
b) Figure Q 9 (b) shows an error time graph. Sketch the PD controller output w.r.t time $K_p = 5\%/%$, $K_D = 0.5\%/s$ and $m(0) = 30\%$. [8]



- c)** Write down the advantages and limitation of proportional control system. [4]

OR

- Q10)a)** Write note on Proportional, Integral and Derivative control Actions and its effect on error and response time. [8]
b) Explain PID controller in detail. [8]

- Q11)a)** Explain the Timers and Counters used in PLC programming. [8]
b) Construct the ladder logic diagrams for [10]

- i) OR gate
 ii) AND gate
 iii) NAND gate

Also develop a truth table for all three logics.

OR

- Q12)a)** Write a short note on concept and purpose of a Programmable Logic Controller (PLC). Explain the basic instructions used in a PLC program. [8]
b) Draw ladder diagram for a simple traffic light controller for the following sequence of operations as below: [10]

Step 1 : Turn Green ON for 35 seconds,

Step 2 : Turn Yellow ON for 5 seconds,

Step 3 : Turn Red ON for 40 seconds,

Step 4 : Repeat the sequence i.e. Step 1 - Step 2- Step 3.

