Total No. of Questions :12]

SEAT No. :

P2815

[Total No. of Pages :5

[4958]-118

T.E. (Mechanical)

MECHATRONICS

(2008 Course) (Semester - II)

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, 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 V/^{o}C. Find the output voltage if the temperature is 200^{o}C. Also find temperature for 3.5V output. **[4]**

OR

P.T.O.

Q2) a) A strain gauge and bridge circuit are used to measure the tension force in a bar of steel that has a cross-sectional area of 13 cm^2. The strain gauge has a nominal resistance of 120Ω and a GF of 2. The bridge is supplied with 10 V. When the bar is unloaded, the bridge is balanced so the output is 0V. Then force is applied to the bar, and the bridge voltage goes to 0.0005 V. Find the force on the bar. (Youngs modulus 2×10^5 N/mm^2 for steel). **[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]**

Q3) a) Write Construction, working, applications, advantages and disadvantages of LVDT. **[8]**

b) A potentiometer with a total range of 350^o 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. **[8]**

b) Use block diagram reduction to simplify the block diagram shown in figure Q5 (b) below into a single block relating Y(s) to R(s). **[10]**

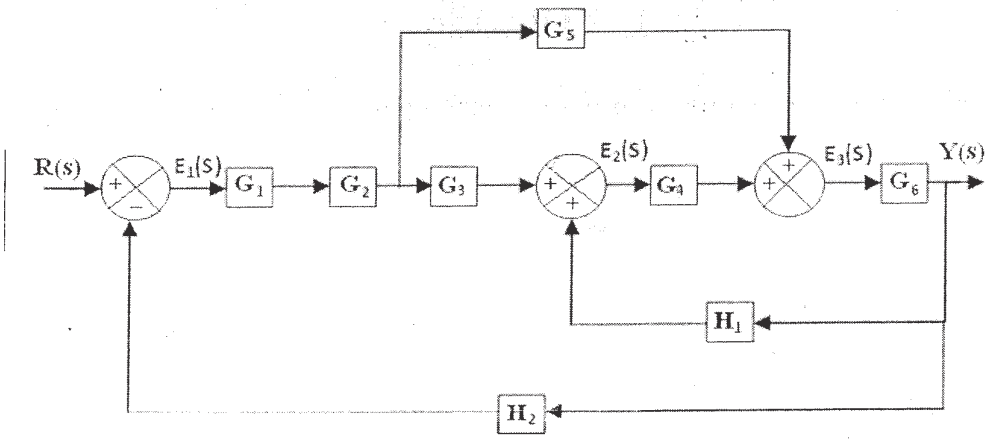

Figure Q 5 (b)

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 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) An open-loop system consists of three elements in series, the elements having transfer functions of 5, 1/s and 1/(s+1) with 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^{o} 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) A proportional controller is used to control temperature within 50^{o}C to 130^{o}C with a set point of 73.5^{o}C. The set point is maintained with 50% controller output. The offset error is corresponding to load change which causes 55% controller output. If the proportional gain is 2 find the % controller output if the temperature is 61^{o}C. **[8]**

c) Write down the advantages and limitations 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 difference in Timers and Counters used in PLC programming with a suitable example each. **[6]**

b) Construct the ladder logic diagrams for **[12]**

i) OR gate

ii) AND gate

iii) NOT 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. **[6]**

b) Consider a tank with inflow valve V1 and outflow valve V2 connected to a tank at top and bottom respectively. The level high (LH) and level low (LL) floats switches mounted at top and bottom to indicate the level. Develop a PLC ladder program for the following objectives **[12]**

i) When LL is OFF and LH is OFF, the V1 should be ON

ii) V1 shall continue to be ON till LH is ON

iii) When LL and LH is ON, V1 should be OFF and V2 should be ON

iv) V2 should continue to be ON till LL is OFF.

Mention the input and outputs and which input is connected to which PLC input terminal.

Write the Boolean equation of each rung.

Draw ladder diagram with Ex ON, Ex OFF and PLC output symbols (Do not show switches in ladder program).

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