Total No. of Questions : 12]

SEAT No. :

P2396

[Total No. of Pages : 4

[5153]-19
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 answer 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 V/°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 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]**

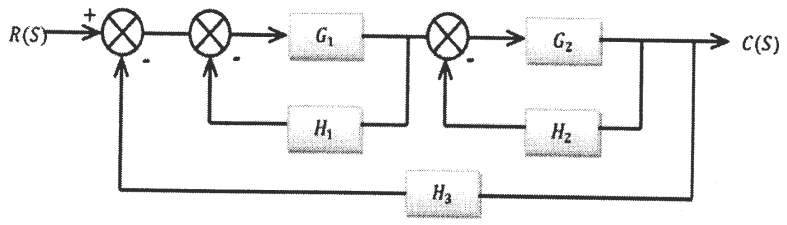

Figure Q 5 (b)

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 Open Loop Contorl System with a suitable example. **[6]**

b) 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 funciton 5. What is the overall transfer function of the system? **[6]**

c) Explain following terms: **[4]**

i) Process lag

ii) Control lag

OR

Q8) a) Explain control systems used for following (as open or closed loop control): **[6]**

i) Controlling the water height in a toilet tank.

ii) Stopping a clothes dryer when the clothes are dry.

iii) Actuation of street lights at 6 p.m.

b) Explain Closed Loop Control System with a suitable example. **[6]**

c) Explain following terms: **[4]**

i) Controlled variable

ii) Process Load

Q9) a) Define proportional controller with mathematical equation. State its advantages and disadvantages. **[6]**

b) Explain why derivative control mode cannot be used alone. **[6]**

c) Explain why PID control system is the most widely used control system.**[4]**

OR

Q10)a) Figure 10a shows an error time graph. Sketch the PD Controller output with respect to time, given, Kp = 5%/%, Kd = 0.5%/s and p(0) = 30%**[10]**

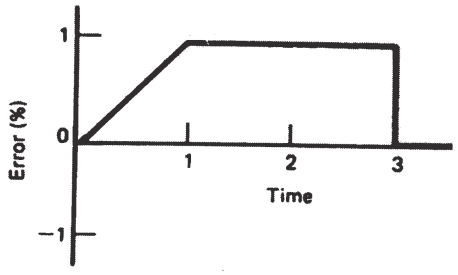

Figure 10a

b) Define P+I controller with mathematical equation. State its advantages.**[6]**

Q11)a) Construct a PLC ladder program for AND and OR gates. Use 2 NO push-button switches as inputs and green lamp as output. Develop a truth table for both logics. Also write Boolean equations for each rung. **[12]**

b) Draw, label and explain a typical PLC Architecture. **[6]**

OR

Q12)a) Develop a ladder diagram for the following:

A small house has three windows and two doors. Each window and door has a switch attached such that the contacts close when a door or window opens. Draw a PLC ladder logic diagram that will turn ON a light if one or more windows are open OR if both doors are open. **[12]**

b) What are the main components of a SCADA system? Explain with a block diagram. **[6]**