[4858] - 118

T.E. (Mechanical Engineering)
MECHATRONICS
(2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

1) *Answers to the two sections should be written in separate answer books.*

2) *Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4 and Q.No.5 or Q.No.6 from section-I and Q.No.7 or Q.No.8, Q.No.9 or Q.No.10, Q.No.11 or Q.No.12 from section-II.*

3) *Neat diagrams must be drawn wherever necessary.*

4) *Figures to the right indicate full marks.*

5) *Use of Electronic pocket Calculator is allowed.*

6) *Assume suitable data, if necessary and mention it clearly.*

SECTION - I

Q1) a) Level of liquid inside a tank is to be measured using capacitive level sensor. For this, draw the set-up and explain the principle of working. **[6]**

b) Using a suitable block diagram explain the working of a Measurement System. **[6]**

c) A rotary potentiometer is used for measurement of angular position. The range of the potentiometer is 300° and the Potentiometer is supplied with 12 Volts. If the angular position is 40°, calculate the output voltage. **[6]**

OR

Q2) a) Draw a suitable diagram and explain the construction of a strain gauge type load cell. Also, explain its working and list its advantages and applications. **[9]**

b) List the static and dynamic characteristics of a sensor. Also, explain any five static characteristics in detail. **[9]**

P.T.O.

Q3) a) Draw suitable diagrams and explain the construction and working of the LVDT. **[8]**

b) With respect to construction, working and advantages explain Potentiometer for linear position measurement. **[8]**

OR

Q4) a) Classify, in detail, the sensors for measurement of displacement. **[4]**

b) Write six distinct points of comparison between Thermocouple and RTD. **[6]**

c) Draw a suitable diagram and explain the working of Optical Encoder. **[6]**

Q5) a) Draw suitable diagrams and explain the construction and working of 6 bit SAR type Analog to Digital Converter. **[10]**

b) A 6-bit DAC has a reference voltage of 0 to 10 V. The binary input is 101100. Find the analog output voltage. **[6]**

OR

Q6) a) Explain resistance, inductance and capacitance as basic electrical elements with derivation of their transfer functions. Hence derive the transfer function of R-L-C arranged in parallel. **[8]**

b) Discuss the following two concepts in detail : **[8]**

  i) Sample & Hold Circuit

  ii) SCADA

SECTION - II

Q7) a) Using a suitable diagram discuss the application of closed loop control in position control. **[8]**

b) Figure Q.7 (b) shows a block diagram. Simplify and find the transfer function : **[8]**
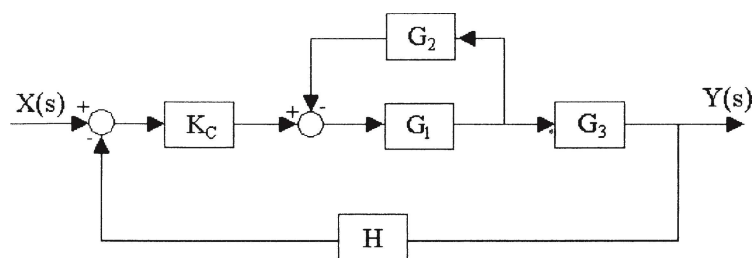

Figure Q7 (b)

OR

Q8) a) Draw suitable diagram and explain the construction of open loop control system. Also, explain the working and list the advantages of open loop control. **[8]**

b) Explain the detail, following four terms : **[8]**

   i) Process Load

   ii) Process Lag

   iii) Dead Time

   iv) Control Parameter Range

Q9) a) A proportional controller is used to control temperature within 50°C to 130°C with a set point of 73.5°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°C. **[10]**

b) Discuss, in detail, the effect of the P, I and D control on following transient specifications : **[6]**

   i) % Overshoot

   ii) Steady State Error

   iii) Rise Time

OR

Q10) a) Draw a suitable block diagram and derive the transfer function of the PID controller. Also, derive the equation for the control signal, u, for the controller. **[10]**

b) Define : **[6]**

   i) Proportional Band

   ii) Integral Action Time

   iii) Derivative Action Time

Q11) a) Consider two NO type push buttons switches S1 and S2, two lamps namely RED and GREEN and write the PLC ladder diagram to achieve following objectives : **[12]**

   i) When S1 is pushed and S2 is not pushed RED lamp is ON and latched.

   ii) When RED lamp is latched ON and S2 is pushed, RED lamp is De-latched and GREEN lamp is ON and Latched.

   iii) When both the buttons are pushed or not pushed, both the lamps are OFF and Delatched.

   b) With the help of a block diagram explain the basic structure of PLC. **[6]**

OR

Q12) a) Considering suitable example, draw the ladder diagram and explain the working of : **[12]**

   i) Timer

   ii) Counter

   b) Explain various factors to be considered for selection of PLC. **[6]**

❄ ❄ ❄