[4459] – 118

Seat No.	

T. E. (Mechanical) II Examination, 2013
402050 : MECHATRONICS
(2008 Course)

Time : 3 Hours Max. Marks : 100

Instructions: *1) Answer **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) Assume suitable data **wherever** necessary but mention it clearly.*
*5) Use of Scientific Calculator is **allowed**.*

SECTION – I

1. a) Give any two definitions of Mechatronics. Explain the scope and importance of Mechatronics and applications. **[08]**

   b) What is a measurement system ? Explain with a neat sketch various components of a measurement system. **[08]**

   OR

2. a) Differentiate between static and dynamic characteristics of measuring instruments. Explain the following. **[08]**

   i) Hysteresis ii) Sensitivity
   iii) Drift iv) Accuracy.

   b) 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 mm^2. The strain gauge has a nominal resistance of 100 Ω 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 0 V. Then force is applied to the bar, and the bridge voltage goes to 0.005 V. Find the force on bar. (Young's modulus 2×10^5 N/mm^2 for steel). **[08]**

3. a) Compare an LVDT with a potentiometer as a position sensor. What are advantages and disadvantages of using an LVDT ? **[06]**

b) A potentiometer with a total range of 350° is supplied with a voltage of 8 V DC. **[05]**

The voltage at the wiper is 3.7 V DC. What is the present angle of the pot ?

c) Describe proximity sensor with application. **[05]**

OR

4. a) How variable reluctance sensor works ? Explain with example. **[05]**

b) State the applications of level measuring system. Explain capacitance level measuring system. **[06]**

c) Explain the principle and working of tacho-generator in flow measurement. **[05]**

5. a) List various applications of SCADA system and explain any one in detail. **[08]**

b) Figure shows a block diagram. Simplify and find the Relation between C(s)/R(s). **[08]**

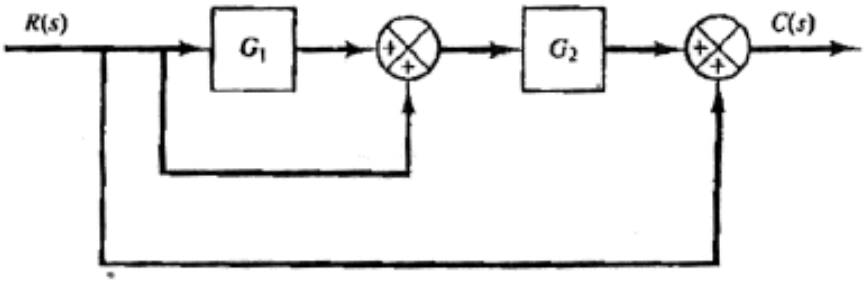

Figure Q.5 (b)

OR

6. a) For a DAC (Digital to Analog Converter) explain the purpose and working of Sample Hold Circuit with neat sketch. **[08]**

b) Carry out block diagram reduction for following system shown in figure **[08]**

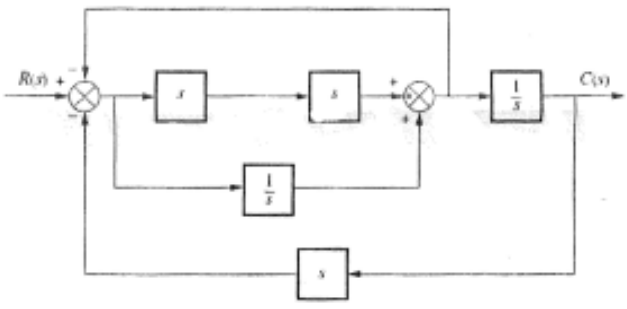

Figure Q. 6 (b)

SECTION – II

7. a) The water in a container placed on a hot plate is a feedback control system. Identify the components required with significance in brief for the same and sketch the block diagram showing all components. **[08]**

   b) Compare Open Loop and Closed Loop Control Systems with suitable example. **[08]**

OR

8. a) Define Proportional Controller, Offset Error and Proportional band. **[08]**

   b) The level in a tank 9 meters high is controlled using proportional controller. **[08]** The set point is 4.5 meters. The level in the tank is 5 meters. The proportional controller has 50% output at zero error with proportional constant of 10.

   Calculate

   i) The error in percent

   ii) The proportional controller output proportional to this error.

9. a) The equation of error is expressed as $e = 0.5 + 1.2\ t^2$ with respect to time. **[10]**

   Sketch the graph of P controller output w.r.t. time with $K_p = 5$ and m(0) = 50 % for t = 0 to t = 3.

   b) Explain advantages of Integral controller over proportional controller. **[06]**

OR

10. a) The equation of error is expressed as e = 0.5 – 1.2 t with respect to time. [10] Sketch the graph of D controller output w.r.t. time with $K_D = 0.5$ and m(0) = 50% for t = 0 to t = 2.

    b) Define PID controller with mathematical equation. **[06]**

11. a) Write a short note on Examine ON and Examine OFF conditions used in PLC Programming. **[06]**

    b) Given two ON-OFF switches (P1, P2), with one lamps L1, write a PLC program to satisfy following objectives **[12]**

    i) Initially both the switches are OFF.

    ii) When P1 is pushed ON and P2 is OFF, the Lamp L1 glows and continue to glow till P2 is Pushed ON.

iii) When P2 is pushed ON and P1 is ON then the lamp goes OFF.

iv) When P2 is pushed OFF and P1 is ON then L1 goes ON

v) When P1 is pushed OFF and P2 is OFF the L1 goes OFF

Draw PLC Ladder diagram with PLC ladder symbols. Symbols of the physical components should not be shown in the program.

Write the names of input terminals to which switches are connected as well as output terminal names to which lamps are connected. **(2)**

Write the Boolean (Digital) equations with truth table of each rung you draw. **(4)**

Draw the ladder diagram using only Examine ON, Examine OFF and output coil symbols. **(6)**

OR

12. a) Explain with block diagram the components and their working in PLC. **[06]**

b) Given four push to On buttons (P1, P2, S1 and S2), with two motors (M1 and M2) write a PLC program to satisfy following objectives. **[12]**

i) When S1 (Start Button) is pushed the Cycle shall start. The cycle shall continue to remain On until S2 (Stop Button) is pushed.

ii) When cycle is started and S1 is pushed, S2 is not pushed, the M1 starts and remains started till S1 is pushed.

iii) When cycle is started and S2 is pushed and S1 is not pushed then Motor M2 starts and remains started till S2 is pushed.

iv) When S1 and S2 both pushed no motor starts and cycle is stopped.

Draw PLC Ladder diagram with PLC ladder symbols. Symbols of the physical components should not be shown in the program.

Write the names of input terminals to which switches are connected as well as output terminal names to which lamps are connected. **(2)**

Write the Boolean (Digital) equations with truth table of each rung you draw. **(4)**

Draw the ladder diagram using only Examine ON, Examine OFF and output coil symbols. **(6)**

———————