Total No. of Questions : 10]

SEAT No. : ____

P2407

[Total No. of Pages : 4

[5253]-119

T.E. (Mechanical)

MECHATRONICS

(2012 Pattern) (Semester - I)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.***

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

3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***

4) ***Assume suitable data, if necessary.***

Q1) a) What is a load cell? Draw the Schematic diagram of a strain gauge based load cell. Discuss the principle of operation. **[6]**

b) Explain advantages and disadvantages of block diagram representation.**[4]**

OR

Q2) a) The output of an LVDT is connected to a 10A ammeter through an amplifier whose amplification factor is 200. An output of 3mA appears across the terminal of LVDT when the core moves through a distance of 0.75 mm. Calculate the sensitivity of LVDT and that of the whole setup. The milliammeter scale has 100 divisions. The scale can be read to 1/10 of a division. Determine the resolution of the instrument in millimeters.**[4]**

b) Explain with a neat sketch any one automotive application of mechatronics system. **[6]**

P.T.O.

Q3) a) Determine the transfer function of the system shown in fig.1 **[6]**

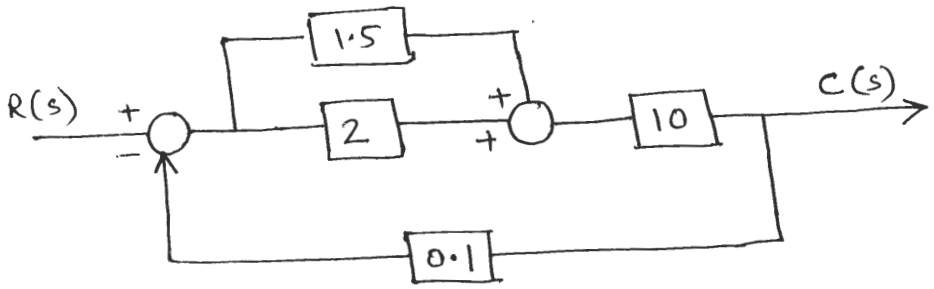

Fig. 1.

b) State and explain Nyquist sampling theorem and bit width. **[4]**

OR

Q4) a) Explain with a neat sketch any one household application of mechatronics system. **[6]**

b) Write a short note on : **[4]**

i) Current amplifier.

ii) Voltage amplifier.

Q5) a) Explain with a neat sketch the internal architecture and hardware components of PLC. **[8]**

b) Draw the ladder diagram for OR and NAND logic gate. **[8]**

OR

Q6) a) Discuss the various elements of SCADA system and state various applications of it. **[8]**

b) Draw the ladder diagram for NOR and NOT logic gate. **[8]**

Q7) a) Derive the modelling equation for rotational mechanical system. **[6]**

b) The transfer function of a system is $\frac{361}{(s^2+16s+361)}$. Find the following for a unit step input : **[10]**

i) Undamped natural frequency

ii) Damping ratio

iii) Damped natural frequency

iv) Settling time

v) Peak time

vi) Rise time

OR

Q8) a) Explain basic building blocks of fluid system. **[8]**

b) What do you mean by overshoot, rise time, peak time and settling time? **[8]**

Q9) a) A PI controller has a gain $K_p = 2$ and an integral action rate $K_i = 0.02\ s^{-1}$. The initial output is assumed to be zero. The graph of the error signal is given in fig.2. Determine the value of the controller output at t = 70s. **[6]**

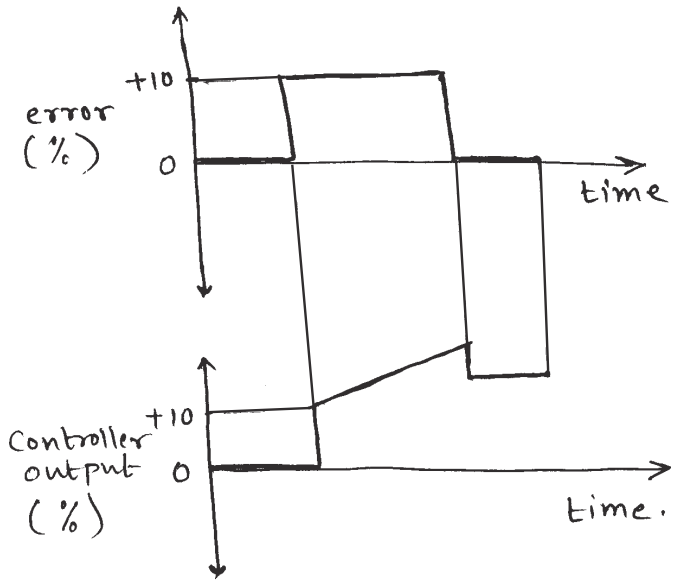

fig. 2.

b) Explain the manual procedure for PID controller tuning with suitable example. **[6]**

c) Describe any application of proportional controller and their limitations. **[6]**

OR

Q10) a) Explain the features of the following : **[6]**

i) Proportional Controller.

ii) PI Controller.

iii) PID Controller.

b) In a proportional controller, the gain is 4%, the output voltage range is 0–10V, the input voltage span 4 – 12V. Determine the value of gain. **[6]**

c) What are the advantages of a PID Controller. **[6]**