22429

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **5 × 2 = 10**

(a) Define open loop & closed loop control system.

(b) Define order of the system.

(c) State laplace transform of ramp & parabolic function.

(d) State any four rules for block diagram reduction technique.

(e) State two advantages of transfer function.

(f) Find the poles of the system :

$$G(s) = \frac{10(s+8)}{s(s+4)(s^2+6s+25)}$$

(g) Define the terms :

(i) Stable system,

(ii) Critically stable system

2. Attempt any THREE : **3 × 4 = 12**

(a) Find the transfer function of the following circuit (as shown in fig. no. 1)

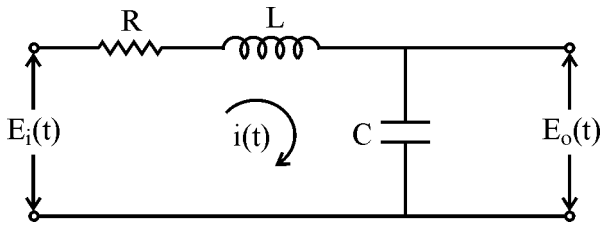

Fig. No. 1

(b) Draw the block diagram of process control system. State functions of its blocks.

(c) Derive the transfer function of following block diagram (as shown in fig. no. 2)

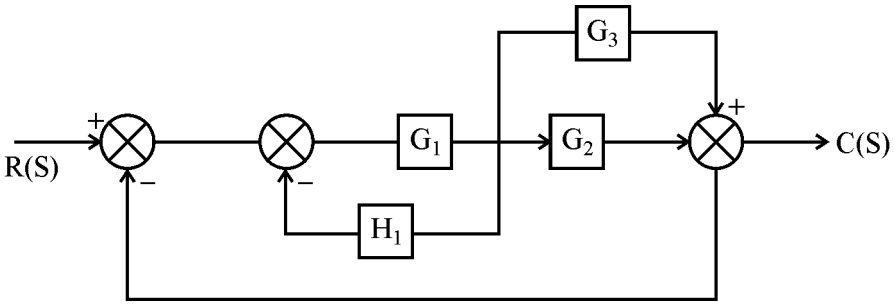

Fig. No. 2

(d) Derive the unit step response of First Order System.

3. Attempt any THREE : **3 × 4 = 12**

(a) Explain Routh's stability criterion.

(b) Sketch output time response relationship of second order system for step input. Define rise time and peak time.

(c) Derive the transfer function of a closed loop system.

(d) Explain in detail standard test input signals with neat sketches.

4. Attempt any THREE : **3 × 4 = 12**

(a) Describe proportional control action w.r.t. equation & response. State the significance of proportional band.

(b) Draw response of PID controller and give its applications. (any four)

(c) Describe PI control action. State their advantages.

(d) Draw block diagram of AC servosystem and explain it.

(e) Draw and explain synchro error detector.

5. Attempt any TWO : **12**

(a) Define ON-OFF controller. Describe its working principle with example.

(b) A unity feedback system has :

$$G(s) = \frac{40(s+2)}{s(s+1)(s+4)}$$

Determine :

(1) Type of system

(2) All error co-efficient

(3) Error for ramp input with magnitude 4.

(c) Draw the block diagram of servosystem. Give the comparison between D.C. servomotor and stepper motor.

6. Attempt any TWO : **2 × 6 = 12**

(a) Explain types of damping with respect to damping factor ξ. Draw the response and state the location of poles for the above types.

(b) Determine the stability of the system having characteristic equation :

$$s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$$

(c) Define gain margin and phase margin. State the conditions of stability with respect to gain margin and phase margin.