22472

03 Hours / 70 Marks   Seat No. ⬜⬜⬜⬜⬜⬜⬜⬜

Instructions – (1) All Questions are *Compulsory*.

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

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

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

Marks

1.   **Attempt any FIVE of the following :**   **10**

a) List practical applications of control system.

b) Define poles and zeros of the system.

c) Define the terms :

   i)   Stable system

   ii) Critically Stable system

d) Compare PI and PD controllers (Any two points)

e) Sketch the Impulse - signal and parabolic signal.

f) A system has poles at S = –3, S = –2 and zero at S = –1. Represent the system in S-plane.

g) Draw the block diagram of process control system.

**Marks**

2. **Attempt any THREE of the following :** 12

   a) List any four rules of block diagram reduction technique.

   b) Derive unit step response of first order system.

   c) Discuss the Routh's Stability Criterion.

   d) Draw block diagram of servo system. List any two advantages of servo system.

3. **Attempt any THREE of the following :** 12

   a) Define servo system. Draw and lable block diagram of servo system.

   b) Explain neutral zone with plot in ON-OFF controller.

   c) Define transfer function, obtain transfer function for RC network. (Refer fig. No. 1)
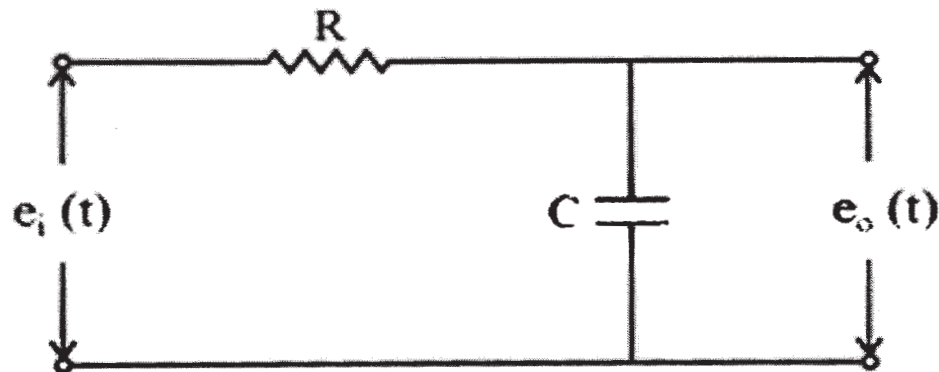
Fig. No. 1

   d) Explain proportional controller action with equation and response.

   e) Explain working of potentiometer as an error detector. Give any two applications.

Marks

4. **Attempt any THREE of the following :** **12**

a) Compare open loop and closed loop control system.

b) Write Laplace transform of the following input signal -

   i) Step

   ii) Ramp

   iii) Parabolic

   iv) Impulse

c) Find stability of system whose characteristics equation is,

   $$S^5 + S^4 + 3S^3 + 9S^2 + 16S + 10 = 0$$

   use Routh's criterion.

d) Draw circuit diagram of electronics Op-Amp based PI controller. Write it's output expression.

e) Explain DC position control system with it's working.

5. **Attempt any TWO of the following :** **12**

a) Apply block diagram reduction rules to obtain Transfer Function C(S)/R(S) of the following block diagram. (Refer Following Fig. No. 2)
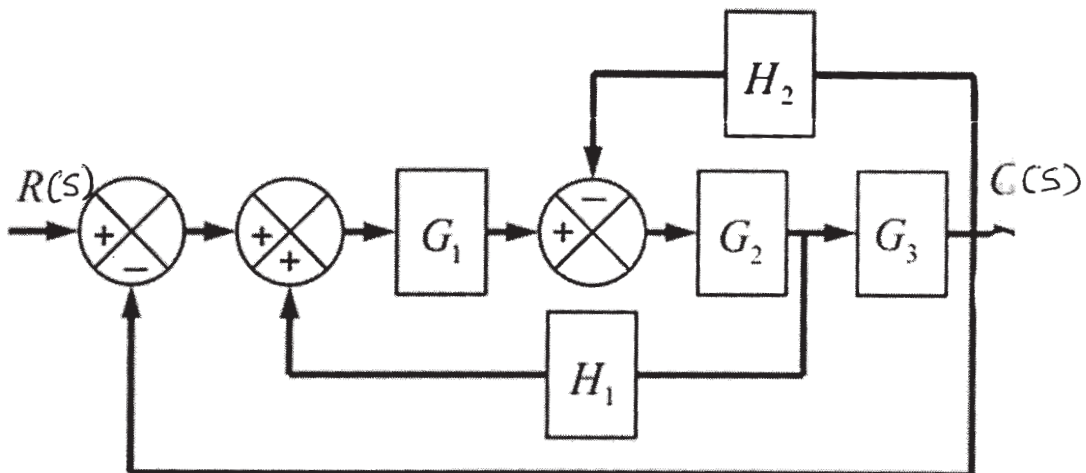

Fig. No. 2

b) Define terms –

i) Poles

ii) Zeros

iii) Order of system

iv) Characteristics equation. Also for a given transfer function C(S) / R(S) :

$$\frac{C(S)}{R(S)} = \frac{K(S + 7)}{S(S + 2)\ (S + 5)\ (S^2 + 7S + 12)}$$

Find –

(1) Poles

(2) Zeros

(3) Plot them on S-plane

c) Give advantages and disadvantages of stepper motor. List any two applications of stepper motor.

6. **Attempt any TWO of the following :** **12**

a) Find out the range of K for the given system to be stable with unity feedback using Routh's Criteria.

$$G(S) = \frac{K}{S(S + 4)\ (S^2 + 2S + 2)}$$

b) Describe PID controller with neat diagram, output equation and response.

c) Explain the working of Rotary encoder. Give applications of rotary encoder.

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