

22541

22223

3 Hours / 70 Marks

Seat No.

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- 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: **10****
- a) Define linear time invariant control system.
 - b) Define :
 - i) Time constant
 - ii) 'Type' of control system
 - c) State any two advantages and two disadvantages of Routh's stability criteria.
 - d) Define Neutral Zone. State the controller which exhibits neutral zone.
 - e) Define servo system. Give any two examples.
 - f) Define time constant. State its significance.
 - g) Draw and label the functional block diagram of AC servo system.

P.T.O.

2. Attempt any THREE of the following: 12

- a) Derive the transfer function of negative feedback control system.
- b) List standard test inputs. State Laplace representation of them. Draw the graphical representation of them.
- c) Compare AC servo motor and SC servo motor. (any four points)
- d) For a given TF $\frac{C(s)}{R(s)} = \frac{S + 10}{S(S^2 + 9S + 20)}$ find
 - i) Poles
 - ii) Zeros
 - iii) Characteristic equation
 - iv) Order of the system

3. Attempt any THREE of the following: 12

- a) Derive the transfer function of RC network in Fig. No. 1.

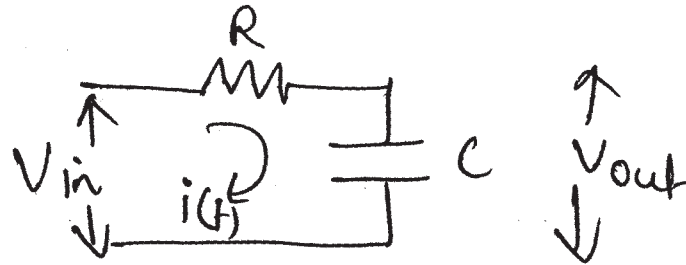


Fig. No. 1.

- b) A unity feedback control system has $G(s) = \frac{10(S + 5)}{S^2(S + 1)(S + 2)}$ find
 - i) Type of the system
 - ii) Error constants
- c) For the system with characteristic equation. $S^3 + 4S^2 + S + 6 = 0$. State how many poles are in right half of s-plane. Analyse its stability.
- d) Draw the block diagram of process control system. Explain the function of each elements.

4. Attempt any THREE of the following:

12

- a) Find state space representation for the transfer function

$$\frac{C(s)}{R(s)} = \frac{6}{s^2 + 5s + 6}$$

- b) Find out the nature of damping for the following system with

$$TF = \frac{C(s)}{R(s)} = \frac{4}{s^2 + 4}. \text{ Draw its response.}$$

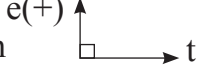
- c) Define :

i) Band width

ii) Cut off frequency

iii) Gain margin

iv) Phase margin w.r.t. frequency response analysis.

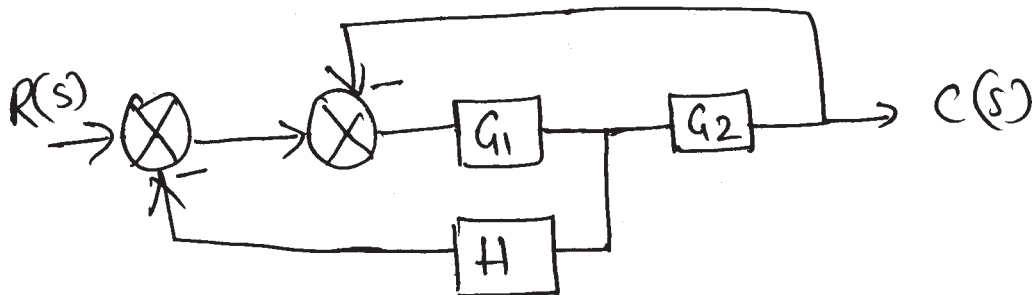
- d) Name the controller which cannot be used alone. State its reasons. Draw its output for the error sign
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- e) Draw and explain the construction and working of any one type of stepper motor.

5. Attempt any TWO of the following:

12

- a) Derive the TF of the given system using block diagram reduction method. Refer Fig No. 2.

Fig. No. 2.

- b) Find out the settling time and peak over shoot of the system

$$\text{with TF } \frac{C(s)}{R(s)} = \frac{16}{s^2 + 4s + 16}. \text{ Draw its response.}$$

- c) Using Routh's criteria, determine the range of K for the system to be stable for
- $G(s)H(s) = \frac{K}{s(s+4)(s^2+s+1)+K}$

P.T.O.

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

- a) Draw the circuit diagram of electronic PID controller. State its output equation and transfer function.
 - b) Name the error detector which can be used in AC servo system. Draw and describe its working.
 - c) Draw Bode plot for the system $G(s)H(s) = \frac{80}{S(S + 2)(S + 20)}$. Find the gain margin.
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