22476

12425

03 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) 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 <u>FIVE</u> of the following :**   **10**

a) Define –

   i)   Transfer function

   ii)   Order of a system.

b) Name the standard test signals. Write the Laplace formula of them.

c) State the equation and advantage (any one) of PD controller.

d) Identify the number of ports and number of positions of 2/2 directional control valve.

e) Define servo system. Draw its block diagram.

f) Draw the location of poles in the S-plane for stable and unstable systems.

g) Name the error detector used in DC servo system. Draw its diagram.

Marks

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

a) Find out the Transfer Function of RC network.

b) For a given Transfer function, $\dfrac{C(S)}{R(S)} = \dfrac{S^2 - 4}{(S^2 + 7S + 12)}$

find out –

i) Poles

ii) zeros

iii) Pole – zero plot

c) Describe with diagram the pneumatic circuit for Memory function.

d) Compare BLDC motor with DC servo motor (any four points)

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

a) Find out the Transfer function of the following differential equation $\dfrac{d^2}{dt^2} y(t) + 4 \dfrac{d}{dt} y(t) + 8y\ (t)$

$= 8x\ (t)$ where $x(t)$ = input

$y(t)$ = output

b) Find out the static error constants for a unity feedback system with $G(S)H(S) = \dfrac{10}{S(S+4)\ (S+1)}$

c) State the name of the controller which cannot be used alone. State its reasons.

d) Explain the principle of double acting cylinder pneumatic actuator with diagram.

Marks

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

a) Find the state space representation for Transfer function.

$$\frac{C(S)}{R(S)} = \frac{9}{S^2 + 6S + 9}$$

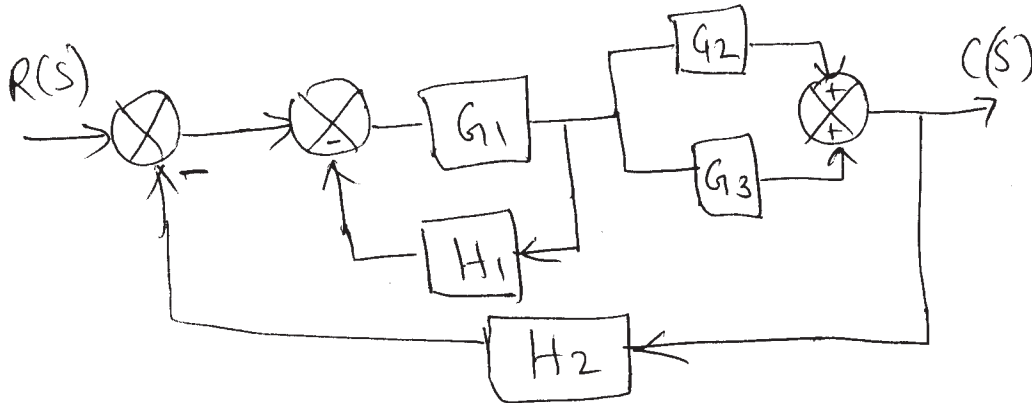b) Examine stability by Routh's Criteria for the characteristic equation –

$1 + G(S)\, H(S) = 3\,S^4 + 10\,S^3 + 5S^2 + 5S + 2 = 0$

c) Explain the ON-OFF control action with equation and response graph.

d) Describe with diagram the pneumatic circuit for signal inversion.

e) Draw and explain the working principle of AC servo motor.

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

a) Derive the Transfer function of the following system using block diagram reduction techniques.

Fig. No. 1

b) Find out the range of 'K' for the system to be stable for unity feedback system with open loop transfer function –

$$G(S)\, H(S) = \frac{K(S + 13)}{S(S + 3)\,(S + 7)}$$

c) Describe with diagram AND and OR functions of pneumatic circuit.

P.T.O.

Marks

6. **Attempt any <u>TWO</u> of the following :** 12

a) Find out the settling time (t$_s$) and peak overshoot (Mp) of the closed loop transfer function.

$$\frac{C(S)}{R(S)} = \frac{16}{S^2 + 4S + 16}$$ Draw its response.

b) Compare Proportional, Integral and Derivative control action (Any six points)

c) Draw and describe the working of synchro as error detector.

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