22476

22223

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: **10**

a) State any four block diagram reduction rule.

b) Identify the no. of ports and no. of positions of 2/2 directional control valve.

c) Explain transient and steady state response.

d) What do you mean by pole and zero.

e) What is meant by PD controller?

f) Define servo system.

g) Draw torque speed characteristics of A.C. servomotor.

Marks

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

a) Derive two transfer function of the electrical R-C system.

b) For the given transfer function

$$\text{T.F.} = \frac{K(S + 6)}{S(S + 2)(S + 5)(S^2 + 7S + 12)}$$

Find out :

i) Poles

ii) Zeros

ii) Characteristic equation

iv) Pole-zero plot in s-plane

c) Describe with diagram on signal and off signal delay of pneumatic circuit.

d) Compare armature controlled and field controlled DC servo system.

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

a) Derive the transfer function of closed loop control system.

b) Explain analysis of 1st order control system for unit step i/p signal.

c) State the name of the controller which cannot be used alone. State the reason why it cannot be used alone.

d) Describe with diagram OR and AND functions of single acting cylinder pneumatic circuit.

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

a) Obtain stability of system whose characteristic equation is $5^5 + 5^4 + 35^3 + 95^2 + 165 + 10 = 0$. Use Routh's criteria.

b) Describe with diagram the pneumatic circuit for flow amplification.

c) State the expression for proportional controller and define -

i) Proportional band

ii) Offset.

d) Explain the working of variable reluctance stepper motor.

e) Draw and explain block diagram of a closed loop control system.

Marks

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

a) Derive the transfer function for the system shown in Fig. No. 1.

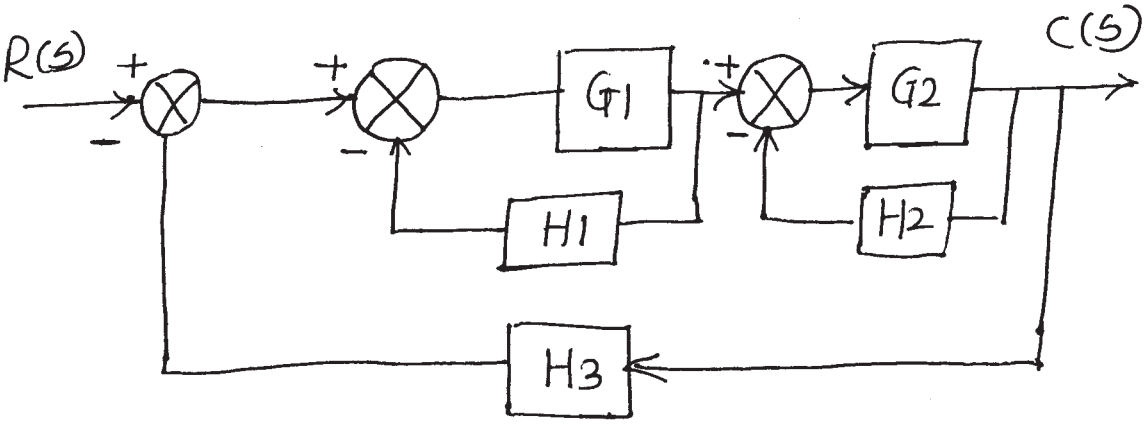

Fig. No. 1

b) Compare pneumatic and hydraulic actuators.

c) Find range of K for stability of a unity feedback system with the characteristic equation.

$$G(s) = \frac{K}{S(S+2)(S+4)(S+6)}$$

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

a) Compare P, I, and D control action on the basis of :-

i) Nature of output

ii) Response to error

iii) Equation

iv) Application

b) For the given differential equation

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y(t) = 8x(t)$$

Where y = output, x = input

Find :

i) Settling time

ii) Rise time

iii) Peak time

iv) Peak overshoot

c) Identify which servocomponent can be used as error detector in AC servo system. Draw and describe its working.
