313329

12425

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

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

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

(3) Assume suitable data, if necessary.

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

(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) Define characteristics equation and order of control system.

b) Define marginally stable system.

c) Draw block diagram of process control system.

d) List applications of servomotors. (Any four)

e) Define actuators. Give classification of actuators.

f) Draw time response of 2^{nd} order control system for $\xi = 0$ and $\xi = 1$.

g) Give classification of controllers.

P.T.O.

Marks

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

a) List examples of closed loop control system. Describe any one.

b) Find the transfer function of given electrical circuit shown in Figure No. 1.

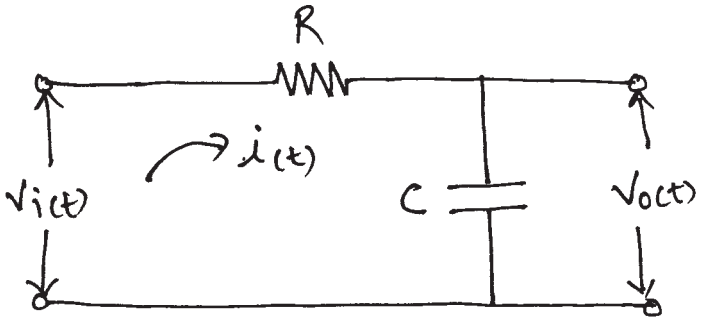

Fig. No. 1

c) With the help of neat diagram, describe working principle of potentiometer as an error detector.

c) With the help of output equation, transfer function, describe integral control action.

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

a) Compare pneumatic and electric actuator on the basis of type of input applied (i.e. driven mode), conversion of energy, accuracy and efficiency.

b) Draw different standard test signals and write its Laplace representation.

c) Describe working principle of ON-OFF control action. Define neutral zone.

d) With the help of neat diagram, describe working principle of electro-mechanical relay.

Marks

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

a) A 2nd order control system has $\frac{C_{(S)}}{R_{(S)}} = \frac{25}{S^2 + 6S + 25}$,

for unit step input determine natural frequency, damped frequency, settling time and peak time.

b) State the equation for time response of first order system for unit step input. Draw its response. Define time constant.

c) With the help of neat diagram, describe working principle of reed relay.

d) With the help of neat block diagram describe working of DC servo position system.

e) Describe working principle of double acting pneumatic cylinder.

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

a) Using block diagram reduction technique derive the transfer function of given system shown in Fig. No. 2.

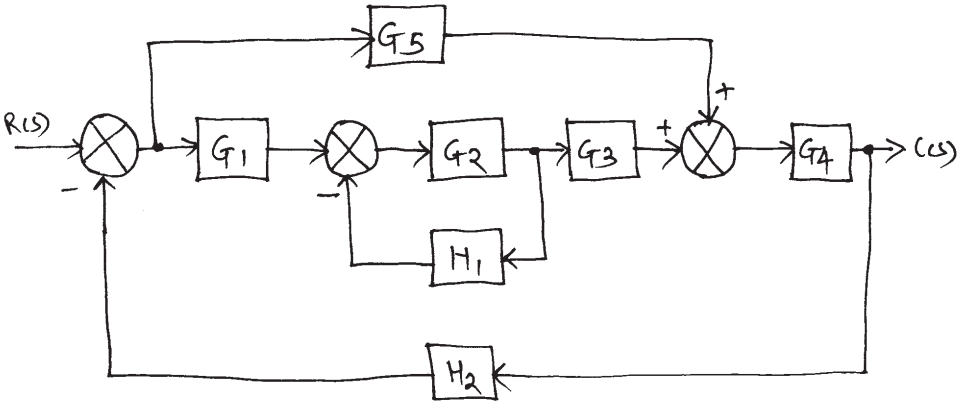

Fig. No. 2

b) Describe working principle of PID controller with output equation, transfer funciton, block diagram and output response.

c) For a given control system - Calculate number of zero's, poles and plot them on s-plane. Also write, characteristics equation and order of system.

$$G_{(S)} = \frac{S^2 - 4}{S^2 + 6S + 8}$$

P.T.O.

Marks

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

a) Find the range of values of k so that the system with following characteristics equation will be stable.

$$F(S) = S(S^2 + S + 1)(S + 4) + K = 0$$

b) A unity feedback system has open loop transfer function

$$G(S) = \frac{10\ (S\ +1)}{S(S\ +\ 2)\ (S\ +\ 5)}$$

Calculate static error co-efficients and steady state error for $r_{(t)} = 3 + 10\ t$.

c) Describe working principle of permanent magnet stepper motor with neat diagram. Also calculate stepping angle of stepper motor for 8 no. of teeth / poles of stator and 6 no. of teeth / poles of rotor

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