# 313329

**12526**

**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 answer 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 one difference between time variant and time invariant control system. Give one example for each of them.

b) Define transient response and steady state response for any system.

c) Define Proportional Band. State its relation with error.

d) Classify servo system. Draw and label block diagram of servo system.

e) Identify the no. of ports and no. of positions of 3/2 directional control valve.

f) State the rule of shifting a take-off point after the block of block diagram reduction technique.

g) State the equation and applications (any two) of PD controller.

P.T.O.

**Marks**

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

a) Determine the transfer function of the RC network.

b) For the given transfer function $\frac{C(S)}{R(S)} = \frac{10(S+3)}{S(S^2 + 8S + 7)}$

Find out:

i) Poles

ii) Zeros

iii) Characteristic equation

iv) Pole-zero plot in s-plane.

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

d) Describe the on-off control action with equation.

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

a) Sketch the symbol of 3/2 and 2/2 Directional control valves for NO and NC position.

b) Find out the static error constants for a unity feedback system with –

$G(S)\ H(S) = \frac{15}{(S + 10)}$.

c) i) Name the Block diagram shown in Figure No. 1.

ii) Identify the block "A" in given block diagram.

iii) State the function of block "A".

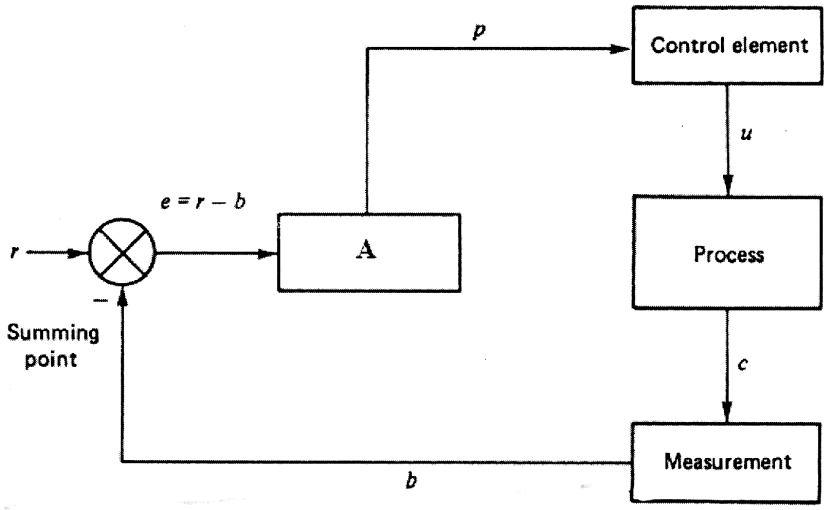


**Fig. No. 1**

**Marks**

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

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

a) State the effect of damping on second order system for the value of ζ(zeta) are '0' and '1' in terms of nature of response and system classification.

b) Derive output time response of 1st order control system for unit step as an i/p signal.

c) Describe the working of solid state relay with diagram. State its applications (Any two points).

d) Describe the working of AC servo motor with diagram.

e) Compare pneumatic, hydraulic and electric actuators based on given parameters.

i) Energy source

ii) Distribution

iii) Output force

iv) Energy storage

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

a) Derive the transfer function of the given block diagram in Figure No. 2.

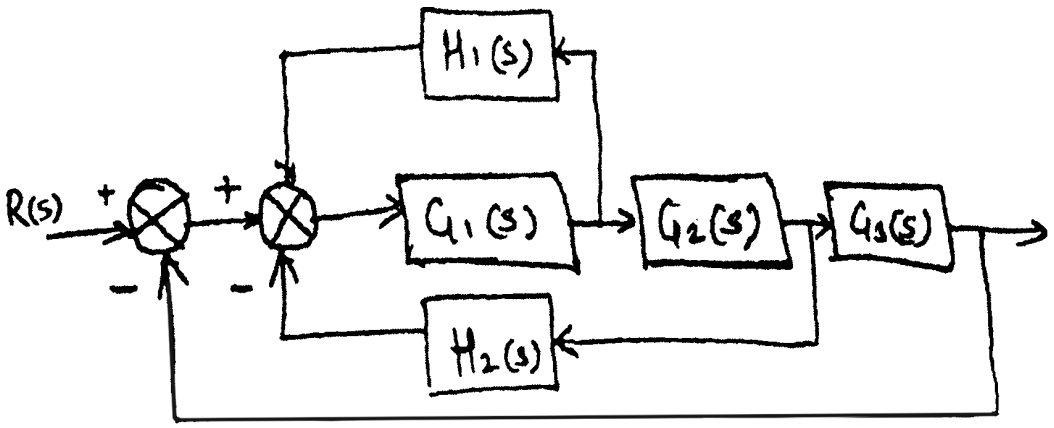


**Fig. No. 2**

**Marks**

b) Compare PI, PD and PID control action based on given parameters.

i) Type of combination

ii) Stability

iii) Equation

iv) Steady state error

v) Gain

vi) Uses.

c) Derive the transfer function of negative feedback system.

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

a) Find out setting time and peak time for unity feedback system with open loop transfer function $G(S) = \frac{1}{S(S+1)}$.

b) Examine stability by Routh criterion for Characteristic equation $S^4 + 10S^3 + 50S + 24 = 0$.

c) Compare DC servo motor with stepper motor. (Any six points)