

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.

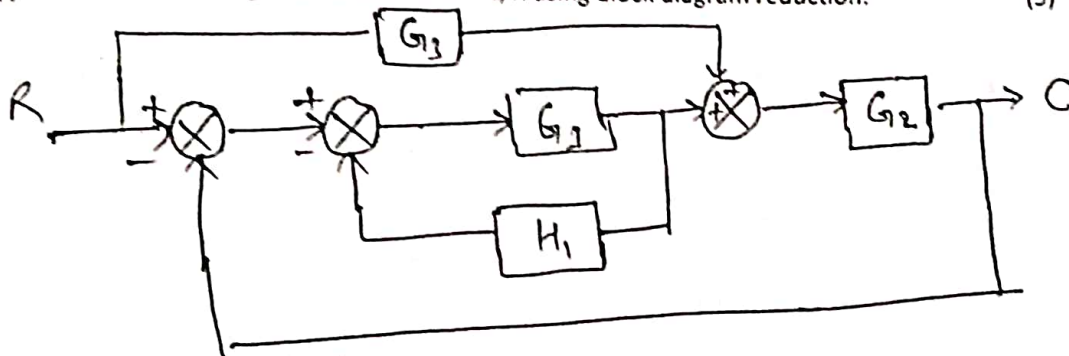
x-x-x

- Q.1
- What is the effect of positive and negative feedback on any system?
 - How transfer function can be obtained from state model?
 - What is the necessity of a compensator?
 - Define state vector as used in state space analysis?
 - Give the importance of Gain Margin and Phase Margin?

(5 x 2)

Part A

- Q.2 (i) From the block diagram determine the C/R using block diagram reduction. (5)



- (ii) A unity feedback control system has its open loop transfer function given by $G(s) = (4s+1)/4s^2$. Determine an expression for the time response when the system is subjected to (i) unit impulse input function and (ii) unit step input function. (5)

- Q.3 (i) What is the necessary and essential condition for the stability according to Routh's Criterion? Hence find the stability of the system described by characteristic equation

$$s^5 + s^4 + s^3 + s^2 + 3s + 15 = 0 \quad (5)$$

- (ii) Write short notes on following two:

- DC Tacho- generators
- Error detectors - potentiometers and synchro's.

(5)

P.T.O.

(2)

Q.4. Draw the root loci of the open loop transfer function of the feedback control system given below and comment about the stability. $G(s)H(s) = \frac{K}{s(s+4)(s+5)}$ (10)

Part B

Q.5 Sketch the Bode plot for the system whose transfer function is $G(s) = \frac{100(1+0.1s)}{s(1+0.2s)(1+0.5s)}$ and determine the following and comment upon the stability.

- (i) Gain crossover frequency
- (ii) Phase crossover frequency
- (iii) Gain margin
- (iv) Phase margin for the transfer function

(10)

Q.6 (i) Explain the significance of controllability and observability of a state model using one physical example. Test the following system for these two characteristics:

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} u(t)$$

$$y(t) = [1 \ 0 \ 0]x(t)$$

(6)

(ii) List various factors for selection of compensators in control system and hence justify the need for compensation.

(4)

Q.7 (i) what is meant by tuning of PID controller? Why is it important? Explain one empirical method used for tuning the parameters.

(5)

(ii) What is the importance of pole placement on system performance? Hence explain the pole placement design concept.

(5)