GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fourth Semester - Regular) Examinations, May – 2024

22BELPC24002 / 22BEEPC24002 – Control Systems

(EE & EEE)

Time: 3 hrs Maximum: 70 Marks

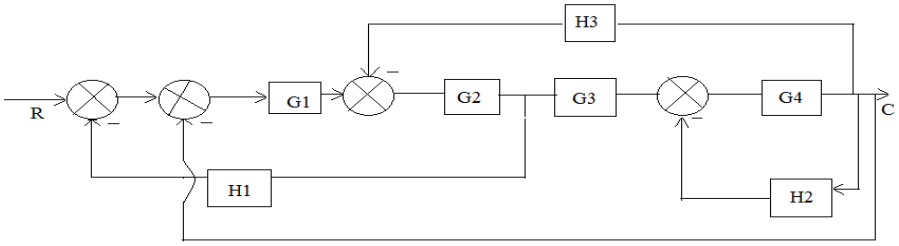
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

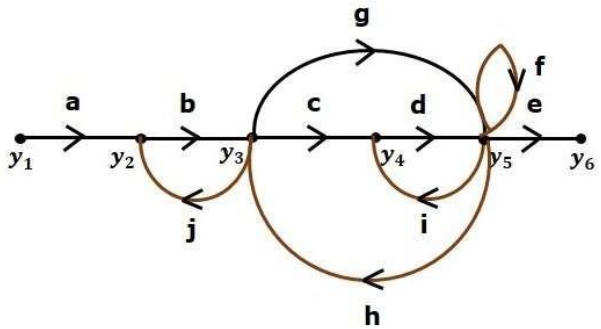
Q.1. Answer ***ALL*** questions	CO	Blooms Level
a. Why negative feedback is preferred in control system?	CO1	K2
b. What do you mean by transient response and steady state response of a dynamic system?	CO2	K2
c. What do you mean by gain crossover & phase crossover frequencies of a system?	CO4	K1
d. What is the necessary & sufficient conditions for stability using Routh's criterion?	CO3	K1
e. What do you mean by frequency response of a system?	CO4	K2

PART – B **(15 x 4 = 60 Marks)**

Answer ***ANY FIVE*** the questions	Marks	CO	Blooms Level
2. a. Using block diagram reduction technique, determine overall transfer function C/R.	8	CO1	K5



b. The open loop transfer function of a servo system with unity feedback is G(s)= $\frac{20}{S(0.1S+1)}$. Evaluate the static error constants and obtain steady state error of the system when subjected to $r(t) = 2 + 3t + 4t^2$	7	CO2	K5
(OR)			
c. Determine the overall transfer function T(s) of the system using Mason' Gain Formula.	7	CO2	K3



d. Derive the output expression of a second order system when it is subjected to a unit step input.	8	CO2	K4

3.a.	For a unity feedback system, the open loop transfer function is given by G(s)= $\frac{K}{(S+1)(S+3)(s^2+4S+20)}$. Using Routh's criterion, determine (i) The range of K the system to be stable (ii) At what value of K, the system becomes unstable (iii) Determine the frequency of oscillations at the limiting value of K	7	CO3	K3
b.	Sketch the root locus plot for the system G(s)H(s) = $\frac{K(S+4)}{S(S^2+2S+2)}$. Determine (i) The range of K the closed loop system to be stable (ii) The value of K the system is marginally stable (iii) The value of K the system is unstable	8	CO3	K4
	(OR)			
c.	For a system with characteristic equation $s^6+3s^5+4s^4+6s^3+5s^2+3s+2=0$. Examine the stability	7	CO3	K3
d.	Sketch the root locus plot of the open loop transfer function G(s)H(s) = $\frac{K}{S(S+2)(s^2+2S+5)}$. Investigate the stability of the system.	8	CO3	K4
4.a.	A certain unity feedback control system is given by G(S) = $\frac{K}{S(1+S)(1+0.1S)}$ Draw the Bode-plot of the system and hence determine the value of K so as to have (i) GM=10db (ii) PM=50^0	10	CO4	K4
b.	If the input of a system is r(t) =5u(t), and G(S) = $\frac{(S+3)}{(S+4)}$. Find the steady state error.	5	CO2	K3
	(OR)			
c.	The open loop transfer function of a certain unity feedback system is G(S) = $\frac{K}{S(S+2)(S+20)}$. Construct the Bode-plots and determine (i) Limiting value of K for system to be stable (ii) Value of K for gain margin to be 10db (iii)Value of K for phase margin to be 50^0	10	CO4	K4
d.	Determine the value of damping ratio, Natural frequency of the system whose transfer transfer function is G(S) = $\frac{10}{(S+2)(S+5)}$. Also specify the nature of step response.	5	CO2	K3
5.a.	Draw the Nyquist Plot for the system whose open loop transfer function is G(S)H(S) = $\frac{K}{S(S+2)(S+10)}$. Determine the range of K for which the close loop system is stable.	10	CO4	K5
b.	Sketch the polar plot for the transfer function G(S) = $\frac{1}{S^2(S+10)}$	5	CO4	K3
	(OR)			
c.	Comment on the stability of the system by Nyquist Stability Criterion whose open loop transfer function is G(S)H(S) = $\frac{1}{S(1+S)(1+2S)}$	10	CO4	K5
d.	Sketch the polar plot for the transfer function G(S) = $\frac{10}{S(1-S)}$	5	CO4	K3

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