Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Fourth Semester – Regular/Supplementary) Examinations, April 2026

23BELPC24002 / 23BEEPC24002 – CONTROL SYSTEMS

(EE /EEE)

Time: 3 hrs Maximum: 60 Marks

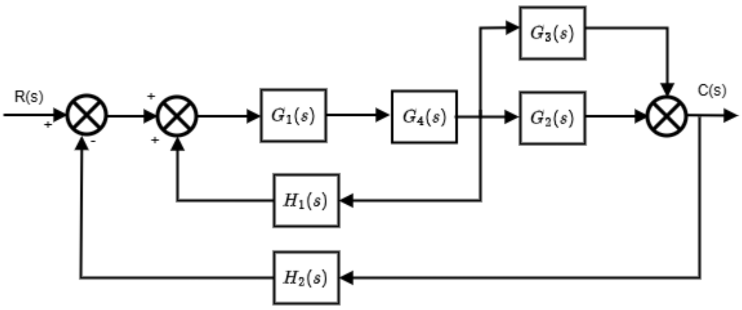
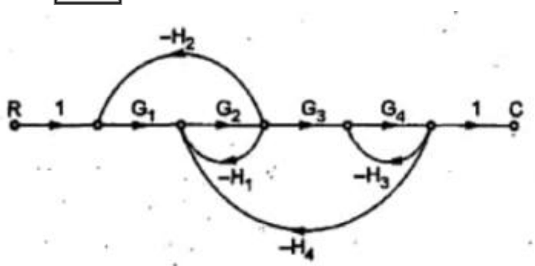
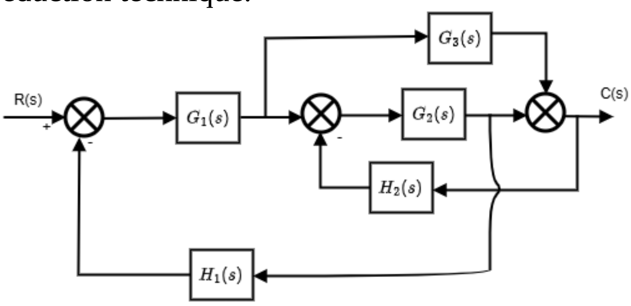
Answer ALL questions

(The figures in the right hand margin indicate marks)

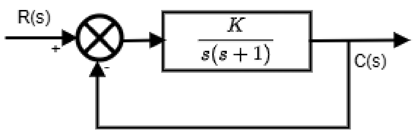
PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	State the condition required for a transfer function to exist.	CO1	K1
b.	Define non-touching loops.	CO2	K2
c.	Define velocity error constant.	CO3	K1
d.	What information can be obtained from the first column of the Routh array?	CO4	K1
e.	What are gain margin and phase margin?	CO4	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Find out the transfer function of following block diagram using Block diagram reduction technique. 	5	CO1	K3
b.	Find the transfer function of the following system using Mason's Gain Formula 	5	CO1	K3
	(OR)			
c.	Derive the expression for Force-Current analogy.	5	CO1	K2
d.	Find out the transfer function of following block diagram using Block diagram reduction technique. 	5	CO2	K3

3.a. Assuming r(t) = 0.1 t and it is desired that $e_{ss} \leq 0.005$, find the range of K for error to be within specified limit for the given system: 5 CO2 K3



b. A unity feedback system has $G(s) = \frac{K}{s(s+2)(s^2+2s+5)}$

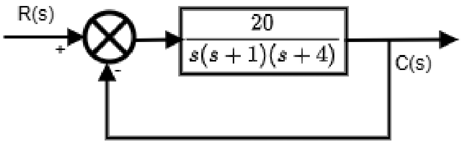
(i) For a unit step input, it is desired $e_{ss} \leq 0.2$, Find K. 5 CO2 K3

(ii) Determine e_{ss} if the input $r(t) = 2 + 4t + \frac{t^2}{2}$

(OR)

c. Derive the expression for the unit step response of a second order underdamped system. 5 CO2 K2

d. For the given system obtain the closed loop transfer function, damping ratio, natural frequency and the expression for the output response if subjected to unit step input. 5 CO2 K3



4.a. Investigate the stability using RH-criteria for following characteristic equation: 5 CO3 K3

$$s^5 + 2s^4 + 3s^3 + 6s^2 + 2s + 1 = 0$$

b. The closed loop trans function of a system is given by $\frac{C(s)}{R(s)} = \frac{K}{s(s^2+s+1)(s+2)+K}$ Determine the value of K for which the system is stable. 5 CO3 K3

(OR)

c. For unity feedback system, $G(s) = \frac{K}{s(s+2)(s+8)}$, Sketch the root locus. 5 CO3 K3

d. For unity feedback system, $G(s) = \frac{K}{s(1+2s)(1+9s)}$, Find the range of K, marginal value of K and frequency of sustained oscillation. 5 CO3 K3

5.a. For unity feedback system, $G(s) = \frac{80}{s(s+2)(s+20)}$ Draw the bode plot. 5 CO4 K3

b. From Q.5(a) Determine the GM, PM, gain and phase crossover frequencies. 5 CO4 K3

(OR)

c. For the transfer function $G(s)H(s) = \frac{20}{s(s+2)(s+10)}$, Draw the Polar plot 5 CO4 K3

d. From Q.5(c) Determine the GM, PM, gain and phase crossover frequencies. 5 CO4 K3

6.a. Explain the working principle of a PID controller 5 CO5 K2

b. For unity feedback system, $G(s) = \frac{K}{s(1+0.4s)(1+0.25s)}$, Find the range of K, marginal value of K and frequency of sustained oscillation. 5 CO5 K3

(OR)

c. For the transfer function, $G(s)H(s) = \frac{60}{s(s+2)(s+10)}$, Draw the Nyquist Plot. 5 CO5 K3

d. From Q.6(c) Determine the GM, PM, gain and phase crossover frequencies. 5 CO5 K3

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