Reg. No.															

Question Paper Code	13534

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fourth Semester

Electrical and Electronics Engineering

20EEPC404 - CONTROL ENGINEERING

Regulations - 2020

(Usage of Ordinary, Semi-log and Polar Graph sheet are permitted)

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	In control system block diagrams, which mathematical operation is performed at summing points? (a) Addition or subtraction (b) Multiplication (c) Integration (d) Differentiation	1	K1	CO1
2.	The primary advantage of using a closed-loop control system over an open-loop control system is: (a) Simplified system design (b) Reduced system complexity (c) Improved accuracy and stability in output (d) Reduced cost of implementation	1	K1	CO1
3.	What is the term used for the time taken by the system output to reach 50% of the final value for the first time? (a) Rise time (b) Settling time (c) Delay time (d) Peak time	1	K1	CO2
4.	The Laplace transform of a unit ramp signal is: (a) 1/s (b) $1/s^2$ (c) s (d) s^2	1	K1	CO2
5.	In the Routh-Hurwitz criterion, if the first column of the Routh array has more than one sign change, the system: (a) Is stable (b) Has a marginally stable response (c) Is unstable (d) Is critically stable	1	K1	CO3
6.	In the Nyquist stability criterion, if the Nyquist plot encircles the critical point (-1, 0) in the clockwise direction, the system is: (a) Stable (b) Unstable (c) Marginally stable (d) Indeterminate	1	K1	CO3
7.	What is the significance of phase margin in a frequency domain analysis? (a) It indicates the system's ability to handle sudden changes in input (b) It indicates the system's stability margin (c) It indicates the system's gain margin (d) It indicates the system's bandwidth	1	K1	CO4
8.	Select the two plots in a Bode plot. (a) Magnitude and phase (b) Gain and bandwidth (c) Time and frequency (d) Open-loop and closed-loop	1	K1	CO4
9.	A compensator is classified as a lead compensator if the phase introduced by the compensator is: (a) Positive (b) Negative (c) Zero (d) None of the above	1	K1	CO5
10.	Which of the following compensators is designed to improve the phase margin and transient response by adding positive phase shift at high frequencies? (a) Lag compensator (b) Lead compensator (c) Lag-Lead compensator (d) Proportional compensator	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

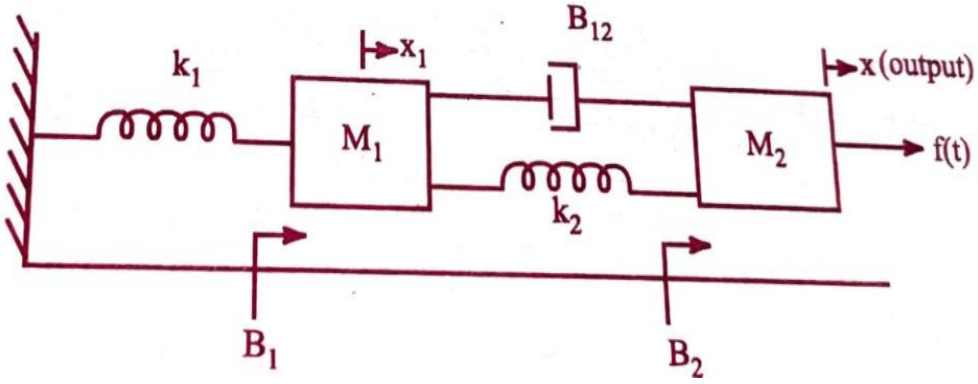
11.	Contrast between open loop and closed loop system.	2	K2	CO1
12.	Infer the Torque balance equation for rotational spring element.	2	K2	CO1

13.	What is the effect of positive feedback on stability?	2	K1	CO1
14.	Interpret pole and zero of a system.	2	K2	CO2
15.	Outline the static error constants.	2	K2	CO2
16.	A unity feedback system has an open loop transfer function. G(s)= 25(S+4)/S(S+0.5)(S+2). Show the steady state error for unit ramp input.	2	K2	CO2
17.	How the angle of asymptotes could be found?	2	K1	CO3
18.	Outline the Nyquist stability criterion.	2	K2	CO3
19.	Define bandwidth.	2	K1	CO4
20.	List the available methods to obtain the closed loop frequency response from open loop frequency response.	2	K1	CO4
21.	Discuss the effect of adding a zero to open loop transfer function of a system.	2	K2	CO5
22.	Infer the transfer function of lead compensator.	2	K2	CO5

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Make use of differential equations governing the mechanical system given below and determine the transfer function.	11	K3	CO1



OR

	b)	Calculate the overall gain C(s)/R(s) for the signal flow graph shown in fig.1	11	K3	CO1

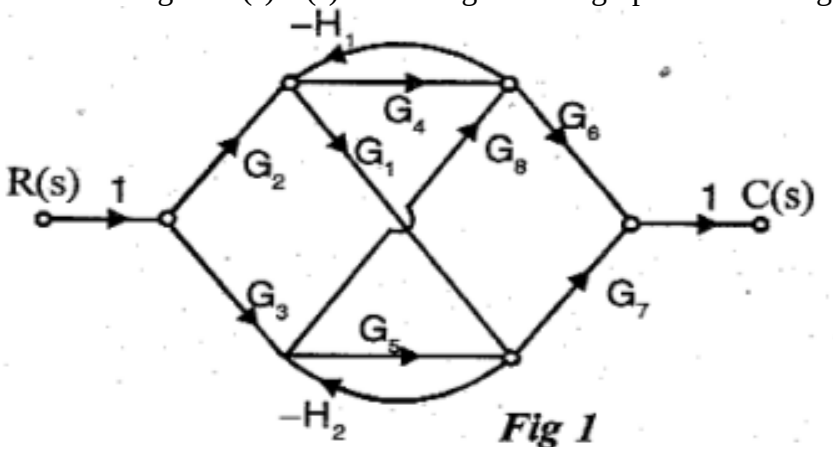
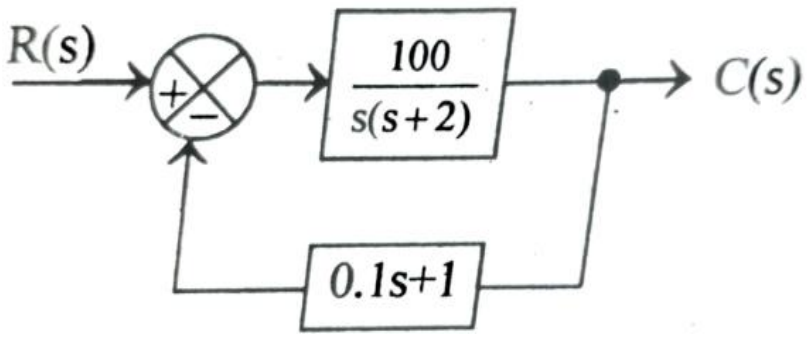


Fig 1

24.	a)	A positional control system with velocity feedback is shown in fig. Develop the response of the system for unit step input.	11	K3	CO2



OR

	b)	The unity feedback system is characterized by an open loop transfer function G(s)= K/s(s+10). Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak overshoot and peak time for a unit step input.	*11*	*K3*	*CO2*
25.	a)	G(s)= K/s(s+2)(s+4) construct the Root locus and find the value of K so that ζ =0.5.	*11*	*K3*	*CO3*

OR

	b)	The characteristic polynomial of a system is $s^7+9s^6+24s^5+24s^4+24s^3+24s^2+23s+15=0$. Use R-H Criterion and determine the location of roots on s-plane and hence the stability of the system.	*11*	*K3*	*CO3*
26.	a)	Make use of unit step input and obtain the expressions for frequency domain specifications.	*11*	*K3*	*CO4*

OR

	b)	Model a bode plot for the unity fed back control system with transfer function $G(s) = 75(1+0.2s)/s(s^2+16s+100)$, also determine its phase margin and gain margin.	*11*	*K3*	*CO4*
27.	a)	Develop the frequency response of lag-lead compensator.	*11*	*K3*	*CO5*

OR

	b)	The open loop transfer function of certain unity feedback control system is given by G(s) = K/s(s+4)(s+80).It is desired to have the phase margin to be at least 33˚ and the velocity error constant Kv =30sec^{-1}. Develop a phase lag series compensator.	*11*	*K3*	*CO5*
28.	a) (i)	Make use of polar plot for the following transfer function and find Gain margin and Phase margin. G(S)= 1/S(1+S)(1+2S)	*6*	*K3*	*CO4*
	(ii)	Make use of Electrical network and realize the Lag compensator.	*5*	*K3*	*CO5*

OR

	b) (i)	Make use of type and order of a system and draw the typical polar plots of: Type 0 Order 3 Type 1 Order 3 Type 2 Order 4 Type 2 Order 5	*6*	*K3*	*CO4*
	(ii)	Organize the procedure for design of lead compensator using Bode plot.	*5*	*K3*	*CO5*