Question Paper Code: R15A31CE03

R15

ANURAG Engineering College

(An Autonomous Institution)

III B.Tech I Semester Supplementary Examinations, Dec–2023/Jan-2024

CONTROL SYSTEMS ENGINEERING

(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time: 3 Hours **Max.Marks:75**

Section – A (Short Answer type questions) (25 Marks)

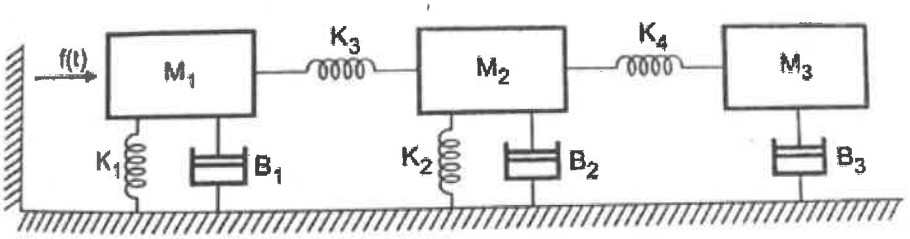
Answer All Questions

		Course Outcome	B.T Level	Marks
1.	What is the difference between the open loop and closed loop systems?	CO1	L1	2M
2.	Discuss the effects of feedback on overall gain and stability?	CO1	L2	3M
3.	List some Standard test signals and their Laplace Transforms.	CO2	L1	2M
4.	Discuss the effects on the performance of a second order control systems of i) Proportional Derivative controller ii) Proportional Integral controller	CO2	L2	3M
5.	Write necessary condition for Routh Hurwitz criterion.	CO3	L1	2M
6.	List the advantages of using root locus for design?	CO3	L2	3M
7.	Explain Nyquist stability criterion.	CO4	L2	2M
8.	Define all frequency domain specifications.	CO4	L1	3M
9.	Draw the block diagram representation of state space model.	CO5	L2	2M
10.	Give properties of state transition matrix?	CO5	L2	3M

Section B (Essay Questions)

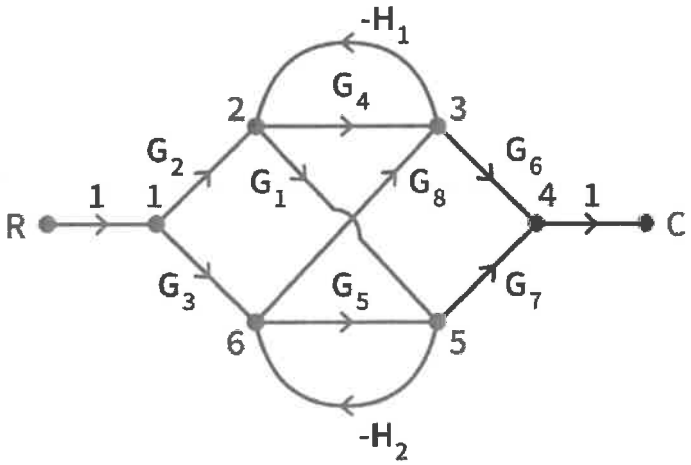
Answer all questions, each question carries equal marks. **(5 X 10M = 50M)**

11. A)	Define Transfer Function and Obtain Transfer Function of given Mechanical Translational system using its mathematical model.	CO1	L2	10M



OR

B)	Find the overall Transfer function of the system whose signal flow graph is shown in figure.	CO1	L3	10M



12. A)	A unity feedback system is characterized by an open loop transfer function, $G(s) = \frac{k}{s(s+10)}$. Determine gain K so that 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. Also obtain closed loop response in time domain.	CO2	L3	10M
	OR			
B)	For a unity feedback control system, the open loop transfer function is $$G(S) = \frac{20}{S(1+4S)(1+S)}$$ Determine i) The position, velocity, acceleration error constants ii) The steady state error of the system for input $r(t) = 2 + 4t + \frac{t^2}{2}$.	CO2	L3	10M
13. A)	Determine the range of K for stability of unity feedback system, using Routh stability Criterion whose Transfer function. $$G(S) = \frac{K}{S(S+4)(S^2+S+1)}$$	CO3	L3	10M
	OR			
B)	The open loop transfer function of a unity feedback system is given by $$G(S)H(S) = \frac{K}{S(S+1)(S+2)}$$ Sketch the root locus of the system and evaluate the system stability with respect to their location of poles.	CO3	L3	10M
14. A)	Given $G(s) = \frac{Ke^{-0.2s}}{s(s+2)(s+8)}$. Find K so that the system is stable with Gain margin = 6 db and Phase margin =45^0 using Bode plot.	CO4	L3	10M
	OR			
B)	Derive the transfer function of i) Lead Network ii) Lag Network.	CO4	L3	10M
15. A)	Define Controllability and Observability and Test Controllability and Observability for the state model whose $$\dot{X}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} X(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} U(t); \quad y = [3 \quad 4 \quad 1]X(t)$$	CO5	L3	10M
	OR			
B)	Obtain the state space model of the system with transfer function. $$\frac{Y(s)}{U(s)} = \frac{6}{S^3+6S^2+11S+6}$$	CO5	L3	10M