R22 Regulation *Subject code: 4E4BD*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech IV Semester Supplementary Examinations, December 2025

CONTROL SYSTEMS

(EEE)

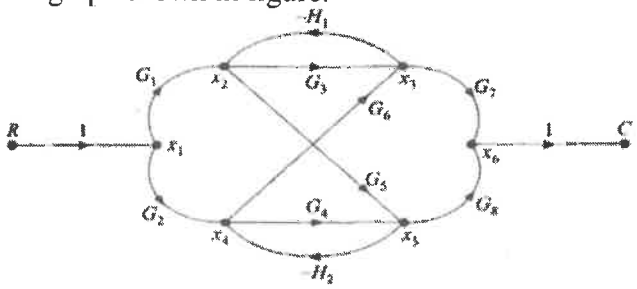
Maximum Marks: 60 Date:23.12.2025 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	Bloom Tx
1.a)	What is Open and Closed loop feedback?	1M	CO1	BL2
b)	What are the basic elements in control systems?	1M	CO1	BL1
c)	Define maximum peak overshoot.	1M	CO2	BL1
d)	Distinguish between type and order of the system.	1M	CO2	BL1
e)	Give the necessary condition for stability.	1M	CO3	BL2
f)	What is centroid?	1M	CO3	BL2
g)	Define phase margin.	1M	CO4	BL1
h)	What are the frequency domain specifications?	1M	CO4	BL1
i)	List the advantages of state space analysis.	1M	CO5	BL2
j)	Give the need of observability test.	1M	CO5	BL1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	Bloom Tx
2	Using mason gain formula find the transfer function CR for the signal flow graph shown in figure. 	10M	CO1	BL3
	OR			
3	a) Give the block diagram reduction rules to find the transfer function of the system. b) List the properties of signal flow graph.	6M 4M	CO1	BL2

4	Derive the expression for second order system for under damped case and when the input is unit step.	10M	CO2	BL3
	OR			
5	a) For servo mechanisms with open loop transfer function $G(S)H(S) = \frac{20(S+2)}{S(S+1)(S+3)}$, determine the type of input signal that results in a constant steady-state error, and calculate the value of that error. b) For a unity feedback control system, the open loop transfer function $G(S) = \frac{10(S+2)}{S^2(S+1)}$, Determine the position, velocity and acceleration error constants.	5M 5M	CO2	BL4
6	With the help of Routh's stability criterion find the stability of the following systems represented by the characteristic equations: a. $s^4 + 8s^3 + 18s^2 + 16s + 5 = 0$ b. $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$.	10M	CO3	BL3
	OR			
7	Sketch the root locus of the system whose open loop transfer function is $G(S)H(S) = \frac{K(S+9)}{S(S^2+4S+11)}$.	10M	CO3	BL4
8	Sketch the Bode plot for the following transfer function $G(S)H(S) = \frac{Ke^{-0.1S}}{S(S+1)(1+0.1S)}$.	10M	CO4	BL4
	OR			
9	A system is given by $G(S)H(S) = \frac{(4S+1)}{S^2(S+1)(2S+1)}$ Sketch the nyquist plot and determine the stability of the system.	10M	CO4	BL3
10	a) Define state, state variable, state equation. b) Derive the expression for the transfer function from the state model. $\dot{X} = Ax + Bu$ and $Y = Cx + Du$	5M 5M	CO5	BL3
	OR			
11	Examine the controllability and observability of a system having following coefficient matrices. $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}; B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}; C^T = \begin{bmatrix} 10 \\ 5 \\ 1 \end{bmatrix}$	10M	CO5	BL3