R22 Regulation *Subject code:4E4BD*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech IV Semester Regular/Supplementary Examinations, June 2026

CONTROL SYSTEMS

(EEE)

Maximum Marks: 60 Date:15.06.2026 Duration: 3 hours

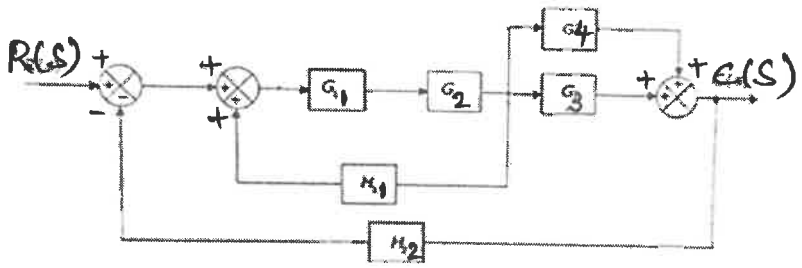
Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	Bloom Tx
1.a)	What are the effects of feedback on stability?	1M	1	1
b)	List the basic elements used for modelling a mechanical rotational system?	1M	1	1
c)	The overall transfer function of a certain system is K/(s+K). The system requires 0.9 second to indicate 95% of response when subjected to a unit step excitation. Calculate the value of K.	1M	2	2
d)	Why is overdamped response slower than critically damped response?	1M	2	1
e)	What is breakaway point?	1M	3	1
f)	What is conditional stability?	1M	3	1
g)	Define resonant peak.	1M	4	1
h)	Can lag compensation improve transient response?	1M	4	3
i)	Define State and State Variable	1M	5	1
j)	If $\varphi(t)$ is the state transition matrix then determine $\varphi(t)$.	1M	5	1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	Bloom Tx
2	a) Explain the Open Loop and Closed Loop Control system with example. b) Define Sensitivity and obtain the sensitivity of closed loop system transfer function subject to G(s).	6M 4M	1 1	2 2
	OR			
3	Simplify the block diagram and find its Transfer function C(s)/R(s).	10M	1	3



4	With a step input of unity feedback control system which has an open loop transfer function $G(S)=10S/(S+4)$. Find the following terms i) Rise time ii) Peak time iii) Settling time iv) Percentage overshoot,	10M	2	4
	OR			
5	Derive the expression for the steady state error (SSE) to the Step, Ramp, Parabolic inputs and Explain how SSE depends on Type of input.	10M	2	3
6	The open loop transfer function of a closed loop system with unity feedback is given by $G(S)=\frac{k}{(S+2)(S+4)(S^2+6S+2)}$ .By applying Routh criteria infer the stability of closed loop system as a function of k which is causing sustained oscillations and find the frequency of oscillations.	10M	3	3
	OR			
7	a) Sketch the root locus of the system, whose open loop transfer function is $G(s)=\frac{K(S+15)}{S(S+1)(S+5)}$. b) Explain the advantages of root locus method.	5M 5M	3 3	4 2
8	Draw Bode plot for $G(s)=\frac{10}{s(0.4s+1)(0.1s+1)}$. Determine gain and phase crossover frequencies.	10M	4	2
	OR			
9	A unity feedback system has an open loop transfer function $G(S)=K/S(3+S)(10+S)$. Design a suitable lag compensation so that phase margin is 45^0 and velocity error constant, Kv ≤15.	10M	4	3
10	a)Find the transfer function of the system having the state model $\begin{bmatrix}\dot{x_1}\\ \dot{x_2}\end{bmatrix}=\begin{bmatrix}0 & 1\\ -3 & -4\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u(t)$ $y(t)=\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$ b) State and prove properties of state transition matrix.	6M 4M	5 2	3 3
	OR			
11	Comment on the stability, controllability and observability of a system. $A=\begin{bmatrix}1 & 5\\ 6 & 8\end{bmatrix}\ B=\begin{bmatrix}0\\ 1\end{bmatrix}\ C=\begin{bmatrix}1 & 1\end{bmatrix}$	10M	5	3