R22 Regulation *Subject code:4E5DA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech V Semester Supplementary Examinations, April 2026

CONTROL STSTEMS

(ECE)

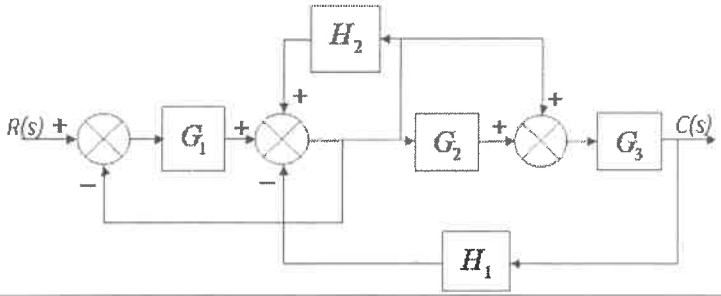
Maximum Marks: 60 Date:15.04.2026 Duration: 3 hours

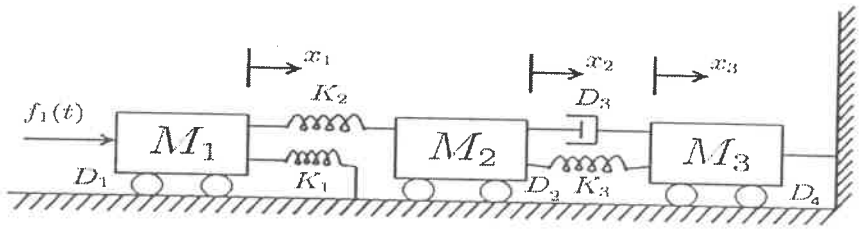
Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	BTL
1.a)	What is meant by closed-loop control system?	1M	1	L1
b)	What are the advantages of feedback in control systems?	1M	1	L1
c)	What are standard test signals used in control systems?	1M	2	L1
d)	What is the rise time?	1M	2	L1
e)	Define relative stability.	1M	3	L1
f)	What happens if all elements of a row in Routh's array are zero?	1M	3	L4
g)	What is a lead compensator?	1M	4	L1
h)	List any two applications of a PID controller.	1M	4	L3
i)	What is the state transition matrix?	1M	5	L1
j)	List any two properties of the state transition matrix.	1M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	a) What is f feedback? Explain effects of feedback.	5M	1	L2
	b) Determine the transfer function for the block diagram shown in Figure below.	5M	1	L3
				
	OR			

3	a) Develop the differential equations governing the mechanical system as shown in below figure. Also find the transfer function $x_1(s)/F(s)$ 	10M	1	L3
4	a) Explain the importance of standard test signals in control system design.	5M	2	L2
	b) Explain the time domain specifications of a second-order system.	5M	2	L2
	OR			
5	Derive expressions for rise time, peak time, maximum overshoot, and settling time of a second-order system.	10M	2	L2
6	a) Explain the limitations of the Routh-Hurwitz criterion.	5M	3	L2
	b) Draw the root locus plot for $G(S)H(s)=k/s(s+1)(s+3)$	5M	3	L3
	OR			
7	Using the Routh criterion to check the stability of the system given by characteristic equation $2s^6+s^5+2s^4+s^3+3s^2+5s+6=0$	10M	3	L3
8	a) A unity feedback system has $G(s) = 10/S(s+1)(s+2)$ draw the Nyquist plot and determine the closed loop system stability.	5M	4	L3
	b) Explain the working of a PI controller.	5M	4	L2
	OR			
9	Sketch the polar plot of the transfer function $G(s) = 12/s^2(s+1)$	10M	4	L2
10	a) Define state and state variable. List the properties of state transition matrix.	5M	5	L3
	b) State and explain the conditions for controllability and observability of a system.	5M	5	L2
	OR			
11	a) List the advantages of state-space analysis compared to classical methods.	5M	5	L2
	b) For the system: $\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ $y=[1 \quad 0]x$ Determine whether the system is controllable and observable.	5M	5	L4