R20 Regulation *Subject code: 3P5DB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech V Semester Supplementary Examinations, April 2026

CONTROL SYSTEMS

(ECE)

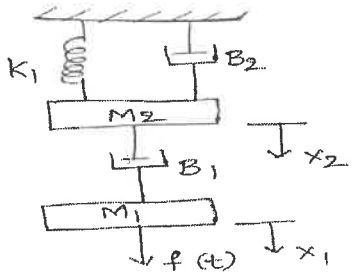
Maximum Marks: 70 Date: 24.04.2026 Duration: 3 hours

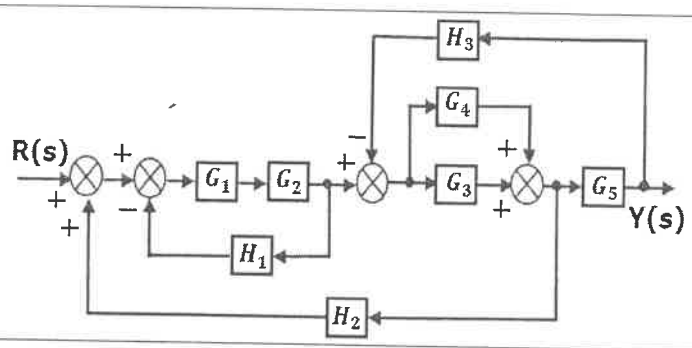
Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X2M=20 Marks)		Marks	CO	BTL
1	What are the characteristics of negative feedback?	2M	1	L1
2	State Mason's gain formula.	2M	1	L1
3	List the time domain specifications.	2M	2	L1
4	Find the peak overshoot for unit step response of the system described by closed loop transfer function, $G(s) = \frac{100}{S^2+20S+100}$.	2M	2	L1
5	What is Routh stability criterion?	2M	3	L1
6	What is phase and gain cross over frequency?	2M	3	L1
7	What is lag compensator?	2M	4	L1
8	What is polar plot?	2M	4	L1
9	List the advantages of state model compare to transfer function model?	2M	5	L1
10	Give the solution of non-homogeneous state equation.	2M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
11	Build the F-V, F-C Analogy circuits for following mechanical system. 	10M	1	L2
	OR			
12	Calculate the transfer function Y(S)/R(S) for the following block diagram.	10M	1	L2

				
13	A unity feedback control system has an open loop transfer function $G(s) = \frac{7}{s(s+2)}$. Determine the time domain specifications for a step input of 10 units.	10M	2	L2
	OR			
14	What are the time response specifications? Derive the expression for each of them.	10M	3	L2
15	Investigate the stability of a control system whose characteristic equation is given by: $S^4+3S^3+5S^2+2S+10=0$.	10M	3	L2
	OR			
16	Sketch the root locus for the following open loop transfer function $G(S)H(S) = \frac{K}{S(S^2+4S+13)}$	10M	4	L2
17	Sketch the Nyquist plot for the following system and verify whether the system is stable or not. $G(S) = \frac{100}{(S+2)(S+4)(S+8)}$	10M		
	OR			
18	Draw the electrical circuit diagram that represents the Lead-Lag compensator and explain in detail.	10M	4	L2
19	Given $X(t) = \begin{bmatrix} -3 & 2 \\ -1 & 0 \end{bmatrix}\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$ and $y = [1 \quad 0]\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$. a) Find Transfer function of the system b) Analyze the system stability with transfer function.	10M	5	L2
	OR			
20	a) What is observability? Explain the tests for observability. b) Test whether the system represented by $X(t) = \begin{bmatrix} 0 & 3 \\ -1 & -4 \end{bmatrix}\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$ and $y = [1 \quad 1]\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$ is observable or not.	5M 5M	5	L2