R20 Regulation *Subject code: 3P5DB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech V Semester Supplementary Examinations, November 2025

CONTROL SYSTEMS

(ECE)

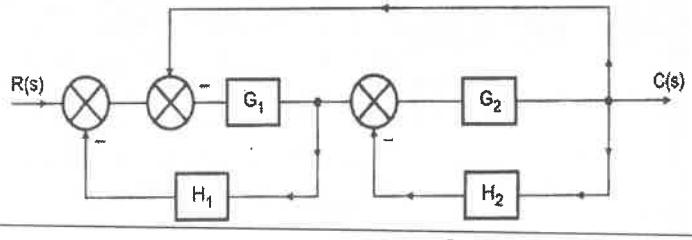
Maximum Marks: 70 Date: 12.11.2025 Duration: 3 hours

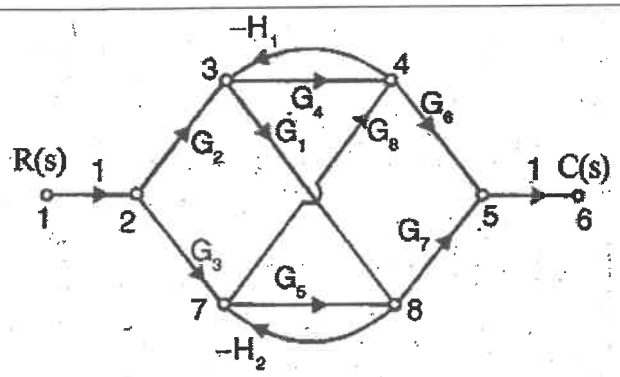
Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X2M=20 Marks)		Marks	CO	BTL
1	Define the closed loop control system. Give its properties.	2M	1	L1
2	Write the rule for eliminating negative feedback loop.	2M	1	L1
3	Define rise time.	2M	2	L1
4	Define steady state error.	2M	2	L1
5	What are asymptotes? How will you find the angle of asymptotes?	2M	3	L1
6	List the frequency domain specifications?	2M	3	L1
7	Draw the pole-zero plot of Lag-Lead compensator.	2M	4	L1
8	What is Nyquist stability criterion?	2M	4	L1
9	Define Observability.	2M	5	L1
10	What are the properties of state transition matrix?	2M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
11	By applying different rules which govern the block diagram reduction technique calculate the transfer function C(s)/R(s) of the given block diagram shown in below figure. 	10M	1	L2
	OR			
12	Calculate the transfer function of the following signal flow graph.	10M	1	L2

				
13	Define steady state error and estimate the static error components for Type 0, Type 1 &Type 2 systems for unit step input.	10M	2	L2
	OR			
14	A unity feedback system is characterized by an open-loop transfer function $G(s)=\frac{K}{S(S+5)}$. Determine the gain 'K' so that the system will have a damping ratio of 0.5. For this value of 'K' determine settling time, peak overshoot and time to peak overshoot for a unit-step input.	10M	3	L2
15	Sketch the root locus for the following open loop transfer function $G(S)H(S)=\frac{K}{S(S^2+4S+13)}$	10M	3	L2
	OR			
16	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	4	L2
17	Derive the expression for the transfer function of a lag-lead compensator.	10M		
	OR			
18	Draw the polar plot for the following system $G(S)=\frac{1+4S}{S(1+S)(1+2S)}$.	10M	4	L2
19	A system is described by $X(t)=\begin{bmatrix}1 & -1\\ 2 & 3\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}1\\ 0\end{bmatrix}u(t)$ and $y=[1 \quad 0]\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}$. Find the transfer function of the system and analyze stability of the system.	10M	5	L2
	OR			
20	Find the state equation and state variable matrix for the following differential equation. $\frac{d^2y}{dx^2}+7\frac{dy}{dx}+9y=2\frac{du}{dx}+u$.	10M	5	L2