



R22 Regulation

Subject code: 4E5DA

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech V Semester Regular/Supplementary Examinations, November 2025

CONTROL SYSTEMS

(ECE)

Maximum Marks: 60

Date: 18.11.2025

Duration: 3 hours

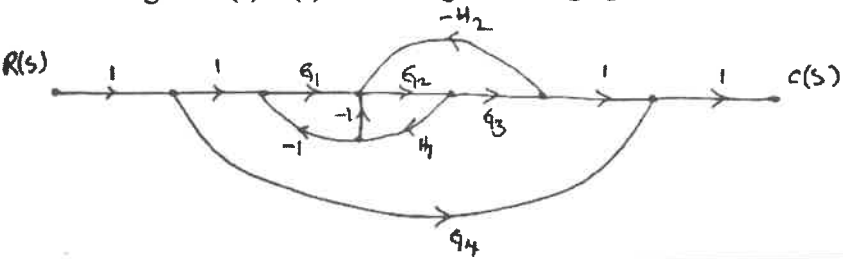
- Note: 1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
 3. Part B consists of 5 Units. Answer any one full question from each unit.
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	Bloom Tx
1.a)	What is meant by open-loop control system?	1M	1	L1
b)	Write Mason's gain formula.	1M	1	L1
c)	What is the settling time?	1M	2	L1
d)	What is meant by critically damped system?	1M	2	L1
e)	Explain the condition for stability in terms of poles?	1M	3	L2
f)	What is the necessary condition for stability using Routh's criterion?	1M	3	L1
g)	Explain the significance of PI controller?	1M	4	L2
h)	What is a lag compensator?	1M	4	L1
i)	What is meant by the state of a system?	1M	5	L1
j)	What is a time-invariant system?	1M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	Bloom Tx
2	<p>a) Explain the differences between open-loop and closed-loop control systems with examples.</p> <p>b) Using block diagram reduction technique find the transfer function for the system shown in below Figure</p>	5M	i	L2
		5M	1	L3
OR				

3	a) Explain in detail the characteristics of feedback and its advantages in control systems.	5M	1	L2
	b) Find the overall gain $C(s)/R(s)$ for the signal flow graph shown in figure	5M	1	L3
				
4	a) Explain the different standard test signals used for time response analysis	5M	2	L2
	b) Derive the time response of a first-order system for a unit step input.	5M	2	L3
OR				
5	a) Derive the expression for the step response of a second-order system	5M	2	L3
	b) For a unity feedback system $G(S)=20(S+2)/S(S+3)(S+4)$ Evaluate static error constants.	5M	2	L3
6	a) Discuss the effect of the location of poles on system stability with examples.	5M	3	L2
	b) Explain the Routh-Hurwitz stability criterion and the procedure to form the Routh array.	5M	3	L2
OR				
7	a) For what values of K the system is stable $S^3+2s^2+3s+K=0$	5M	3	L4
	b) State and explain the rules for constructing the root locus of a system.	5M	3	L2
8	a) Sketch the polar plot of transfer function $G(s) = 500/s(s+6)(s+9)$	5M	4	L3
	b) Discuss the advantages and limitations of the Nyquist stability criterion	5M	4	L3
OR				
9	a) What is compensator? Explain about lead compensator.	5M	4	L2
	b) Explain the significance of PID controller in system performance.	5M	4	L2
10	a) Discuss the significance of state space analysis	5M	5	L2
	b) Explain the properties of the state transition matrix.	5M	5	L2
OR				
11	a) State and explain the concepts of Controllability and Observability	5M	5	L2
	b) The state-space model of a system is: $\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ $y = [1 \quad 0]x$ Find the State Transition Matrix $(\Phi(t))$	5M	5	L3