

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2026

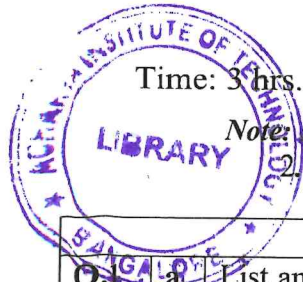
Control Engineering

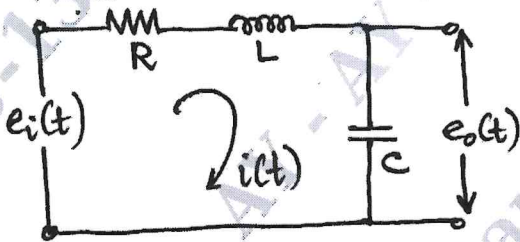
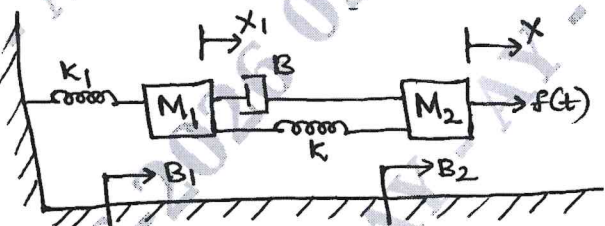
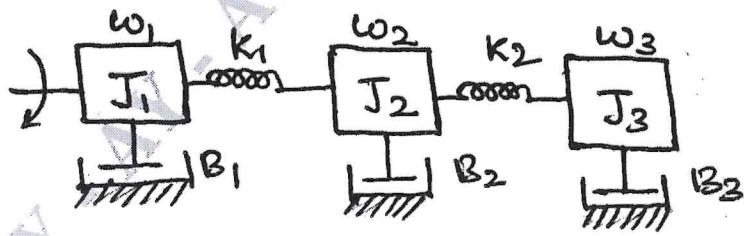
Time: 3 hrs.

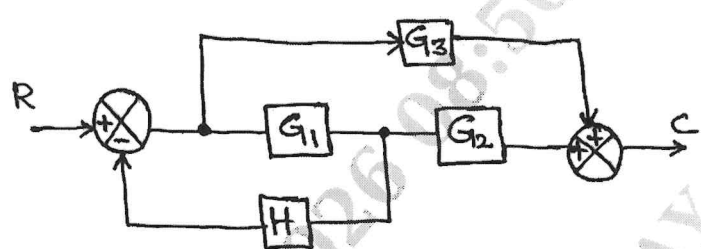
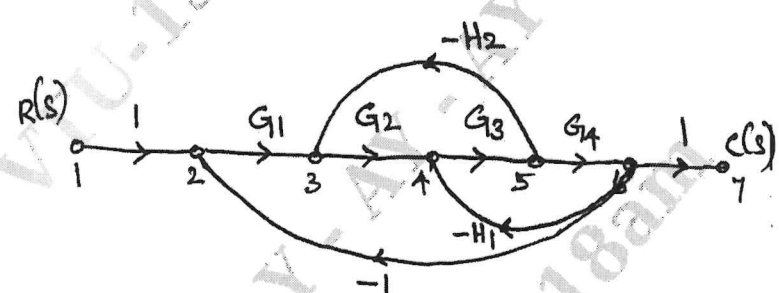
Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks , L: Bloom's level , C: Course outcomes.



Module – 1			M	L	C
Q.1	a.	List and discuss the requirements of an ideal control system.	5	L1	CO1
	b.	Demonstrate the function of closed loop control system with any one example.	5	L2	CO1
	c.	Develop the transfer function for the given electrical circuit with zero initial conditions and apply Laplace domain circuit analysis.	10	L2	CO1
 Fig Q1(c)					
OR					
Q.2	a.	Write the differential equations governing the mechanical system shown in Fig Q2(a) and determine the transfer function of the system.	10	L2	CO1
		 Fig Q2(a)			
	b.	Write the differential equations for the mechanical system shown in Fig Q2(b) below and draw the electrical analogous network based on i) Torque-voltage analogy ii) Torque – current analogy.	10	L2	CO1
		 Fig Q2(b)			

Module – 2						
Q.3	a.	Using the block diagram reduction technique find closed loop transfer function whose block diagram is shown in the Fig Q3(a) below.	10	L2	CO2	
		 Fig Q3(a)				
	b.	Find the overall transfer function of the system using Mason's gain formula whose signal flow graph is shown Fig Q3(b) below.	10	L2	CO2	
		 Fig Q3(b)				
OR						
Q.4	a.	Develop an expression for the response of a critically damped second order system for a unit step input.	10	L2	CO2	
	b.	A unity feedback system whose open loop transfer function is $G(s) = \frac{25}{s(s+5)}$. Find the peak time, percentage of overshoot and rise time for unit step input.	10	L2	CO2	
Module – 3						
Q.5	a.	Using Routh criterion, determine the stability of the system represented by following characteristic equation and also comment the location of the root of the equation. $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 24s^2 + 23s + 15 = 0$	8	L2	CO2	
	b.	Sketch the root locus for a unity feedback open loop transfer function of the system. $G(s) = \frac{K}{s(s+2)(s+4)}$	12	L3	CO2	

OR

Q.6	a.	Construct Routh array and determine the stability of the system for the following characteristics equation and comment the location of the roots of the equation. $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$	8	L2	CO2
	b.	Plot the bode diagram for the following transfer function and obtain the gain and phase cross over frequencies. $G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}$	12	L3	CO2

Module – 4

Q.7	a.	The open loop transfer function of a unity feedback system is given by $G(s) = \frac{1}{s(1+s)(1+2s)}$. Sketch the polar plot and determine the Gain Margin and Phase Margin.	12	L3	CO3
	b.	Explain about the frequency response specifications with relevant expressions.	8	L2	CO3

OR

Q.8	a.	Derive the conditions of M and V constant circles.	8	L2	CO3
	b.	Construct Nyquist plot for a feedback control system whose open loop transfer function is given by $G(s) = \frac{K}{s(s+2)(s+10)}$. Comment on the stability of open loop and closed loop system.	12	L3	CO3

Module – 5

Q.9	a.	What are the Controllers in Control System? Explain the types of controller with their transfer function. Mention its advantages.	10	L2	CO3
	b.	Discuss about Compensation Methods. Derive their transfer function of phase lead and phase lag network.	10	L2	CO3

OR

Q.10	a.	Consider the system with state space representation: Evaluate system controllability and observability. $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 & 0 \\ 1 & 2 \\ 2 & 1 \end{bmatrix} u(t)$	12	L3	CO3
	b.	Write a short note on the following : i) State variables ii) State equation iii) State space iv) State vector	8	L2	CO3