

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER- III EXAMINATION – SUMMER 2026

Subject Code:3130905

Date:02-07-2026

Subject Name:Control System Theory

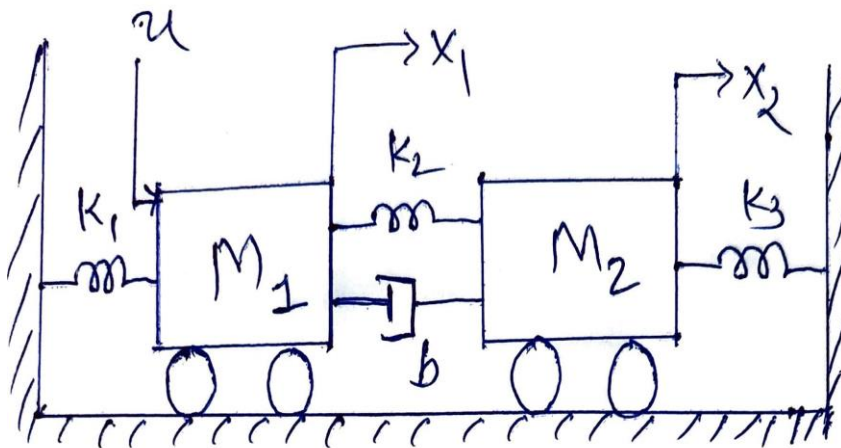
Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Explain Standard Test Signals used in control system.	03
	(b) Compare Open loop Vs Close loop control systems.	04
	(c) Explain open loop control system with suitable example in detail.	07
Q.2	(a) State advantages and limitations Routh's criteria.	03
	(b) Define transfer function and State advantages and Dis-advantages of transfer function.	04
	(c) The Characteristic equation of a feedback control system is $S^5+4S^4+8S^3+8S^2+7S+4=0$. Predict stability of system by using R-H criterion.	07
OR		
	(c) Describe the rules to reduce the Block Diagram to find transfer function of the control system.	07
Q.3	(a) Calculate damping ratio and Undamped natural frequency of oscillation for the open loop transfer function of a servo system with unity feedback system: $G(S)=10/(S+2)(S+5)$	03
	(b) Sketch the polar plot for the given transfer function $G(s) = 10/S (S+2)$	04
	(c) Determine the transfer function for given mechanical system shown in below fig. and also draw the equivalent mechanical circuit.	07



Mechanical system

OR

- Q.3** (a) State limitations and effects of Lag compensator. **03**
(b) Derive steady state error constants of the Type-1 system for a Step input. **04**
(c) State and explain Nyquist Stability Criteria. **07**
Q.4 (a) Draw the step response of values of damping ratio (i) $\zeta=1$ (ii) $\zeta < 1$ (iii) $\zeta > 1$ **03**
(b) Define: Delay time, Rise time, Peak time and Settling time. **04**
(c) Explain Proportional-Integral-Derivative (PID) Controller. **07**

OR

- Q.4** (a) State the condition for stability of control system with respect to bode plot and Nyquist stability criterion. **03**
(b) State the advantages of Bode Plot. **04**
(c) Sketch the Root Locus Plot for the given transfer function **07**
 $G(s)H(s) = K/S(S+4)(S^2+4S+20)$
Q.5 (a) Define compensation. List out different types of compensations. **03**
(b) Explain the effect of derivative control action on system performance. **04**
(c) Write design procedure of Lag Compensation. **07**

OR

- Q.5** (a) Define following terms. 1) State variable 2) State trajectory 3) State vector. **03**
(b) Discuss properties of state transition matrix. **04**
(c) Check Controllability and Observability of the system whose state model is given below. **07**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$
$$y(t) = \begin{bmatrix} 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$
