

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2023****Subject Code:3142407****Date:01-02-2024****Subject Name: Control Theory****Time: 10:30 AM TO 01:00 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) Define (i) System (ii) Control System	03
	(b) Compare open loop and close loop control system with example.	04
	(c) Obtain differential equations of the mechanical system shown in Figure-1 and draw the electric network using F-I analogy.	07

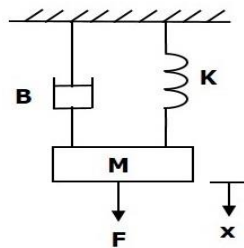


Figure-1

Q.2	(a) Discuss need for standard Test signals in control system	03
	(b) Discuss force voltage (F-V) analogous system with analogous quantity.	04
	(c) Explain Impulse Response and Transfer function and also list out advantages of Transfer function.	07

OR

	(c) Explain mason's gain formula for solving signal flow graph.	07
Q.3	(a) Define following terms: State, State variable, State space	03
	(b) Explain steady state error in Type-0, Type-1 and Type-2 system for step input.	04
	(c) Write a short note on state variable representation of a control system	07

OR

Q.3	(a) Discuss steady state error for a simple closed loop control system with negative feedback.	03
	(b) Explain classification of second order control system based on damping factor.	04
	(c) Obtain rise time, peak time, maximum overshoot and settling time for given transfer function, $C(s)/R(s) = 25/(s^2+5s+25)$	07

Q.4	(a) Define: Stability	03
	(b) Explain angle of asymptotes and centroid used in root locus.	04
	(c) Find the range of "k" to make the unity feedback system stable using Routh's criterion whose characteristic equation is given by $s^4 + 5s^3 + 5s^2 + 4s + k = 0$.	07

OR

Q.4	(a) Explain Breakaway point used in root locus.	03
	(b) Explain marginal stable system.	04
	(c) Explain Routh's stability criterion to check the stability of a system in detail.	07

- Q.5** (a) Distinguish between phase lead and lag compensation. **03**
(b) Discuss following terms with respect to Bode plot: Gain Margin, Phase Margin, Gain crossover frequency, Phase crossover frequency **04**
(c) Explain Nyquist Stability Criterion. **07**
- OR**
- Q.5** (a) Write a note on PID Controller. **03**
(b) Explain lead compensation. **04**
(c) Explain design of PID Controllers with Frequency-Response Approach. **07**
