# GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2024

Subject Code:3131101   **Date:19-07-2024**
Subject Name: Control Systems
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: (1) System (2) Output (3) Input	**03**
	(b)	Compare open loop and closed loop system.	**04**
	(c)	What is transfer function? Define Pole, Zero, Gain and Characteristic equation with examples.	**07**
Q.2	**(a)**	List properties of Laplace Transform.	**03**
	(b)	Find Laplace transform of sin (wt)	**04**
	(c)	Determine the Transfer function Vo (s) /Vi (s) of the electrical system shown in given Figure.	**07**
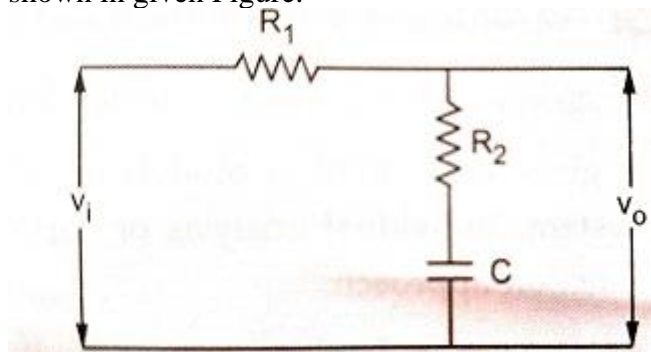
OR

	(c)	Discuss rules for block diagram reduction with example	**07**
Q.3	**(a)**	Define: (1) State (2) State variable (3) State vector	**03**
	(b)	Discuss various standard inputs used in the control system analysis.	**04**
	(c)	Explain the mathematical modelling of fundamentals components of mechanical rotational system.	**07**

OR

Q.3	**(a)**	Define Type and order of the system	**03**
	(b)	Derive the expression for static error coefficients.	**04**
	(c)	What is force voltage analogous system? Which are analogous quantities according to this method?	**07**
Q.4	**(a)**	Define: (1) Undamped system (2) Damped frequency of oscillation (3) Natural frequency of oscillation	**03**
	(b)	Analyze necessary conditions for Hurwitz's criterion.	**04**
	(c)	Sketch the root locus of the system whose open loop transfer function is G(s) = K / s (s+2) (s+4). Find the value of K so that the damping ratio of the closed loop system is 0.5.	**07**

OR

Q.4	**(a)**	Define: (1) Peak overshoot (2) Settling time (2) Delay time	**03**
	(b)	Analyze Routh's stability criterion.	**04**
	(c)	Discuss general steps to solve the problem on root locus.	**07**

Q.5	**(a)**	Define: (1) Conditional stable system (2) Unstable system (3) Marginally stable system	**03**
	(b)	Discuss steps to sketch the bode plot.	**04**
	(c)	Explain the following controllers (1) P controller (2) PI controller (3) PID controller	**07**

OR

Q.5	**(a)**	Define: (1) Gain margin (2) Phase margin (3) cut-off frequency	**03**
	(b)	Consider a system with open loop transfer function as $G(s)H(s) = 10 / s$, obtain its polar plot.	**04**
	(c)	A unity feedback control system has $G(s) = 80 / s (s+2) (s+20)$. Draw the bode plot.	**07**

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