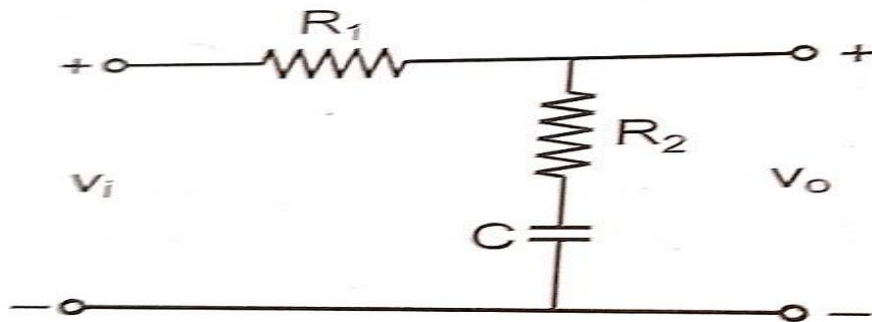


GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2023****Subject Code:2141004****Date: 06-02-2024****Subject Name:Control System Engineering****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

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) Transfer Function (2) Pole (3) Zero	03
	(b) Compare Open loop system & Closed loop system with suitable example	04
	(c) Discuss block diagram reduction techniques with example.	07
Q.2	(a) Define: (1) Branch (2) Node (3) Forward Path	03
	(b) Construct following Signal Flow Graph:	04
	(1) $y_1 = y_2/a_{12}$	
	(2) $y_2 = a_{12} y_1 + a_{32} y_3$	
	(3) $y_3 = a_{23} y_2 + a_{43} y_4$	
	(4) $y_4 = a_{24} y_2 + a_{34} y_3 + a_{44} y_4$	
	(c) For the electrical network of the given figure, find the transfer function $V_o(s)/V_i(s)$	07

**OR**

	(c) Discuss analogous quantities in Force – Voltage – Current analogy.	07
Q.3	(a) Define: (1) Step function input (2) Ramp function input (3) Impulse function input	03
	(b) Explain unit-step response of First order control system.	04
	(c) Analyze error constant and steady state errors for various inputs.	07
	OR	
Q.3	(a) Define: (1) Delay time (2) Rise time (3) Peak time	03
	(b) Explain unit-step response of Second order control system.	04
	(c) Discuss (1) Proportional (2) Derivative (3) Integral control systems with block diagram.	07
Q.4	(a) Discuss Mechanical Translation motion system.	03
	(b) Explain design procedure for a lead compensator.	04
	(c) The characteristic equation of a system is given by	07

$F(s) = s^4 + 8s^3 + 18s^2 + 16s + 4 = 0$. Determine the stability of a system by means of Hurwitz's criterion.

OR

- Q.4** (a) Explain Constant M and N circles **03**
 (b) Discuss general procedure for construction of Bode plot. **04**
 (c) The characteristic equation of a system is given by **07**
 $3s^4 + 10s^3 + 5s^2 + 5s + 1 = 0$. Determine the stability of the system described by means of Routh-Hurwitz criterion.

- Q.5** (a) Define: (1) Phase Margin (2) Gain Margin (3) Resonant peak **03**
 (b) Discuss the rules for construction of polar plot. **04**
 (c) Discuss rules for construction of root locus. **07**

OR

- Q.5** (a) Define: (1) Minimum Phase (2) Non Minimum Phase (3) All Pass system **03**
 (b) Explain Nyquist Stability Criterion. **04**
 (c) Sketch the bode plot for the transfer function **07**
 $G(s) = 10 / s(1 + 0.5s)(1 + 0.1s)$.
