

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2023****Subject Code:3142003****Date:19-01-2024****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: (1) Stable control system (2) Time Varying control system and (3) Linear control system.	03
	(b) Write Requirements of a good control system. Critically compare Open loop and Closed loop systems.	04
	(c) Justify the following statements if true: (1) Feedback control systems are also referred to as closed-loop systems. (2) Fixed-time traffic light control system is an example of closed loop control system. (3) In a multivariable control system there is one input variable but variable outputs.	07
Q.2	(a) Derive the transfer function of simple closed loop system.	03
	(b) Is an automatic electric iron an open loop or closed loop control system?	04
	(c) What is mathematical modeling? Explain the steps for mathematical modeling of any physical system.	07
	OR	
	(c) Derive the transfer function of the circuit shown in figure .1	07

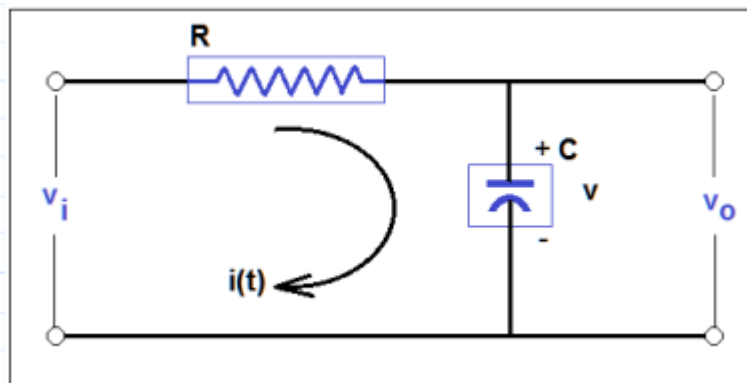


Figure.1

Q.3	(a) Explain the analysis of MIMO systems using block diagram approach.	03
	(b) Explain and derive the transfer function for an armature-controlled D.C. motor.	04
	(c) What is force-voltage analogous system? Which are the analogous quantities according to this method.	07
	OR	
Q.3	(a) What is force-current analogy?	03
	(b) Derive a transfer function for a liquid level system. Explain resistance and capacitance of any liquid level system.	04
	(c) What does a block diagram represent? Explain it in detail. List its salient characteristics. Explain the following: Summing point, takeoff point.	07

- Q.4** (a) Define signal flow graph **03**
 (b) The transfer function of system is given by: **04**

$$T(s) = K(s+2) / s(s+2)(s+5)(s^2+7s+12)$$

Determine (1) Poles, (2) Zeros, (3) Characteristic Equation and (4) poles-zeros plot in s-plane

- (c) Using block diagram reduction technique find closed loop transfer function $C(s) / R(s)$ shown in figure.2 **07**

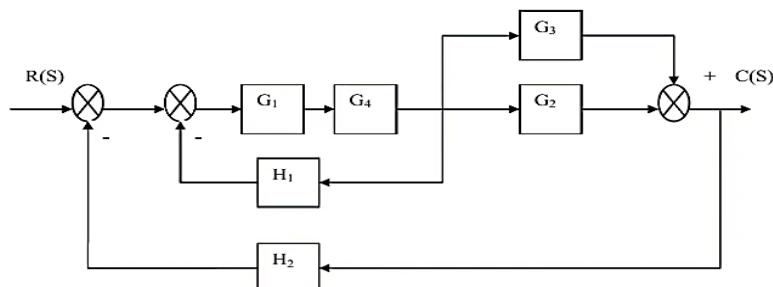


Figure.2

OR

- Q.4** (a) State the properties of Signal flow graph. **03**
 (b) Compare block diagram representation with signal flow graph representation **04**
 (c) Draw the SFG from the block diagram given below. **07**

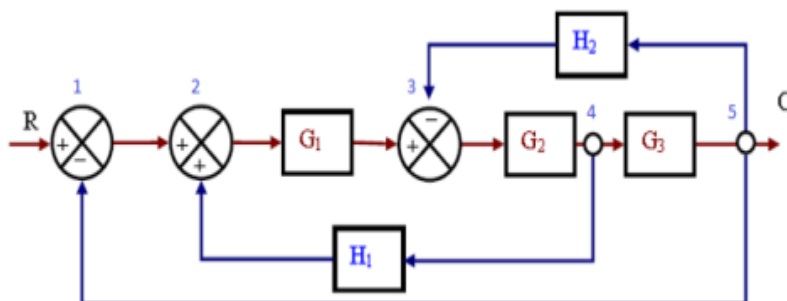


Figure.3

- Q.5** (a) Discuss the various standard inputs used in control system analysis **03**
 (b) What is compensation? Why compensation required? What are the basis of selection of a particular compensator? **04**
 (c) Determine the stability of the following system using Routh's criterion. **07**

(a) $G(s)H(s) = \frac{1}{(s+2)(s+4)}$

(b) $G(s)H(s) = \frac{9}{s^2(s+2)}$

OR

- Q.5** (a) Derive the steady state error for simple closed loop system. **03**
 (b) Define Routh's stability criterion. **04**
 (c) How the Gain Margin and Phase Margin are obtained from Bode Plot ? **07**
