

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2022****Subject Code:3151908****Date:04-01-2023****Subject Name:Control 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
<b>Q.1</b>	(a) 1. What does the arrow on the branch of a Signal Flow Graph represent? 2. In a 4/3 DCV, 4 stands for _____ and 3 stands for _____ ? 3. Define self-loop.	<b>03</b>
	(b) Write advantages and disadvantages of Open Loop System.	<b>04</b>
	(c) Differentiate between Open Loop and Close Loop System.	<b>07</b>
<b>Q.2</b>	(a) Write Laplace Transform of following, 1. t                      2. $e^{-at}$ 3. $\sin \omega t$	<b>03</b>
	(b) The transfer function of a system is given by, $T(S) = \frac{K(S + 6)}{S(S + 2)(S + 5)(S^2 + 7S + 12)}$ Determine: i) Poles    ii) Zeros    iii) Characteristic equation iv) Plot Poles and zeros on S-plane	<b>04</b>
	(c) Explain the Analogous Elements of Mechanical Rotational System.	<b>07</b>
	<b>OR</b>	
	(c) Determine C(s)/R(s) by using Block Diagram Reduction Technique. (Fig. 1)	<b>07</b>
<b>Q.3</b>	(a) Explain the following, 1. Step Input 2. Ramp Input 3. Parabolic Input	<b>03</b>
	(b) Compare Block Diagram and Signal Flow Graph.	<b>04</b>
	(c) Determine C(s)/R(s) by using Mason's Gain Formula. (Fig. 2)	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) Define, i) Delay Time ii) Peak Time iii) Setting Time	<b>03</b>
	(b) The characteristic equation of the system is given by $s^4 + 2s^3 + (4 + k)s^2 + 9s + 25 = 0$ Determine the range of k for the system to be stable.	<b>04</b>
	(c) Find the Open Loop Transfer Function of an equivalent prototype, single loop unity feedback system having second order, whose step response is shown in (Fig. 3).	<b>07</b>
<b>Q.4</b>	(a) Draw basic hydraulic circuit with standard symbols and label.	<b>03</b>
	(b) Explain nozzle flapper amplifier with neat sketch.	<b>04</b>
	(c) Obtain the transfer function for hydraulic system with PID control action.	<b>07</b>
	<b>OR</b>	
<b>Q.4</b>	(a) Differentiate hydraulic and pneumatic control system.	<b>03</b>
	(b) Write down the sources of hydraulic power.	<b>04</b>

- (c) Sketch the root locus of the system whose open loop transfer function is, 07

$$G(s) = \frac{K}{s(s+1)(s+3)}$$

Determine the value of K for damping ratio equal to 0.5.

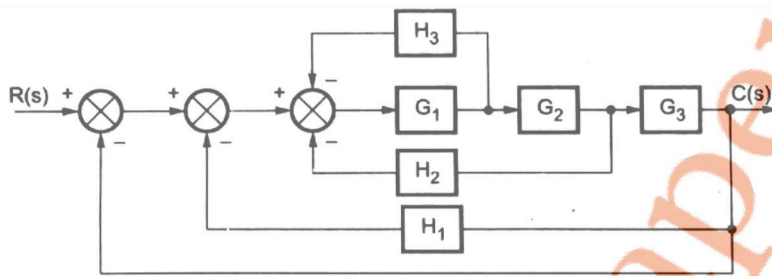
- Q.5 (a)** Determine the stability of following system using Routh's Criterion. 03

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

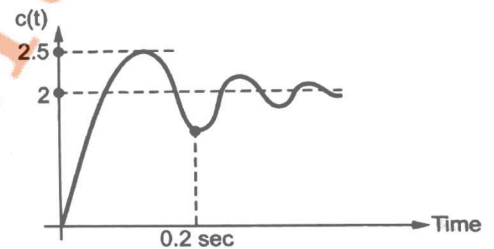
- (b) Explain Lag – Lead Compensation of Time response. 04  
 (c) Explain Phase margin and Gain margin related to frequency response. 07

**OR**

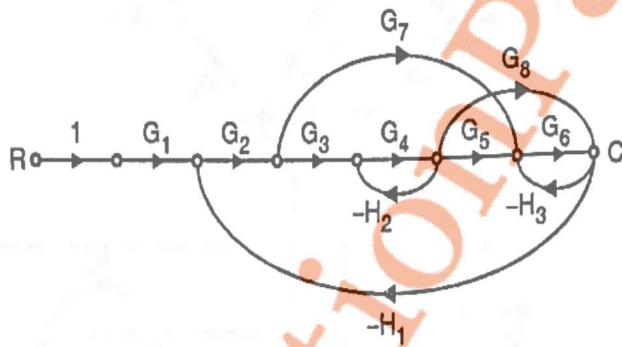
- Q.5 (a)** Obtain State Space model of Spring Mass Damper system. 03  
 (b) Explain frequency response specifications,  
 i) Resonant Peak ii) Bandwidth iii) Resonant Frequency 04  
 (c) Write a short note on Nyquist Stability Criteria. 07



(Fig. 1)



(Fig. 3)



(Fig. 2)

\*\*\*\*\*