

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE MINOR - SEMESTER-VI EXAMINATION – SUMMER 2024****Subject Code:116AO01****Date:27-05-2024****Subject Name:Control of Robotic 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.

		<b>Marks</b>
<b>Q.1</b>	(a) Define: State, state vector and State space.	<b>03</b>
	(b) Define transfer function and state its properties for closed loop system.	<b>04</b>
	(c) Sketch the root locus of the system whose open loop transfer function is,	<b>07</b>
	$G(s) = K / s(s + 1)(s + 3)$	
	Determine the value of K for damping ratio equal to 0.5.	
<b>Q.2</b>	(a) What is Bode plot? State its advantages.	<b>03</b>
	(b) Explain Nyquist stability criterion for frequency response unity feedback systems with suitable example.	<b>04</b>
	(c) Explain Hydraulic PID controller with neat sketch.	<b>07</b>
	<b>OR</b>	
	(c) Briefly discuss performance specifications of frequency response analysis for linear controls systems	<b>07</b>
<b>Q.3</b>	(a) Explain Lag – Lead Compensation of Time response.	<b>03</b>
	(b) Determine stability of a close-loop system using Routh-Hurwitz criterion whose characteristics equation is	<b>04</b>
	$S^3 + 4.5S^2 + 3.5S + 15 = 0$	
	(c) Explain the procedure of drawing Bode plot and determination of gain margin, phase margin and stability with a suitable example.	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) Write any three salient features of Root Locus plot.	<b>03</b>
	(b) Briefly discuss about the relative stability from Nyquist plot.	<b>04</b>
	(c) Explain working of hydraulic PID controller with neat sketches and write transfer function for the same with usual notations.	<b>07</b>
<b>Q.4</b>	(a) What is Common physical non-linear system?	<b>03</b>
	(b) Explain the concepts of Observability and Controllability.	<b>04</b>
	(c) Explain phase plane method for non-linear control system.	<b>07</b>

**OR**

- Q.4** (a) What is Point to Point Control system? **03**  
(b) Explain Continuous Path Control. **04**  
(c) Explain Liapunov's stability criterion in details. **07**
- Q.5** (a) Explain Force Control system. **03**  
(b) How the stability of non-linear system is achieved? **04**  
(c) With neat sketch explain the working of Hydraulic PI controller and derive the transfer function. **07**

**OR**

- Q.5** (a) Explain pole placement by state feedback. **03**  
(b) Explain system analysis by phase plane method. **04**  
(c) Write a short note on stability analysis by describing function method. **07**

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