

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020****Subject Code:3151908****Date:22/01/2021****Subject Name:Control Engineering****Time:10:30 AM TO 12:30 PM****Total Marks: 56****Instructions:**

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
<b>Q.1</b>	(a) Define following related to control systems: (i) Transfer Function, (ii) Poles & (iii) Zeros	<b>03</b>
	(b) Explain various rules of block-diagram reduction with neat sketches.	<b>04</b>
	(c) Discuss Force-Current analogy with suitable example.	<b>07</b>
<b>Q.2</b>	(a) Explain the linearization of non-linear systems with a suitable sketch.	<b>03</b>
	(b) Define controlled variables and manipulated variables with suitable example.	<b>04</b>
	(c) Differentiate between open loop and closed loop control systems with suitable examples.	<b>07</b>
<b>Q.3</b>	(a) Define Rise time, Peak time and Settling time for unit step response of second order systems.	<b>03</b>
	(b) Discuss briefly about standard input test signals for time domain systems with neat sketches.	<b>04</b>
	(c) A unity feedback control system has its open-loop transfer function given by $G(s) = \frac{4s+1}{4s^2}$ Determine and expression for the time response when the system is subjected to Unit step input.	<b>07</b>
<b>Q.4</b>	(a) Define following related to state-space analysis of a control system: (i) State, (ii) State variables, (iii) State space	<b>03</b>
	(b) Determine stability of a close-loop system using Routh-Hurwitz criterion whose characteristics equation is $s^3 + 4.5s^2 + 3.5s + 15 = 0$	<b>04</b>
	(c) Obtain unit step response of first order system and discuss steady state error for the same.	<b>07</b>
<b>Q.5</b>	(a) Write any three salient features of Root Locus plot.	<b>03</b>
	(b) Explain the concepts of Observability and Controllability.	<b>04</b>
	(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>Q.6</b>	(a) Write steady state error coefficients for type '0' system with Unit step, Unit ramp and Unit parabolic inputs.	<b>03</b>
	(b) Briefly discuss about the relative stability from Nyquist plot.	<b>04</b>
	(c) Explain experimental determination of close loop transfer function with suitable example.	<b>07</b>
<b>Q.7</b>	(a) Explain tuning of a PID controller in brief.	<b>03</b>

- (b) Explain hydraulic proportional plus derivative controller with neat sketches. **04**
- (c) Explain working of hydraulic PID controller with neat sketches and write transfer function for the same with usual notations. **07**
- Q.8** (a) Explain briefly various elements of pneumatic circuit. **03**
- (b) Compare hydraulic and electrical control systems. **04**
- (c) Sketch a schematic diagram of pneumatic nozzle-flapper amplifier system and explain its working. Sketch and explain characteristic curve relating nozzle back pressure and nozzle flapper distance for the same. **07**

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