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

(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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