Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2024

Subject Code:2141708 Date:18-07-2024

Subject Name:Control System

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)**	Compare Block diagram method and signal flow diagram method with suitable example.	**03**
	(b)	Explain open loop system with suitable	**04**
	(c)	Derive the expression of delay time, Peak Overshoot and Rise time for under damped second order system with unit step input.	**07**
Q.2	**(a)**	State the properties of state transition method.	**03**
	(b)	Draw the polar plot of G(s) = (s + 2) / [(s + 1)* (s - 1)]. Discuss stability too.	**04**
	(c)	Discuss the step response of second order system for various values of damping ratio (i) $\zeta > 1$ (ii) $\zeta = 1$ (iii) $0 < \zeta < 1$ (iv) $\zeta = 0$,with associated diagrams.	**07**
		OR	
	(c)	Discuss the main difference between transfer function approach and state space approach, with appropriate examples	**07**
Q.3	**(a)**	Explain the concept of linearity and time invariance in the context of control system.	**03**
	(b)	Describe the various details about types and orders of the control system, with suitable example.	**04**
	(c)	Discuss the procedure to convert State model in to transfer function form, and vice versa, with the example of Armature control DC MOTOR.	**07**
		OR	
Q.3	**(a)**	Discuss the benefits of closed loop system over open loop system.	**03**
	(b)	Define bandwidth, gain margin and phase margin for frequency response, with suitable example.	**04**
	(c)	Derive the governing Diff. equation for The Gear Train and find its analogous network. Discuss the force-voltage and force-current analogy.	**07**
Q.4	**(a)**	Define following terms of Signal Flow Graph. Node, Loop , Self Loop	**03**
	(b)	Enlist the characteristics of positive feedback and Discuss in Brief.	**04**
	(c)	Write the rules for drawing Root locus for open loop TF having gain K.	**07**
		OR	
Q.4	**(a)**	Discuss the effect of time delay on the stability of the process.	**03**
	(b)	Determine the stability of the system $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$. Comments on the results.	**04**
	(c)	What is M circle and N circles in Nyquist plot? Discuss its importance in Nichols chart.	**07**
Q.5	**(a)**	Discuss the various standard test signals used in control system analysis, with diagram and mathematical formulae/equations.	**03**
	(b)	Explain Initial value theorem and Final Theorem in Laplace Transformation, with supported proof.	**04**
	(c)	Sketch the Root locus for the unity feedback system whose open loop transfer function is given by $G(s) = K / s*[(s + 4)*(S^2 + 4s + 20)]$.	**07**

OR

Q.5 **(a)** Explain following: absolute stability, relative stability and BIBO stability, with examples. **03**

(b) Write a technical note on steady state error and error constants with appropriate example and calculations. **04**

(c) Draw the Bode plot for a system having TF $(s)H(s) = 64*(s + 2) / s *[(s + 0.5)* (s^2 + 3.2s + 64)]$. Find Gain margin, Phase margin and Cross over frequencies. **07**

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