GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering - SEMESTER - IV EXAMINATION - WINTER 2025

Subject Code: 3140313   **Date: 24-11-2025**

Subject Name: Control System and Analysis

Time: 02:30 PM TO 05:00 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)	Explain close loop control system with neat sketch.	03
(b)	Explain any four rules of Block Diagram Reduction with neat sketch.	04
(c)	Write short note on Standard Test Signals with all details.	07
Q.2 (a)	Explain how to derive Transfer Function from State Space Model	03
(b)	Write short note on Nyquist Stability Criterion.	04
(c)	Draw the root locus of the following system.	07

$$G(s)H(s) = \frac{K(s+1)(s+3)}{s(s+2)(s+4)}$$

OR

(c)	Draw the root locus of the following system.	07

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

Q.3 (a)	Write short note on mathematical modelling of liquid level system.	03
(b)	Find the Laplace transform of	04

$$x(t) = 1 + e^{-3t}$$

(c)	Write a short note on Force to current analogy and Force to voltage analogy.	07

OR

(a)	Write short note on mathematical modelling of Muscle stretch reflex model (Lumped).	03

(b) Find the inverse Laplace transform of 04

$$X(s) = \frac{10}{(s+1)(s+2)}$$

(c) What is Mason's Gain formula? Demonstrate its use with an example. 07

Q.4 (a) Find the stability using Routh's criteria. 03

$$F(s) = s^5 + s^4 + 3s^3 + 4s^2 + 5s + 6$$

(b) Explain how to derive State Space Model from Differential Equation 04

(c) What is steady state error and error constants? Derive the steady state error for type-0, type-1 and type-2 systems. 07

OR

(a) What is relative stability? How to find it using Routh's Criteria? 03

(b) Explain how to derive State Space Model from Transfer Function. 04

(c) Enlist various time domain specifications. Explain each in detail. Also give equations of each specification. 07

Q.5 (a) Explain gain margin and phase margin in frequency domain analysis. 03

(b) Enlist the steps to draw the polar plot. 04

(c) Draw the bode plot of the following transfer function. Also comment on stability. 07

$$G(s)H(s) = \frac{10(s+2)(s+4)}{(s+1)(s+3)}$$

OR

(a) Explain gain cross over frequency and phase cross over frequency in frequency domain analysis. 03

(b) Enlist the steps to draw the bode plot. 04

(c) Draw the polar plot of the following transfer function. Also comment on stability. 07

$$G(s)H(s) = \frac{75}{s(s+1)(s+2)}$$

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