

Enrollment No./Seat No.:

# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - IV EXAMINATION - SUMMER 2025

Subject Code: 3140313

Date: 19-05-2025

Subject Name: Control System and Analysis

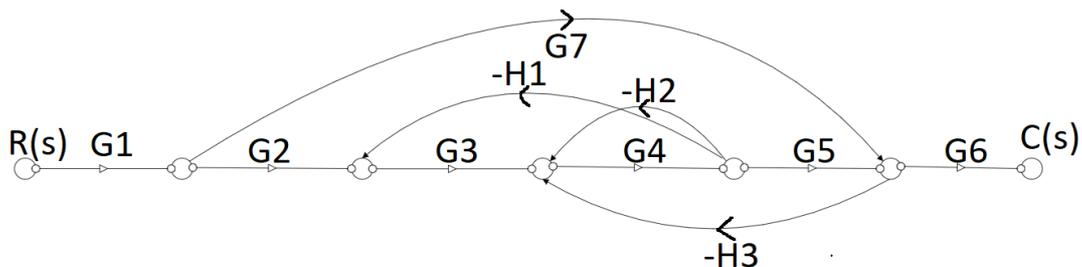
Time: 10:30 AM TO 01:00 PM

Total Marks: 70

## Instructions

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

	Marks
<b>Q.1 (a)</b> Define Control System. Explain the control system which does not have feedback.	03
<b>(b)</b> Draw and Explain any four rules of block diagram reduction.	04
<b>(c)</b> Explain Step Input, Ramp Input and Impulse input in brief. Also derive step response of 1st order system.	07
<b>Q.2 (a)</b> Explain Hurwitz stability criterion.	03
<b>(b)</b> Define terms gain cross over frequency, phase cross over frequency, gain margin and phase margin.	04
<b>(c)</b> Derive time response specifications of following system. $C(s)R(s)=100s^2+10s+100$	07
<b>OR</b>	
<b>(c)</b> What is steady state error. Derive error constants $K_p$ , $K_v$ and $K_a$ of the following transfer functions for Unit Step, Ramp and parabolic inputs. 1. $G(s)H(s)=10s+1$ 2. $G(s)H(s)=10s(s+1)$ 3. $G(s)H(s)=10s^2(s+1)$	07
<b>Q.3 (a)</b> Determine laplace transform of $f(t)=1+5\sin(\omega t)+10\cos(\omega t)$	03
<b>(b)</b> Explain mathematical modelling of thermal system.	04
<b>(c)</b> Derive the transfer function of following signal flow graph.	07

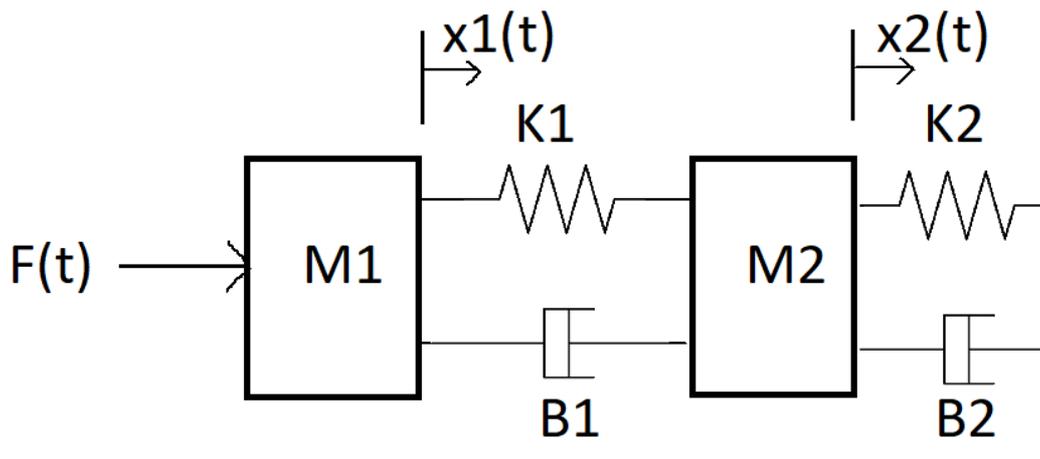


**OR**

- |   |    |
|---|----|
| <b>(a)</b> Determine inverse laplace transform of $F(s)=10(s+1)(s+2)$ | 03 |
| <b>(b)</b> Explain mathematical modelling of liquid level system.     | 04 |

(c) Determine Force to voltage and force to current analogy of the given system.

07



Q.4 (a) Determine stability of following equation  $q(s) = s^5 + 4s^4 + 7s^3 + 5s^2 + 10s + 20$

03

(b) Write short note on relative stability.

04

(c) Explain various steps to draw bode plots.

07

OR

(a) Explain steps to draw polar plot with one example.

03

(b) Write short note on Nyquist stability criterion.

04

(c) Draw the root locus of  $G(s)H(s) = Ks(s+1)(s+2)$

07

Q.5 (a) In comparison to conventional approach, state the advantages and disadvantages of state variable approach.

03

(b) Explain state model with an example.

04

(c) Draw the Bode Plot of given transfer function and judge the stability of the system.  $G(s)H(s) = 10s(s+1)(s+10)$

07

OR

(a) Define: 1) State 2) State Variable 3) State Vector

03

(b) Explain how to derive Transfer Function from State Space Model with an example.

04

(c) Draw the nyquist plot of given transfer function.  $G(s)H(s) = 10(s+1)(s+10)$ . Also judge the stability of the system.

07

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