

**GUJARAT TECHNOLOGICAL UNIVERSITY**

**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2021**

**Subject Code:2141708**

**Date:04/09/2021**

**Subject Name:Control System**

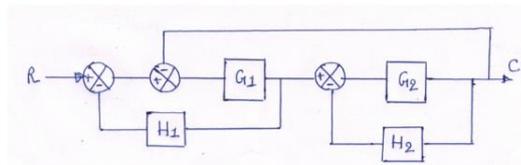
**Time:02:30 PM TO 05:00 PM**

**Total Marks: 70**

**Instructions:**

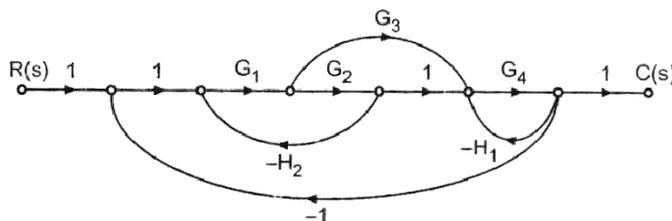
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
<b>Q.1</b>	(a) Define following terms: (1) rise time (2) peak time (3) settling time (4) peak overshoot	<b>03</b>
	(b) Define Transfer function. Find the impulse response of a system whose transfer function is $G=1/(S+4)$	<b>04</b>
	(c) Draw second order unit step response and explain associated specification terms.	<b>07</b>
<b>Q.2</b>	(a) Find the inverse laplace of $s/(s+1)(s+2)(s+6)$	<b>03</b>
	(b) Difference between signal flow graph and block diagram representation of system	<b>04</b>
	(c) Find out the overall transfer function using block diagram reduction rule	<b>07</b>



**OR**

- (c) Using mason's gain formula find the transfer function of following system **07**



- Q.3**
- |            |                                                                |           |
|------------|----------------------------------------------------------------|-----------|
| <b>(a)</b> | Define 1. Source node, 2. Loop, 3. Sink node                   | <b>03</b> |
| <b>(b)</b> | Write Mason's gain formula and define each term of the formula | <b>04</b> |
| <b>(c)</b> | Determine the stability using Routh Criterion                  | <b>07</b> |
- $$s^4 + 5s^3 + 20s^2 + 50s + 4 = 0$$

**OR**

- Q.3**
- |            |                                                                                    |           |
|------------|------------------------------------------------------------------------------------|-----------|
| <b>(a)</b> | What is analogous of all variables in mechanical network in force-voltage analogy? | <b>03</b> |
| <b>(b)</b> | Write a note on steady state error and error constants.                            | <b>04</b> |
| <b>(c)</b> | Briefly explain the first order system and its response to unit step input         | <b>07</b> |
- Q.4**
- |            |                                                                  |           |
|------------|------------------------------------------------------------------|-----------|
| <b>(a)</b> | Find the polar plot of $G=1/S$                                   | <b>03</b> |
| <b>(b)</b> | Discuss in state transition matrix and its computational method. | <b>04</b> |

- (c) Draw the Bode plot for  $G(s) = 10(1+0.5s) / s(1+0.1s)(1+0.2s)$ . Also find phase and gain margin. **07**

**OR**

- Q.4** (a) What is M circle and N circles in Nyquist plot **03**  
 (b) Write the rules for drawing root locus **04**  
 (c) A unity feedback system is characterized by open loop transfer function  $G(s) = K/s(s+10)$ . Determine gain K so that the system will have a damping ratio of 0.5. **07**

- Q.5** (a) Explain standard test signals **03**  
 (b) For the system  $G=25/S^2+4S+25$ , find the natural frequency, damping ratio. Depending on the damping ratio, describe the system **04**  
 (c) A unity feedback control system's open loop transfer function is **07**

$$G(s)H(s) = \frac{k(s+13)}{s(s+3)(s+7)}$$

Using Routh criterion, calculate the range of k for the system to be stable. If the value of k=1, comment on stability.

**OR**

- Q.5** (a) For the closed loop system  $G=(S+1)(S+3)/S^3(S+1)(S+3)$ , find the following 1. Order, 2. Type, 3. characteristic equation **03**  
 (b) Mention difference between transfer function approach and state space approach. **04**  
 (c) Derive the state model of RLC circuit. **07**

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