

www.FirstRanker.com www.FirstRanker.com
GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- III (New) EXAMINATION – WINTER 2019

Subject Code: 3130905

Date: 3/12/2019

Subject Name: Control System Theory

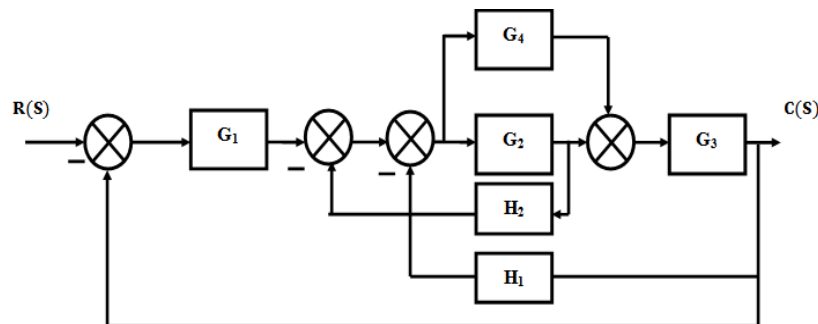
Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

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

- | | Marks |
|--|-------|
| Q.1 (a) Define the following terms.
(1) Control system (2) Plants (3) Process | 03 |
| (b) Explain transfer function and State advantages and Dis-advantages of transfer function. | 04 |
| (c) Solve the block diagram to find transfer function of the system shown in figure. | |



- | | |
|---|----|
| Q.2 (a) Explain Steady state Error. | 03 |
| (b) Compare Open loop Vs close loop control systems | 04 |
| (c) The characteristic equation of feedback control system is given by $s^4 + 20s^3 + 15s^2 + 2s + K = 0$ | |
| 1) Calculate the range of K for the system to be stable. | 07 |
| 2) Can the system be marginally stable? If so, find the required value of k and frequency of sustained oscillation. | |

OR

- | | |
|--|----|
| (c) Write Nyquist contour and Nyquist stability criterion in brief. | 07 |
|--|----|

- | | |
|---|----|
| Q.3 (a) Calculate damping ratio and Undamped natural frequency of oscillation for the open loop transfer function of a servo system with unity feedback system: $G(S) = \frac{10}{(s+2)(s+5)}$ | 03 |
| (b) Explain Standard Test Signals used in control system | 04 |
| (c) Construct the root loci of open loop transfer function of the feedback control system given as $G(S)H(S) = \frac{k(s+3)}{s(s+2)}$ | 07 |

OR

- | | |
|--|----|
| Q.3 (a) Simplify the significance of proportional control. | 03 |
| (b) Define following terms with respect to second order system. | |
| 1) Delay Time | |
| 2) Rise Time | 04 |
| 3) Peak Time | |
| 4) Steady state error | |

$$G_c(s) = k \frac{(s + \frac{1}{T_1})(s + \frac{1}{T_2})}{(s + \frac{\beta}{T_1})(s + \frac{1}{\beta T_2})}$$

07

Show that at frequency ω_1 , where $\omega_1 = \frac{1}{\sqrt{T_1 T_2}}$, the phase angle of $G_c(j\omega)$ becomes zero.

- Q.4** (a) Explain the effect of integral control action on system Performance. **03**
 (b) Explain relationship between time and frequency response. **04**
 (c) Explain step by step Procedure for Phase Lag Network. **07**

OR

- Q.4** (a) Explain the advantages of bode plot. **03**
 (b) Summarize types of compensation and explain any one. **04**
 (c) Explain the step by step procedure for obtaining bode plot. **07**

- Q.5** (a) Explain polar plots with a sketch of a simple example **03**
 (b) Decide that How stability can be ensured from Routh Table? **04**
 (c) Distinguish state variable approach versus the classical approach of transfer function for the analysis of control systems. **07**

OR

- Q.5** (a) Explain following terms. 1) State variable 2) State trajectory 3) State vector **03**
 (b) Define and explain following terms with respect to frequency response.
 1) Gain Margin **04**
 2) Phase Margin
 3) Gain Crossover frequency
 4) Phase Crossover frequency
 (c) Investigate Controllability and observability of the system

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} X(t) + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} u(t)$$

07

$$c(t) = [1 \quad 0 \quad 0]x(t)$$
