

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER-IV (NEW) EXAMINATION – WINTER 2020

Subject Code: 3140313

Date: 19/02/2021

Subject Name: Control System and Analysis

Time: 02:30 PM TO 04:30 PM

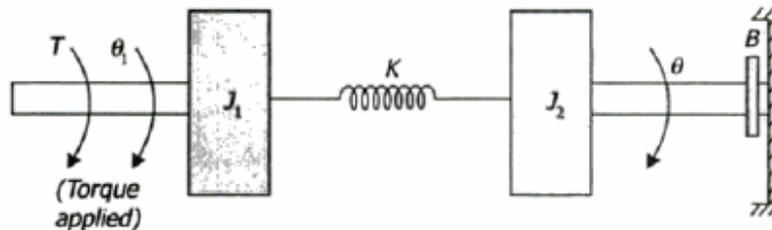
Total Marks: 56

Instructions:

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
Q.1	(a) Define state variable using example.	03
	(b) State the advantage and Limitation of state variable approach.	04
	(c) Explain open loop and closed loop control system with suitable example & gives its advantages and disadvantages	07

Q.2	(a) Explain Electrical-Mechanical Analogy.	03
	(b) Write properties of Signal Flow Graph.	04
	(c) Draw the mechanical network. Write differential equations of performance and also draw the analogous electrical circuit of the system shown below in Fig.	07



Q.3	(a) Define below given terminologies with proper equations. i. Rise Time(t_r) ii. Peak Time(t_p) iii. Peak Overshoot (M_p)	03
	(b) Explain effect of Damping factor in Second Order System Performance.	04
	(c) Second order system is given by	07

$$\frac{C(s)}{R(s)} = \frac{25}{(s^2 + 64s + 25)}$$

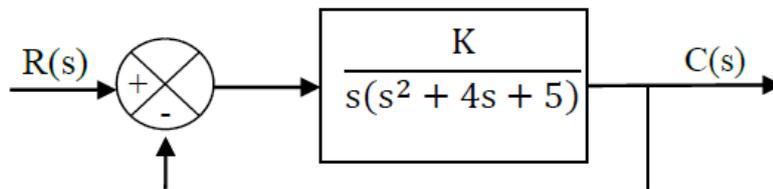
Find the rise time, peak time, peak overshoot and settling time if subjected to unit step input. Also calculate expression for its output response.

Q.4	(a) What are standard Test Signals and their Significance?	03
	(b) Explain PI type of Controller with its effect on the system.	04
	(c) The open loop transfer function of a unity feedback control system given by	07

$$G(s) = \frac{20}{(s + 1)(s + 5)}$$

Determine the Characteristic equation of the system, natural frequency of oscillations(ω_n), damping frequency of oscillations (ω_d), damping ratio (ζ), and the maximum overshoot of a unit step input (M_p).

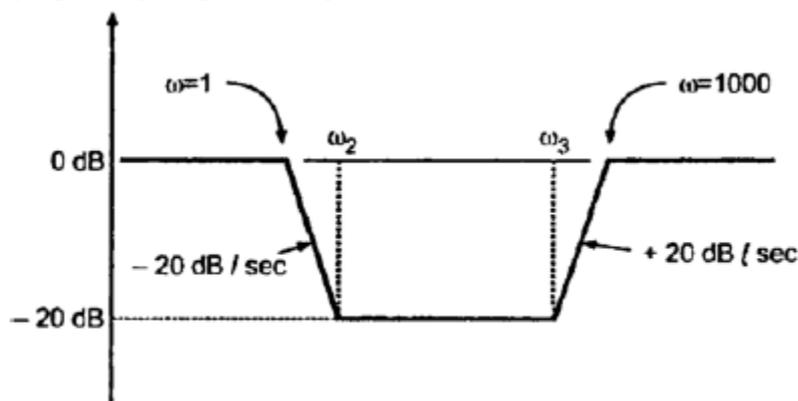
- Q.5** (a) Write needs of Frequency Domain Analysis for Control system. **03**
 (b) Comment on the stability of the system represented by below given characteristic equation $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 15 = 0$. **04**
 (c) Draw the root locus of the system given below. Find the values of valid break-away-point, interaction with imaginary axis and the range of K for which the system will be stable. **07**



- Q.6** (a) List out advantages of Nyquist criteria. **03**
 (b) State and Explain applications of Routh's stability Criterion. **04**
 (c) Draw the complete root locus of the system having **07**

$$G(s)H(s) = \frac{K(s + 5)}{(s^2 + 4s + 20)}$$

- Q.7** (a) Define and explain following terms with respect to frequency response (i) Gain Margin (ii) Phase Margin (iii) Gain cross-over frequency **03**
 (b) Find if the system is stable using Nyquist plot. **04**
 $G(s)H(s) = 1/s(s+1)$
 (c) Determine the open-loop transfer function, of a system whose asymptotic gain plot is as given below **07**



- Q.8** (a) Explain the definitions of ω_{gc} & ω_{pc} in polar plot with example. **03**
 (b) Using Nyquist criteria examine the closed loop stability of a system whose open loop transfer function is: **04**
 $G(s)H(s) = 50/((s+1)(s+2))$
 (c) Derive the transfer function from the given bode plot. **07**

