

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- IV EXAMINATION – SUMMER 2020

Subject Code: 3141708

Date: 27/10/2020

Subject Name: Control Theory

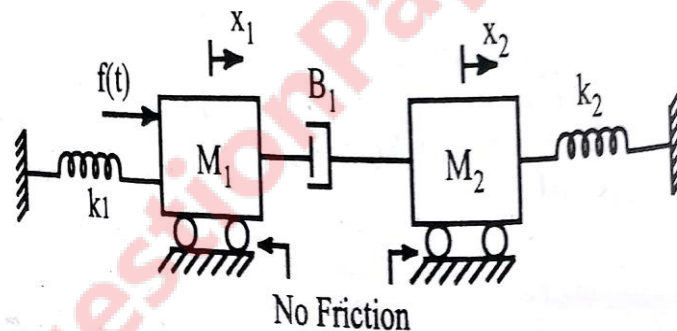
Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

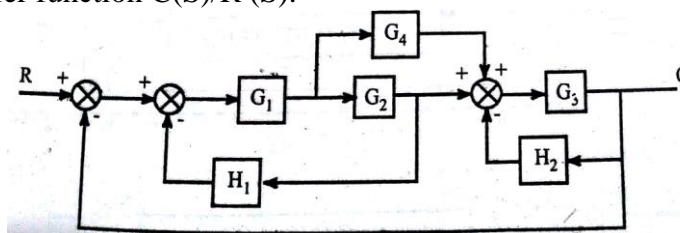
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
Q.1	(a) Differentiate between open loop and close loop system	03
	(b) For mechanical translational system. Write the analogous electrical elements in force voltage and force-current analogy.	04
	(c) Explain standard Test signals & derive equation of steady state	07
Q.2	(a) Define transfer function and Explain importance of Laplace transform in control system.	03
	(b) Explain following terms with necessary diagrams. (1) Delay Time (2) Rise Time (3) Peak Time (4) Steady state error	04
	(c) For the given mechanical system Write down differential equations, mechanical circuit diagram and obtain force-current analogy.	07



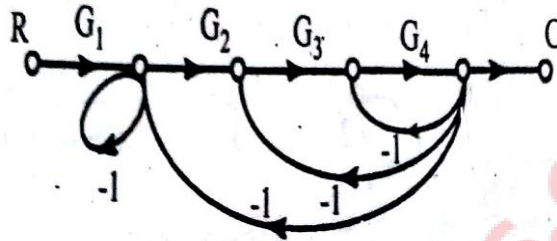
OR

	(c) What is force voltage analogous system? Which are the analogous quantities according to this method?	07
Q.3	(a) State the limitation of Routh criterion and how these limitations are overcome by Root Locus.	03
	(b) Explain the mathematical model of thermal system.	04
	(c) A linear feedback control system has the block diagram shown in Figure. Using block diagram reduction rules, obtain overall transfer function $C(S)/R(S)$.	07



OR

- Q.3** (a) Derive unit step response of a first order system. **03**
- (b) By means of Routh criterion, determine the stability of the system described by characteristic equations.
 $S^4+8S^3+18S^2+16S+5=0$
Comment on location of the roots. **04**
- (c) For the signal flow graph shown in Figure, using Masson's gain formula determine the overall transfer function C/ R. **07**



- Q.4** (a) Define pole, zero and order of a system. **03**
- (b) Explain Performance Indices. **04**
- (c) List all the rules to construct a root locus and explain. **07**

OR

- Q.4** (a) Derive expression of K_P, K_V, K_A for Type '0' control system **03**
- (b) Define and explain following terms with respect to frequency response (i) Gain Margin (ii) Phase Margin **04**
- (c) Explain Sensitivity of Control Systems to Parameter Variations. **07**

- Q.5** (a) Define : 1) state variable, 2) state vector, 3) state space **03**
- (b) With example explain the location of the roots of characteristics equation for the stable control system. **04**
- (c) Sketch the root locus for the given open loop transfer function $G(s)H(s)= K/s (s + 2)(s + 3)$ **07**

OR

- Q.5** (a) Explain the Nyquist stability criterion. **03**
- (b) Sketch polar plot for the system with open loop transfer function is $G(s)H(s)= 1/(s + 4)(s + 2)$ **04**
- (c) Sketch the Bode plot and determine the gain margin and phase margin for the given unity feedback control system.
 $G(s)H(s)= k / s (1+0.02s)(1 + 0.04s).$ **07**
