

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- IV EXAMINATION – SUMMER 2020

Subject Code: 2141708

Date: 02/11/2020

Subject Name: Control System

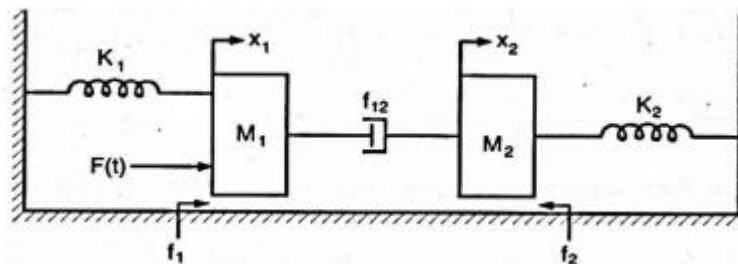
Time: 10:30 AM TO 01:00 PM

Total Marks: 70

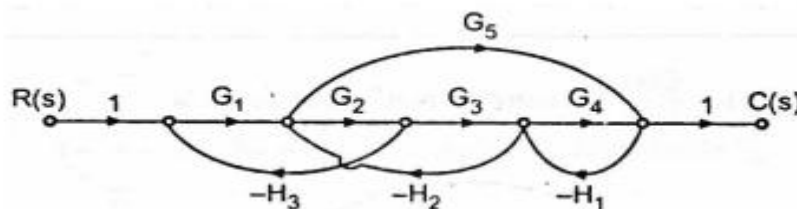
Instructions:

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

		MARKS
Q.1	(a) Draw and explain block diagram of open loop control system with suitable example.	03
	(b) Enlist advantages and disadvantages of closed loop control system over open loop control system.	04
	(c) Find out transfer function of electrical lead network.	07
Q.2	(a) Define the following terms: 1. Gain 2. Characteristic Equation 3. Pole	03
	(b) Find out inverse Laplace transform for $F(s) = \frac{4}{s(s+1)}$.	04
	(c) Derive transfer function of field controlled dc motor.	07
	OR	
	(c) Obtain $F \rightarrow I$ and $F \rightarrow V$ analogy for given mechanical network	07



Q.3	(a) Define following terms of Signal Flow Graph. Node, Loop, Self Loop	03
	(b) Derive state model for series RLC circuit.	04
	(c) Write the rules for block diagram Reduction technique	07
	OR	
Q.3	(a) Define state transition matrix using equation.	03
	(b) Draw the step response of second order system for values of damping ratio (i) $\zeta > 1$ (ii) $\zeta = 1$ (iii) $0 < \zeta < 1$ (iv) $\zeta = 0$	04
	(c) Obtain the overall transfer function using Mason's gain formula for the signal flow graph shown in Fig.	07



- Q.4** (a) What are the advantages of state variable analysis over classical methods? **03**
- (b) Derive first order step response. **04**
- (c) The closed loop transfer function of a second order system is given by $G(s) = \frac{100}{s^2 + 10s + 100}$. Determine damping ratio, peak overshoot, settling time, rise time, peak time. **07**

OR

- Q.4** (a) Define position error constant, velocity error constant, Acceleration error constant. **03**
- (b) Explain standard test signals. **04**
- (c) $s^6 + 4s^5 + 3s^4 - 16s^2 - 64s - 48 = 0$ Check the stability of the given characteristic equation using R-H method. **07**

- Q.5** (a) What is M circle and N circles in Nyquist plot. **03**
- (b) Define the following terms with respect to frequency response (i) Gain Margin (ii) Phase Margin (iii) Gain cross-over frequency (iv) Phase crossover Frequency **04**
- (c) Draw the Bode plot for a system transfer function $G(s)H(s) = \frac{100}{s(s+1)(s+2)}$. **07**

OR

- Q.5** (a) Explain polar plot in brief. **03**
- (b) Explain Nyquist stability criteria in brief. **04**
- (c) Draw the root locus for the open loop transfer function of a unity feedback control system is $G(s) = \frac{k}{s(s+6)(s+9)}$ **07**
