GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 141701   **Date: 08/06/2017**
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.**

Q.1	**(a)**	What is servomechanism? Explain servomechanism in detail.	**07**
	(b)	Explain rules for Block Diagram Reduction Technique to find Transfer function.	**07**
Q.2	**(a)**	Define the following terms:- (1) Gain Margin (2) Phase margin (3) Gain cross over frequency (4) phase cross over frequency (5) Band Width (6) Corner frequency (7) Transfer function.	**07**
	(b)	What is stability? Explain necessary and sufficient conditions for stability of control system by R-H criterion.	**07**

OR

	(b)	Determine the range of value K for system to be stable having the following characteristic equation using R-H criterion. $G(s) = S^3 + 3KS^2 + (K+2)S + 4 = 0$	**07**
Q.3	**(a)**	Determine the overall transfer function using Mason's Gain formula for the signal flow graph as shown in fig. no.1(a).	**07**
	(b)	Obtain the transfer function of the mechanical system shown in fig.no.1(b).	**07**

OR

Q.3	**(a)**	Draw the Root Locus for the following transfer function. $G(S) = K/S \, (S+4) \, (S^2+4S+20)$.	**07**
	(b)	Define the Time Response specifications.	**07**
Q.4	**(a)**	Draw the polar plot for the transfer function $G(S)= 5/S \, (S+1) \, (S+2) \, (S+3)$.	**07**
	(b)	A unity feedback system is characterized by an open loop transfer function $G(S) = K/S \, (S+10)$. Determine the gain K, so that the system will have a damping ratio of 0.5. For the value of K, determine settling time, peak overshoot, time to peak over shoot and Damped frequency of oscillations for unit step input.	**07**

OR

Q.4	**(a)**	Determine the stability of control system having the following transfer function using Nyquist Stability Criterion. $G(S)= K/S \, (S^2 + S + 4)$.	**07**
	(b)	Give comparison between Block Diagram and Signal Flow Graph methods.	**07**
Q.5	**(a)**	Draw the Bode Plot for the system having the following transfer function $G(S)= 100/ S(S+1) \, (S+2)$ and determine stability of the system.	**07**
	(b)	Mention the difference between open loop and closed loop control systems.	**07**

OR

Q.5	**(a)**	Explain Co-relation between Time domain and Frequency domain.	**07**
	(b)	Derive the analogous relationship between mechanical system and electrical system based on force (torque) – voltage analogy.	**07**

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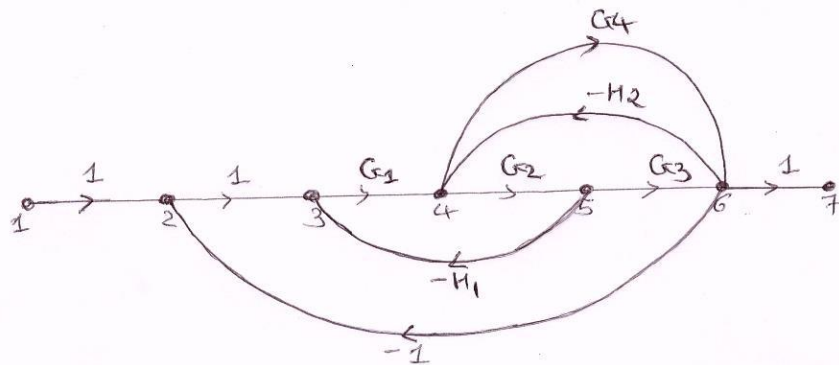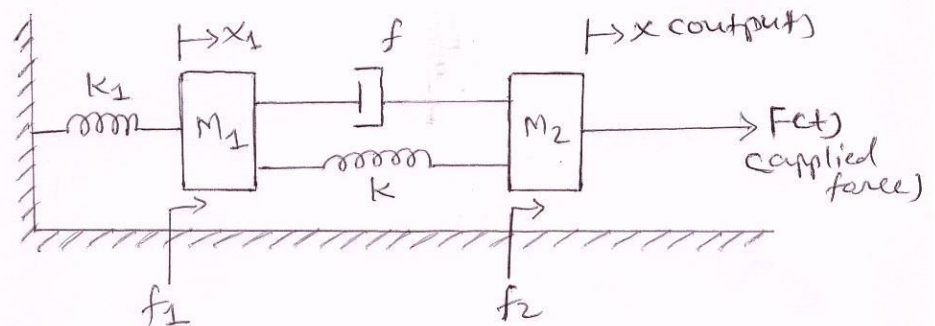
Q-3 (a)

fig No. 1(a)

Q-3 (b)

fig No. 1(b)