GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code:2151908   **Date:31-05-2024**
Subject Name:Control Engineering
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.**
4. **Simple and non-programmable scientific calculators are allowed.**

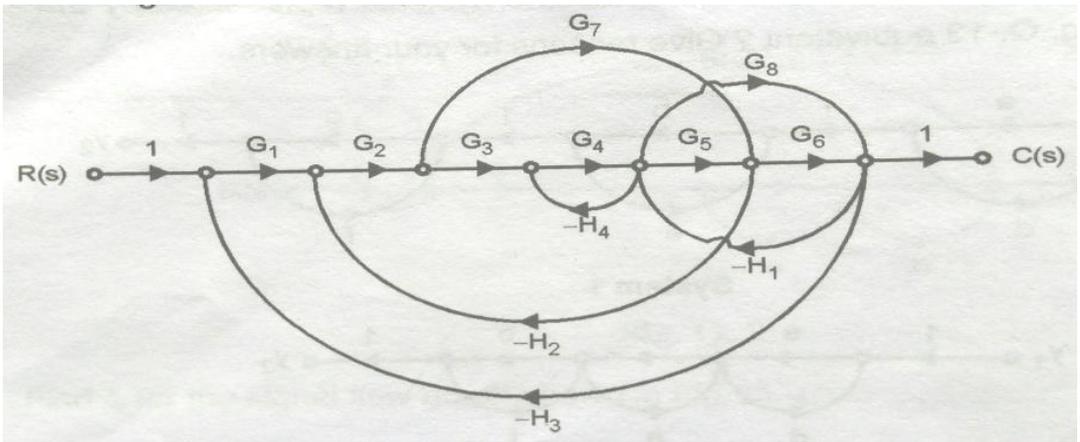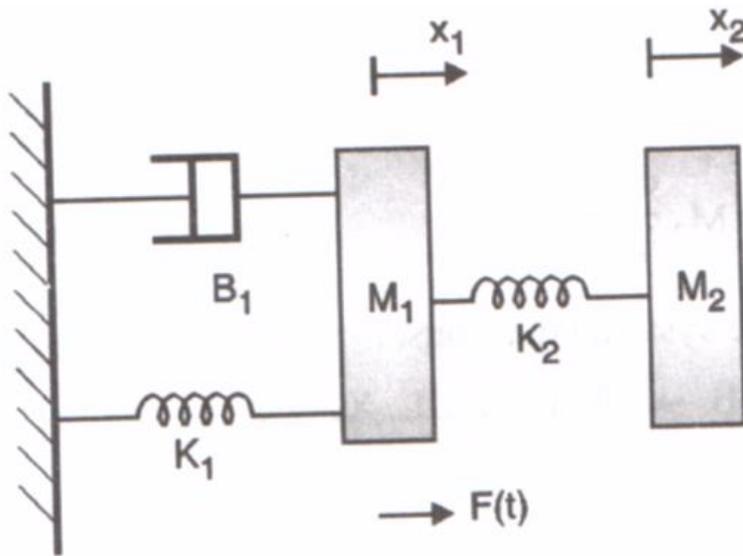|			
Q.1	**(a)**	Draw a general block diagram of an automatic control system.	**03**
	(b)	Differentiate open loop and closed loop control systems.	**04**
	(c)	Reduce block diagram as shown in fig. 1 and obtain overall transfer function.	**07**
Q.2	**(a)**	Differentiate a linear time invariant and linear time varying systems.	**03**
	(b)	Compare between signal flow graphs and block diagrams.	**04**
	(c)	Using Mason's gain formula, find the gain of the system shown in fig. 2.	**07**
		OR	
	(c)	What are the signal flow graphs ? Define node, transmittance, branch, source node, sink node, path, loop and loop gain with necessary diagrams.	**07**
Q.3	**(a)**	State the advantages of Analogues systems.	**03**
	(b)	Explain in brief force-voltage analogy.	**04**
	(c)	Explain the mathematical modeling of fundamental components of mechanical translational system	**07**
		OR	
Q.3	**(a)**	Define hydraulic system. State the major components of hydraulic system.	**07**
	(b)	Name the various types of pumps commonly used for hydraulic power purposes. Explain any one pump with necessary diagram.	**04**
	(c)	For the mechanical system shown in fig.3. draw the mechanical network diagram and obtain the differential equations of performance of the system.	**07**
Q.4	**(a)**	Explain in brief various types input test signals used for time response analysis of a control system.	**03**
	(b)	Define delay time and rise time in reference to transient response specifications of second order system using neat sketch.	**04**
	(c)	Define pneumatic control systems. List all major components of this system. Briefly explain the properties of air.	**07**
		OR	
Q.4	**(a)**	What is modern control theory ?	**03**
	(b)	Compare modern control theory with conventional control theory.	**04**
	(c)	Determine the stability of a closed loop control system with characteristic equation : $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$.	**07**
Q.5	**(a)**	State the advantages and disadvantages of frequency response analysis.	**03**
	(b)	Explain the following terms : i) Resonant peak; ii) Resonant frequency	**04**
	(c)	Define Controller and give classification of it. Explain Two Position Controller with suitable example.	**07**
		OR	
Q.5	**(a)**	Obtain state-space model for spring-mass-damper system.	**03**
	(b)	Explain pneumatic nozzle-flapper amplifier with a neat sketch.	**04**
	(c)	Explain with neat sketch PID Controller and derive its transfer function.	**07**
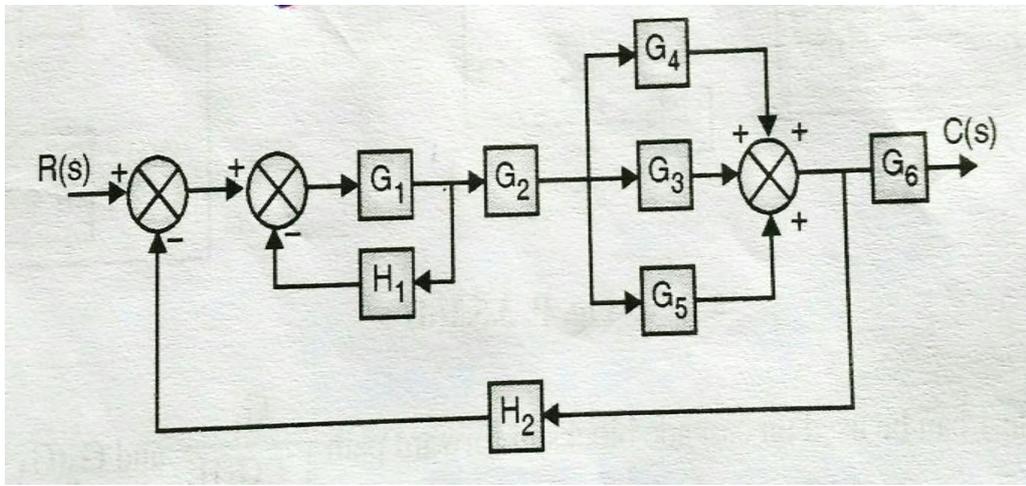
Figure No. 1 (Q.1(c))

Figure No. 2 (Q.2(c))

Figure No. 3 (Q.3(c))

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