Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022

Subject Code:3130905 Date:18-07-2022

Subject Name:Control System Theory

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)**	Define control system and give classification of control systems.	**03**
	(b)	State advantages and dis advantages of transfer function.	**04**
	(c)	Explain closed loop control system with suitable example in detail.	**07**
Q.2	**(a)**	Define transfer function and state methods to find transfer function of control system.	**03**
	(b)	Prepare table showing analogous quantities of Electrical and mechanical translation systems for F-V and F-I analogy.	**04**
	(c)	Determine the transfer function for given mechanical system shown in fig 1 and draw equivalent electrical circuit for F-V analogy.	**07**
		OR	
	(c)	Draw schematic diagram of Field controlled D.C. Motor and derive it's transfer function.	**07**
Q.3	**(a)**	List out the different types of Controllers.	**03**
	(b)	Define the following terms related to signal flow graph: 1. Source node 2. Sink node 3. Chain node. 4. Dummy node.	**04**
	(c)	Evaluate overall transfer function of the system shown in fig.2 using block diagram reduction technique.	**07**
		OR	
Q.3	**(a)**	Define the terms: - 1. Delay Time 2. Rise Time 3. Peak overshoot.	**03**
	(b)	For a system having G(S) = 15/(S+1) (S+3) , H(S)= 1. Determine (i) Characteristic equation (ii) Damping Ratio (iii) Undamped frequency.	**04**
	(c)	With neat sketch explain all the time response specifications.	**07**
Q.4	**(a)**	A system has G(S) = 50 (1+0.1S)/S (S+20) (0.02S+1) calculate corner frequencies of the system.	**03**
	(b)	State limitations of frequency Response Analysis.	**04**
	(c)	Explain constructional rules for Root Locus Technique.	**07**
		OR	
Q.4	**(a)**	Write technical note of Gain margin or Phase margin.	**03**
	(b)	Predict stability of control system for given characteristic equation using R-H Criterion. $S^5 + S^4 + 24S^3 + 48S^2 - 25S - 5 = 0$	**04**
	(c)	State and explain Nyquist Stability Criteria.	**07**
Q.5	**(a)**	Explain effect of PD controller on second order system.	**03**
	(b)	Write characteristics of PI (Proportional + Integral) Mode.	**04**
	(c)	Explain the design of lag compensator using root locus.	**07**
		OR	
Q.5	**(a)**	Define the terms: 1. State variable 2. State vector 3. State space.	**03**
	(b)	State advantages of State Variable Analysis.	**04**

(c) Obtain state model for given electrical system shown in fig 3. **07**

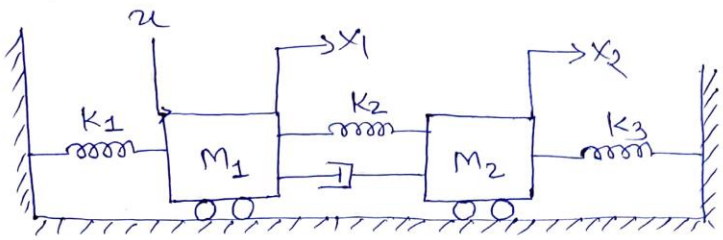

fig. 1

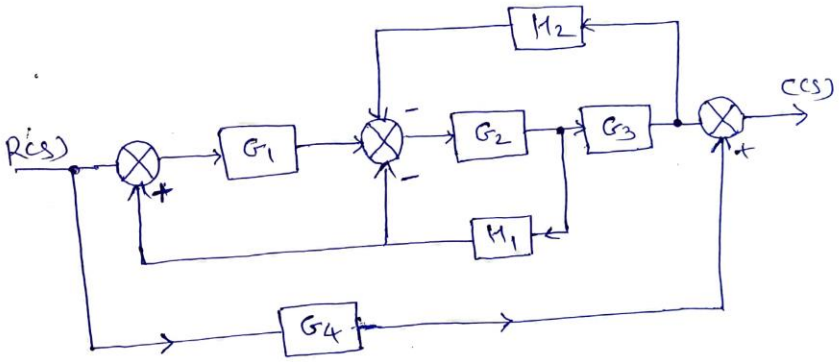

fig. 2

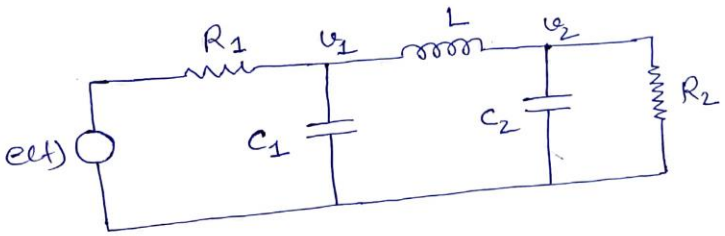

fig. 3

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