Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(NEW) EXAMINATION – WINTER 2022

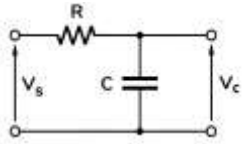
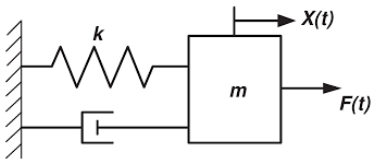
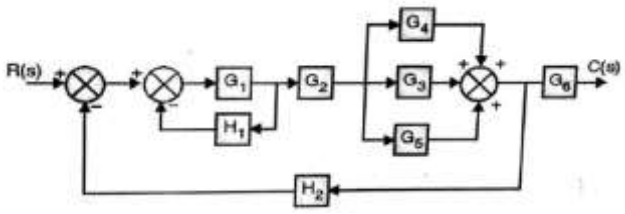
Subject Code:2141708 Date:14-12-2022

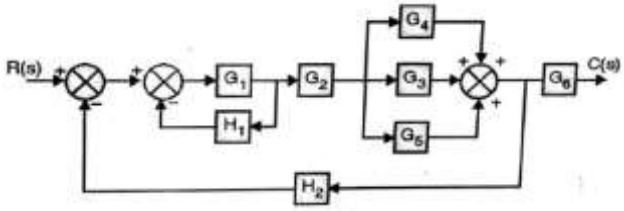
Subject Name:Control System

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define following terms: 1) source node 2) sink node 3) self loop with respect to signal flow graph	**03**
	(b)	Derive the transfer function for the RC circuit Shown below 	**04**
	(c)	List out and define the specifications of second order time response system. Derive equation for the peak overshoot and settling time.	**07**
Q.2	**(a)**	Write Mason's gain formula and define each term of the formula	**03**
	(b)	Give details about type and order of the system	**04**
	(c)	Mention difference between transfer function approach and state space approach.	07
		OR	
	(c)	Derive the response of second order systems and plot the output	07
Q.3	**(a)**	Derive the rule of shifting the summing point behind and ahead of the block. Explain with diagram	**03**
	(b)	Write the equilibrium equations for the mass spring damper system shown below 	**04**
	(c)	Find the overall transfer function by block diagram reduction rules 	**07**
		OR	
Q.3	**(a)**	What is analogous of all variables in mechanical network in force-voltage analogy?	**03**
	(b)	Write a note on steady state error and error constants.	**04**
	(c)	Find the overall transfer function using Masons Gain Formula	**07**



Q.4	**(a)**	Find the polar plot of *G=1/S+1*	**03**
	(b)	Define Transfer Function and find the impulse response of G(s)=1/(s+1)	**04**
	(c)	Draw the Bode plot for G(s) = 10(1+0.5s) / s (1+0.1s) (1+0.2s). Also find phase and gain margin.	**07**
		OR	
Q.4	**(a)**	What is M circle and N circles in Nyquist plot	**03**
	(b)	Write the rules for drawing root locus	**04**
	(c)	A unity feedback system is characterized by open loop transfer function G(s) =K/s(s +10). Determine gain K so that the system will have a damping ratio of 0.5.	**07**
Q.5	**(a)**	Explain standard test signals	**03**
	(b)	For the system $G=25/S^2+4S+25$, find the natural frequency, damping ratio. Depending on the damping ratio, describe the system	**04**
	(c)	A unity feedback control system's open loop transfer function is $$G(s)H(s) = \frac{k(s+13)}{s(s+3)(s+7)}$$ Using Routh criterion, calculate the range of k for the system to be stable. If the value of k=1, comment on stability.	**07**
		OR	
Q.5	**(a)**	For the closed loop system $G=(S+1)(S+3)/S^3(S+1)(S+3)$, find the following 1. Order, 2. Type, 3. characteristic equation	**03**
	(b)	Give the difference between Block diagram reduction and Signal Flow Graph	**04**
	(c)	Derive the state model of RLC circuit.	**07**

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