Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2021

Subject Code:3140313 Date:08/09/2021

Subject Name:Control System and Analysis

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.**

			Marks
Q.1	**(a)**	Describe LTI system with one example.	**03**
	(b)	Define impulse, step, ramp and parabolic signal with its laplace transform.	**04**
	(c)	Explain open loop and closed loop control system with suitable example & gives its advantages and disadvantages.	**07**
Q.2	**(a)**	Write applications of control system.	**03**
	(b)	For the electrical network of Fig.1 Find the transfer function Vo(s) /Vi(s).	**04**
	(c)	Write differential equation for mechanical system as shown in Fig.2. Find F-I & F-V analogous circuits.	**07**
		OR	
	(c)	Using Block diagram Reduction technique, find the transfer function for the system shown in Fig.3.	**07**
Q.3	**(a)**	The impulse response of a system is e^{-2t}. Find the transfer function.	**03**
	(b)	Write properties of Transfer Functions.	**04**
	(c)	Find the transfer function of given control system in fig.4. using signal flow graph.	**07**
		OR	
Q.3	**(a)**	Write properties of Signal Flow Graph.	**03**
	(b)	Test the stability of a system whose characteristics equation is, $S^3+5S^2+6S+30 = 0$.	**04**
	(c)	The open loop transfer function of a unity feedback control system is given by, $G(S) = 20S/(S+4)$. Determine time domain specifications.	**07**
Q.4	**(a)**	Derive impulse response of first order control system.	**03**
	(b)	Find the inverse Laplace transform of $F(s) = (s+2)/ s(s+5)(s+1)$	**04**
	(c)	Derive Steady state error of type 0, 1, 2 closed loop control system for unit step, ramp, and parabolic input signal.	**07**
		OR	
Q.4	**(a)**	Explain mason gain formula.	**03**
	(b)	Draw polar plot of $G(S)H(S) = 50/ (S+3)(S+4)(S+5)$.	**04**
	(c)	Consider the unity feedback control system whose open loop transfer function is $G(s) = 20/s(1+0.2s)$. Determine the steady state error and its variation with time when the input is $r(t) = 1 + t + t^2$.	**07**
Q.5	**(a)**	Define State Variables, State Vectors and State Space.	**03**
	(b)	Draw the response for Under damped, Critically damped & Over damped systems with necessary equations.	**04**
	(c)	For the system having the open loop transfer function $G(S)H(S) = 10 /S(S+8)(S+4)$. Determine the stability of the system by plotting the bode plot of the system.	**07**
		OR	
Q.5	**(a)**	Describe the State model of nth order of system.	**03**
	(b)	Draw Nyquist plot of $G(S)H(S) = 1/ (S+3)(S+8)$.	**04**

(c) Sketch the root locus of a unity feedback control system with $G(s) = k/s(s+2)(s+5)$ and determine the value of k for marginal stability. **07**

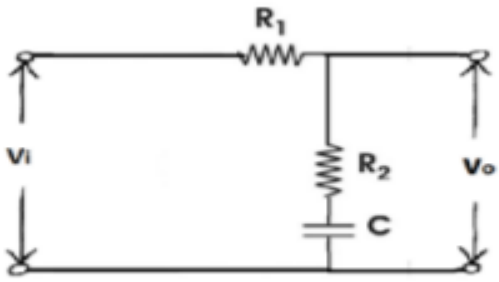

Fig. 1

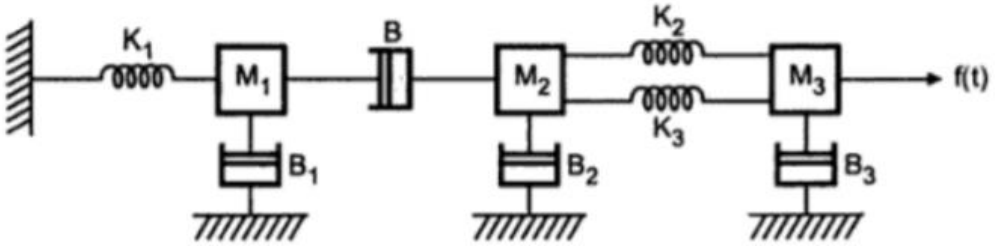

Fig.2

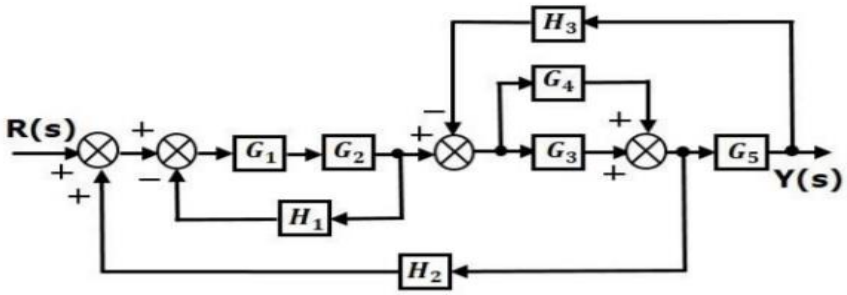

Fig.3.

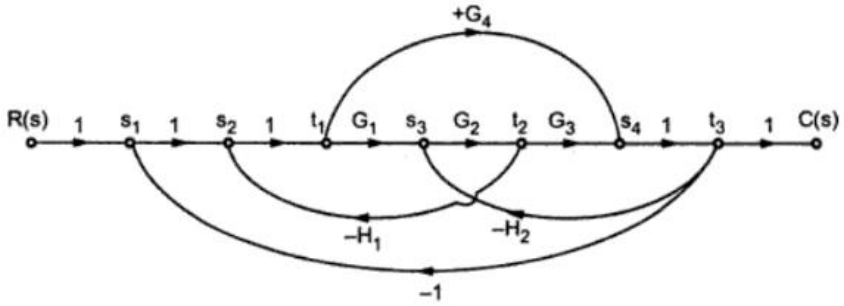

Fig.4.