GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2022

Subject Code:2141708   **Date:27-06-2022**

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)**	Draw and explain block diagram of closed loop control system with suitable example.	**03**
	(b)	Describe the benefits of closed loop system over open loop system.	**04**
	(c)	Derive transfer function of armature controlled dc motor.	**07**
Q.2	**(a)**	Explain standard test signals.	**03**
	(b)	Find out inverse Laplace transform for $F(s)=\dfrac{4}{S(S+1)}$.	**04**
	(c)	Draw second order unit step response and explain associated specification terms.	**07**

<div align="center">OR</div>

	(c)	Using mason's gain formula find the transfer function of following System	**07**
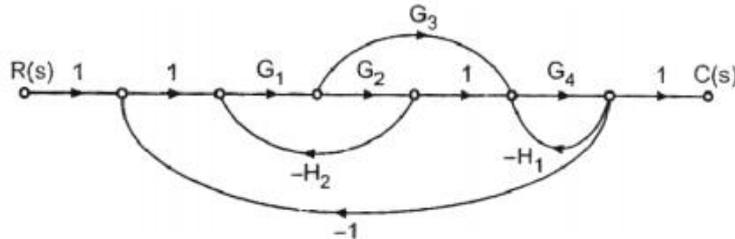
Q.3	**(a)**	Write the force balance equations for an 1) ideal mass 2) ideal spring and 3) ideal dash pot/damper	**03**
	(b)	Discuss the main difference between transfer function approach and state space approach, with appropriate examples.	**04**
	(c)	Using Block Diagram reduction technique, find closed loop transfer function of system shown in figure.	**07**
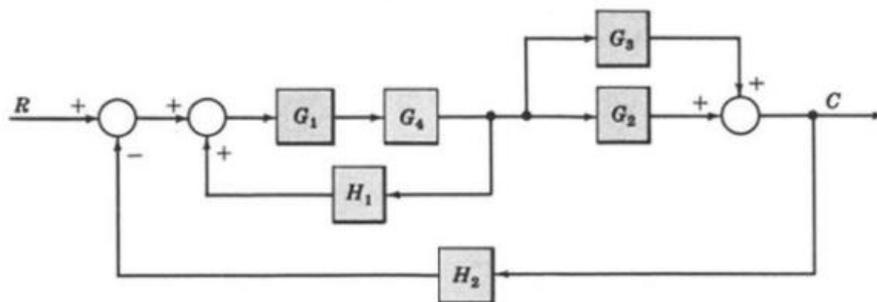
<div align="center">OR</div>

Q.3	**(a)**	Derive force-voltage analogy, with appropriate equations & diagrams.	**03**
	(b)	Explain any four rules of block diagram reduction.	**04**

	(c)	Define steady state error. Derive steady state errors for step, ramp, parabolic inputs for type 0 system.	**07**
Q.4	**(a)**	Explain state, state variables and state vector	**03**
	(b)	Write Mason's gain formula and define each term of the formula	**04**
	(c)	Explain the rules for drawing root locus.	**07**

<div align="center">OR</div>

Q.4	**(a)**	Determine the stability of the system $s^4+8s^3+18s^2+16s+5=0$. Comments on the stability.	**03**
	(b)	Find Centroid & Angle of asymptotes of Root Locus for the given system $G(s)= \dfrac{k}{s(s^2+8s+32)}$	**04**
	(c)	Obtain the mathematical model of a gear train.	**07**
Q.5	**(a)**	Explain gain margin and phase margin	**03**
	(b)	Find the polar plot of $G(s)= \dfrac{1}{1+sT}$	**04**
	(c)	Sketch Bode plot of a unity feedback control system having open loop transfer function as given below $G(s)H(s) = \dfrac{100}{s(s+1)(s+2)}$. Find GM,PM.	**07**

<div align="center">OR</div>

Q.5	**(a)**	Define terms for the system. 1.Order 2. Type 3. characteristic equation	**03**
	(b)	Explain the Nyquist stability criterion.	**04**
	(c)	Derive the expression for transfer function from the state space representation of the system.	**07**

<div align="center">*************</div>