

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2023****Subject Code:2151908****Date:20-12-2023****Subject Name: Control Engineering****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) State requirements of a good control system.	03
	(b) Define the following terms(1) Disturbances (2) Control system	04
	(c) Write down Classification of Control systems. Critically Compare Open loop system with Closed loop system.	07
Q.2	(a) What are the properties of Signal flow graph?	03
	(b) What is Transfer function? State the properties of Transfer function.	04
	(c) Obtain the Transfer function of the block diagram given in Fig. I using the block diagram reduction rules.	07
	OR	
	(c) What is Block Diagram? Explain Block diagram reduction rules briefly.	07
Q.3	(a) State Translational mechanical and Rotational mechanical systems with suitable sketches.	03
	(b) Compare modern control theory with conventional control theory.	04
	(c) Explain Force-Voltage and Force-Current analogy for Mechanical systems.	07
	OR	
Q.3	(a) Define (1) Rise time (2) Settling time (3) Steady state error	03
	(b) Explain in brief Stable system, Unstable system and Marginally stable system.	04
	(c) Obtain transfer function for the signal flow graph shown in Figure II using Mason's Gain formula.	07
Q.4	(a) State Advantages of frequency response Analysis.	03
	(b) Define Resonant Peak, Resonant Frequency and Gain crossover frequency for frequency response specification.	04
	(c) Draw the root locus plot of the system with $G(s) = \frac{k}{s(s+1)(s+2)}, H(s) = 1$	07
	OR	
Q.4	(a) Define State, State vector and state space in the context of state-space approach.	03
	(b) Explain unit step response of first order linear time invariant system.	04
	(c) Using the Routh-Hurwitz criterion for simple design problems, consider that the characteristic equation of a closed-loop control system is $s^3 + 3k s^2 + (k+2)s + 4 = 0$ Determine the desired range of k so that the system is stable.	07
Q.5	(a) Define Hydraulic system and Pneumatic system.	03
	(b) State Basic elements of Hydraulic circuits.	04

- (c) Explain working of Proportional-Derivative (PD) hydraulic controller with a neat diagram. 07

OR

- Q.5 (a) State various components used in pneumatic circuit. 03
 (b) Write Comparison between Pneumatic control systems with Hydraulic control systems. 04
 (c) Explain Pneumatic nozzle-flapper amplifier with a neat sketch. 07

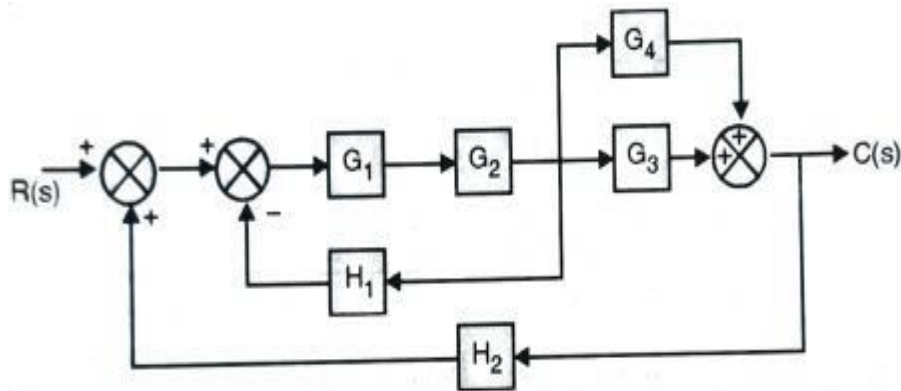


Figure I Block Diagram

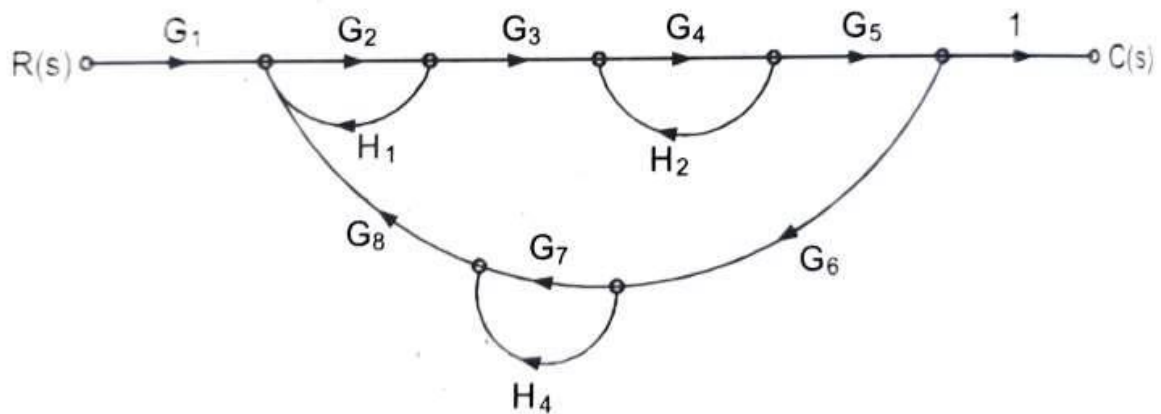


Figure II Signal Flow Graph
