

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2023****Subject Code:3151908****Date:05-12-2023****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) Define transfer function and state its properties for closed loop system.	03
	(b) Compare Open loop and closed loop control systems.	04
	(c) Using block diagram reduction technique, obtain the overall transfer function of the system whose block diagram is as given in Fig. - 1	07
Q.2	(a) Define: State, state vector and State space.	03
	(b) Enlist the type of controllers. Explain Two position On-off controller with neat sketch.	04
	(c) Obtain Transfer function and state space model for the electrical system shown in Fig. 2.	07
<b>OR</b>		
	(c) Use Mason's Gain formula, Obtain the transfer function of the control system shown in Fig. 3	07
Q.3	(a) Define the terms: 1. Peak time 2. Maximum overshoot 3. Rise time 4. Settling time	03
	(b) Find the range of K for stability using Routh's stability criteria for the unity feedback system whose open loop transfer function is given by	04
$G(s) = \frac{K}{s(s+1)(s+2)}$		
	(c) Determine the values of K and k of the closed-loop system shown in Fig. 4 so that the maximum overshoot in unit-step response is 25% and the peak time is 2 sec. Assume J=1 kg-m <sup>2</sup> .	07
<b>OR</b>		
Q.3	(a) Determine: i) Poles ii) Zeros iii) Characteristic equation For the control system represented by following equation.	03
$T(S) = \frac{K(S+5)}{S(S+1)(S-2)(S^2+7S+12)}$		
	(b) Explain the terms:(1) steady state error (2) Time constant	04
	(c) Sketch the root loci for the system shown below:	07
Q.4	(a) List out the advantages of frequency response analysis	03
	(b) Explain Nyquist stability criterion for frequency response unity feedback systems with suitable example.	04

- (c) Explain Phase margin and Gain margin related to frequency response. 07

OR

- Q.4 (a) What is lag and lead compensation for frequency response analysis? 03

- (b) What is Bode plots. State its advantages. 04

- (c) Write a short note on Relative stability for frequency response method with neat sketches for various stabilities. 07

- Q.5 (a) Write a short note on pneumatic actuating valve. 03

- (b) Explain the working principle of nozzle-flapper with neat line sketch. 04

- (c) Compare the features, merits and demerits of pneumatic system and hydraulic system in detail. 07

OR

- Q.5 (a) Explain the importance of FRL unit of the pneumatic system. 03

- (b) Draw a generalized hydraulic control system and state function of each component. 04

- (c) Write a note on working of Hydraulic Proportional plus integral (PI) controller with neat sketch and obtain the transfer function of the same. 07

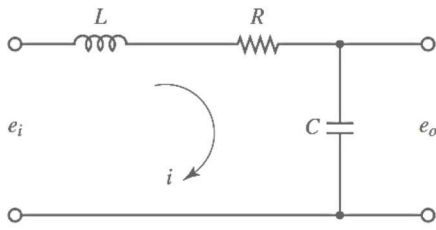


Fig. 2 Mathematical modelling (Q.2(C))

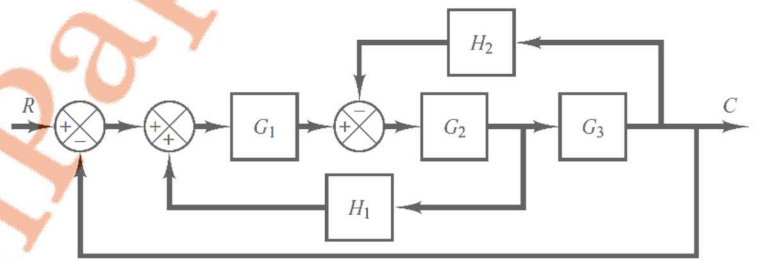


Fig. 1 Block diagram reduction (Q.1(C))

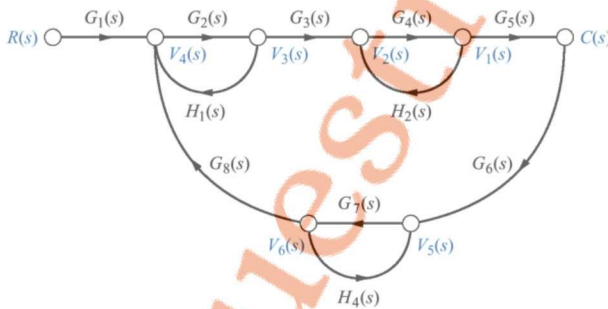


Fig. 3 Signal flow graph – OR (Q. 2(c))

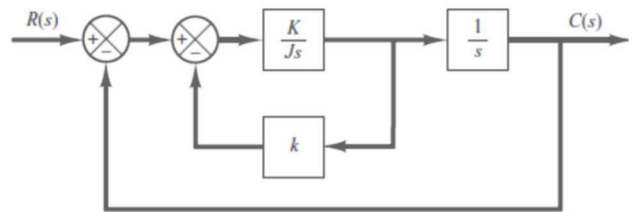


Fig. 4 Feedback control system, (Q. 3(c))

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GTU Questions