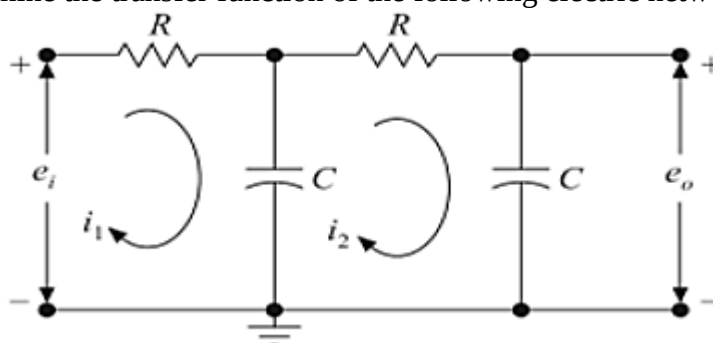


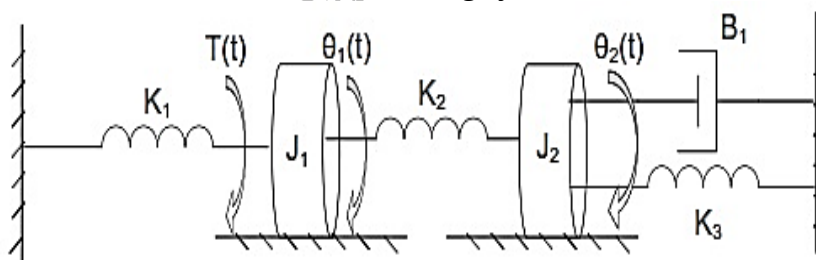
GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-IV(NEW) – EXAMINATION – SUMMER 2019
Subject Code:2142003
Date:15/05/2019
Subject Name: Control Theory
Time:02:30 PM TO 05:00 PM
Total Marks: 70
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- | | | MARKS |
|------------|--|-----------|
| Q.1 | (a) Define: 1) delay time, 2) rise time, 3) pick time. | 03 |
| | (b) State the advantages of frequency response of control system. | 04 |
| | (c) Give the difference between block diagram and SFG method. | 07 |
| Q.2 | (a) Derive transfer function of Field controlled D.C. Motor. | 03 |
| | (b) Derive and sketch the time response of 1st order control system for the unit step input. | 04 |
| | (c) Determine the transfer function of the following electric network. | 07 |


OR

- | | | |
|------------|--|-----------|
| (c) | Find mathematical model of following system. | 07 |
|------------|--|-----------|



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|------------|--|-----------|
| Q.3 | (a) Explain initial value and final value theorem. | 03 |
| | (b) Explain Force-Voltage analogous system. | 04 |
| | (c) Write a short note on Gear Train and derive all the required equation. | 07 |

OR

- | | | |
|------------|---|-----------|
| Q.3 | (a) Define Gain crossover frequency. | 03 |
| | (b) Explain Force-Current analogous system. | 04 |

(c) Refer Fig.1 and determine the transfer function.

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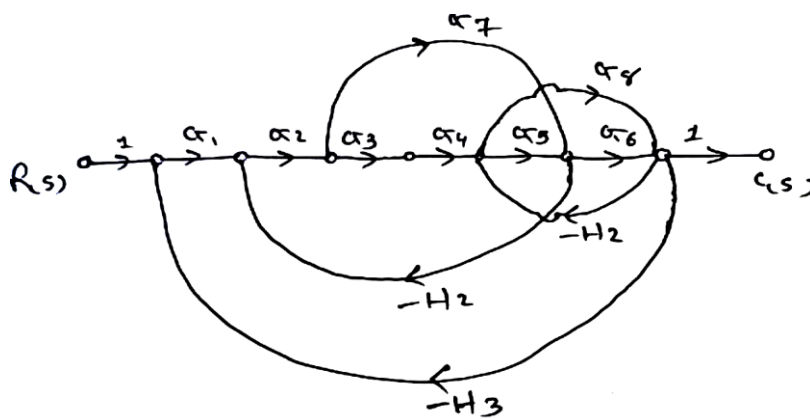


FIG 1.

- Q.4** (a) Define : 1) state variable, 2) state vector, 3) state space 03
 (b) A unity feedback system has $G(s) = \frac{k(s+1)}{s^2(s+2)(s+5)}$. Using Routh-Hurwitz criteria find range of k for the closed loop system to be stable. 04
 (c) Simplify the block diagram shown in Figure 2. Then; obtain the closed-loop transfer function $C(s)/R(s)$. 07

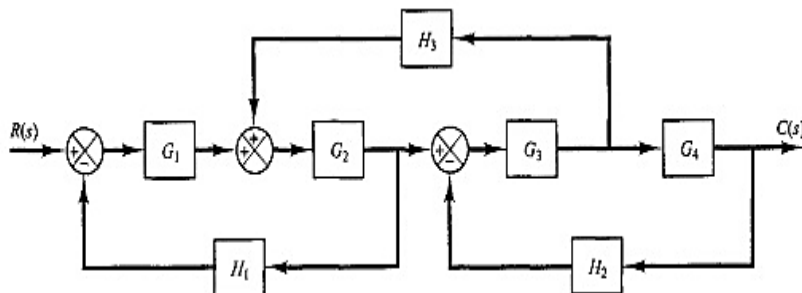


Fig 2.

OR

- Q.4** (a) Derive expression of K_P , K_V , K_A for Type '0' control system. 03
 (b) Define thermal resistance and thermal capacitance. Also derive the transfer function of Thermometer placed in water bath as a Thermal system. 04
 (c) For the system having the open loop transfer function 07

$$G(s)H(s) = \frac{10}{s(s+1)(s+10)}$$

Determine the stability of the system by plotting the Bode plot of the system.

- Q.5** (a) Define and explain following terms with respect to frequency response (i) Gain Margin (ii) Phase Margin (iii) Stability 03
 (b) Write advantages and disadvantages of nyquist plot. 04
 (c) A feedback control system has open loop transfer function 07

$$G(s)H(s) = \frac{k}{s(s+4)(s^2+4s+20)}$$

Plot the root locus for $K=0$ to ∞ . Indicate all point on it.

OR

- Q.5** (a) Explain with suitable example, one method for linearization of nonlinear mathematical model. 03

- (b) Draw the response of three damping condition and explain critical damping for second order system. **04**
- (c) Explain constant-M circles and constant-N circles by deriving related expressions. Explain how resonant peak can be obtained. **07**

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