USN

17ME73

Seventh Semester B.E. Degree Examination, Feb./Mar.2022
Control Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. What is a control system? State its ideal requirements. **(08 Marks)**

b. With suitable mathematical expression, explain the following :

(i) Proportional-Integral control mode.

(ii) Proportional-Derivative control mode. **(12 Marks)**

OR

2 a. With a neat sketch, explain open loop and closed loop control system. Give one "day to day" life example for each. **(12 Marks)**

b. Distinguish between open loop and closed loop control system. **(08 Marks)**

Module-2

3 a. Construct equivalent mechanical network and determine transfer function $\frac{X_1(s)}{F(s)}$ for the mechanical system shown in Fig. Q3 (a). **(10 Marks)**

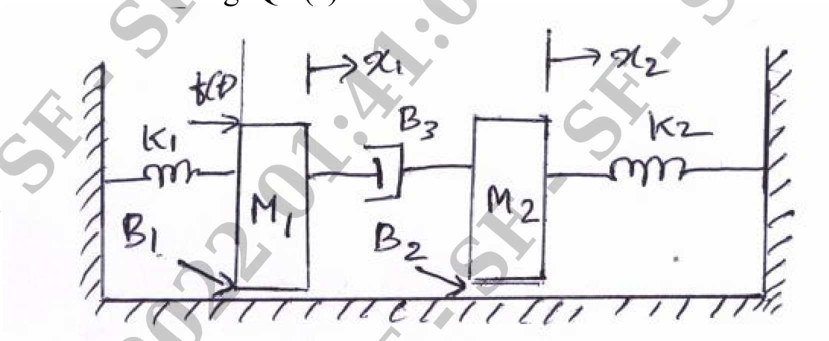

Fig. Q3 (a)

b. Determine the transfer function $\frac{C(s)}{R(s)}$ for the system shown in Fig. Q3 (b). **(10 Marks)**

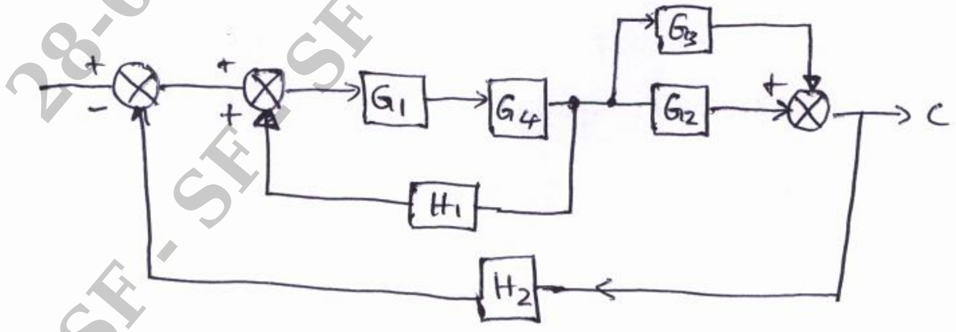

Fig. Q3 (b)

OR

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

4 a. For the mechanical system shown in Fig. Q4 (a), find the electrical analog based on force-current analogy. **(12 Marks)**

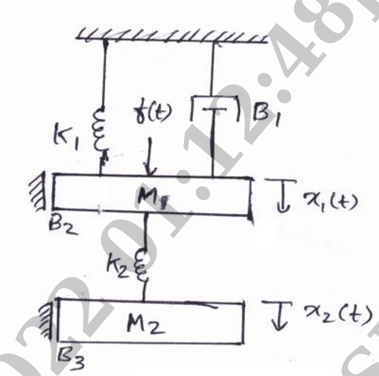

Fig. Q4 (a)

b. With a neat sketch, obtain transfer function for a pneumatic actuator. **(08 Marks)**

Module-3

5 a. By using Routh's method comment on stability of system having characteristic equation,
$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$ **(10 Marks)**

b. Sketch the root locus plot for a closed loop system having an open-loop transfer function,
$G(s)H(s) = \dfrac{K(s+2)}{s(s+1)}$ **(10 Marks)**

OR

6 Sketch the compute root-locus plot for the control system given by,
$G(s) = \dfrac{K}{s(s+2)(s^2+6s+25)}$ **(20 Marks)**

Module-4

7 Investigate the closed loop stability of the system using Nyquist stability criterion for open-loop system with transfer function,
$G(s)H(s) = \dfrac{5}{s(s+1)}$. **(20 Marks)**

OR

8 Draw Bode plot, determine GM, PM, W_{gc}, W_{PC} and comment on stability for a unity feedback control system having,
$G(s) = \dfrac{80}{s(s+2)(s+20)}$. **(20 Marks)**

Module-5

9 a. Explain (i) Lag-compensator
(ii) Lead-compensator **(10 Marks)**

b. What is state variable analysis? What are its advantages? **(10 Marks)**

OR

10 a. Define: (i) State (ii) State variables (iii) State space
(iv) State vector (v) State trajectory. **(10 Marks)**

b. Obtain transfer function for a simple thermal system by mathematical modeling approach. **(10 Marks)**

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