U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

October 2023 Semester End Main Examinations

Programme: B.E. **Semester: IV**

Branch: ECE,ETE,EEE,MD,EIE **Duration: 3 hrs.**

Course Code: 19ES4ESCST **Max Marks: 100**

Course: Control Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Enumerate the important features of feedback control systems. Explain with an example. **08**

b) Apply the fundamental laws to obtain the mathematical model translational mechanical system shown in fig 1b. Also obtain the F-V and F-I analogy. **12**

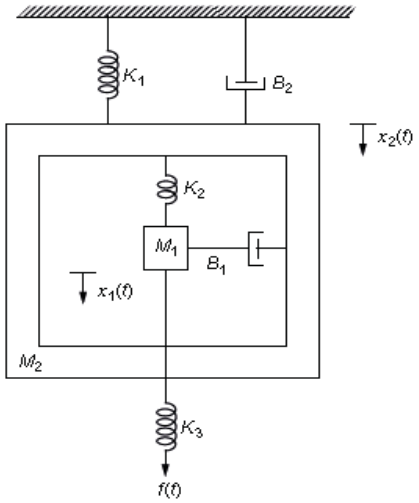

fig 1b

OR

2 a) Enumerate the differences between open and closed loop control system. **05**

b) Apply the appropriate reduction rules and obtain the transfer function for the system shown in Figure 2(b). **08**

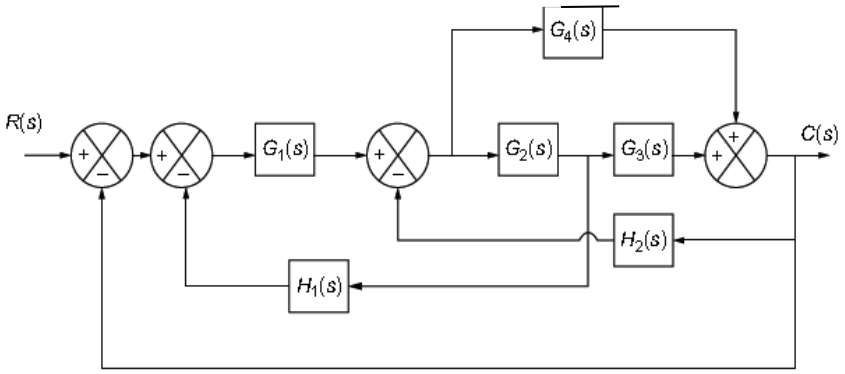

Fig. 2(b)

c) Apply Mason Gain Formula to obtain transfer function for the system shown in Figure 2(b). **07**

UNIT - II

3 a) Define the time domain specifications of a second order system injected with a unit step input with diagram. **06**

b) A feedback system has $G(s) = \frac{144}{s(s+2)}$, $H(s) = 1$ Determine the time-domain specifications such as rise time, percentage peak overshoot, peak time and settling time when the system is subjected to a step input of 1 unit. **08**

c) The open-loop transfer function of a unity feedback system is $G(s) = \frac{k}{s(1+0.025s)}$ and damping ratio = 0.4. Determine K and the steady-state error for the ramp input. **06**

UNIT - III

4 a) The characteristic equation of a single loop feedback system is given as **10**
i) $F(s) = s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 3s + k = 0$
ii) $F(s) = s^4 + 3s^3 + 3ks^2 + (k+2)s + 4 = 0$
Find the stability of the system using R-H criterion and the range of value of k for stability if applicable.

b) Sketch the root locus of the system whose loop transfer function is given by $G(s)H(s) = \frac{K}{s(s^2+2s+2)}$. Comment on the stability of the system. **10**

UNIT - IV

5 a) Explain the stability analysis using polar plot. **06**

b) Comment on stability using Nyquist criterion for the system having $G(s)H(s) = \frac{50}{s(1+s)(2+s)}$ **09**

c) Obtain the polar plot for $G(s)H(s) = \frac{1}{s^2(1+s)}$ **05**

OR

6 a) Define the frequency domain specifications. **06**

b) Sketch the Bode plot and determine the frequency domain specifications for $G(s)H(s) = \frac{80}{(s+2)(s+20)}$ Also, comment on the stability of the system. **14**

UNIT - V

7 a) Determine the state-space model for the electrical system shown in Fig. 7(a) **08**

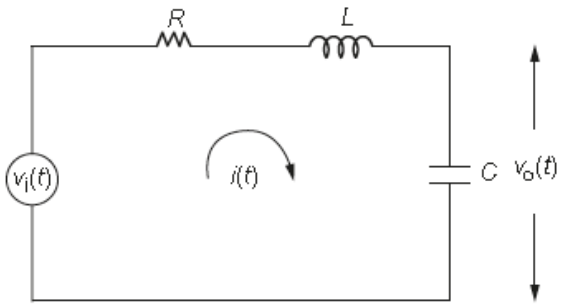

Fig. 7(a)

b) Obtain state-space representation for the system represented by **06**

$$\frac{d^3y(t)}{dt^3} + 8\frac{d^2y(t)}{dt^2} + 11\frac{dy(t)}{dt} + 6y(t) = u(t)$$

c) Obtain the transfer function for the state-space representation of a system given by **06**

A=[-1 -2 3;0 -1 1;-3 -1 -1]; B=[0; 0; 1]; C=[0 1 0];D=[0 0 0]

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