U.S.N.										

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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

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

Branch: ECE,EEE,ETE,EIE,MD **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 and explain different types of control systems with examples **06**

b) Refer the block diagram shown in figure 1b, using block diagram reduction techniques find the overall transfer function **07**

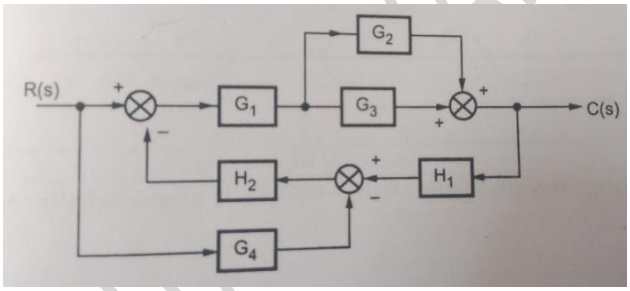

Figure 1b

c) For the mechanical system shown in figure 1c, draw the mechanical network, Write differential equations and force-voltage electrical network **07**

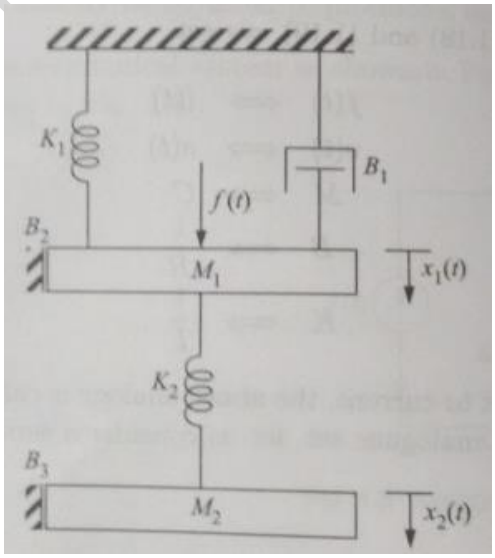

Figure 1c

OR

2 a) For the signal flow graph shown in figure 2a, find the transfer function using mason's gain formula. **07**

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

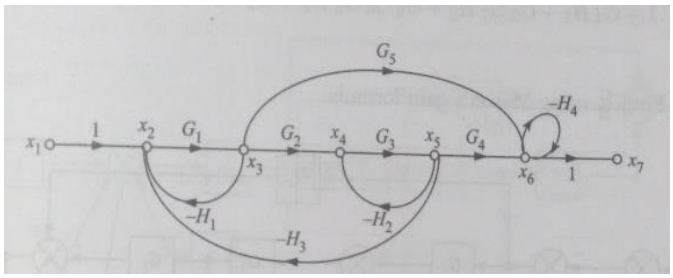

Figure 2a

b) For the rotational mechanical system shown in figure 2b, draw an electrical network based on torque –voltage analogy **07**

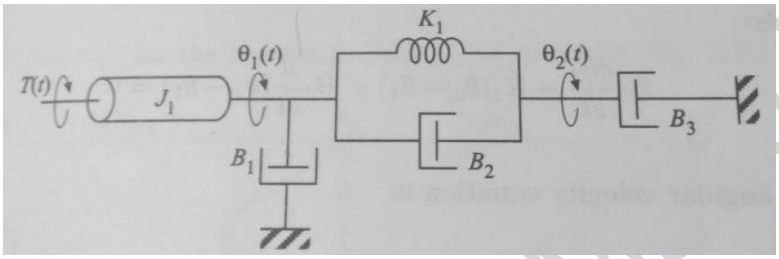

Figure 2b

c) Draw the lead compensator electrical network and obtain its transfer function **06**

UNIT - II

3 a) A system is given by differential equation $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 8x$ **06**

where *y* is output and *x* is input. Determine all time domain specifications for unit step input.

b) Obtain response of a second order system for a unit step input for an under damped system **08**

c) Find error constants K_p , K_v , K_a for a unity feedback system represented by open loop transfer function $G(s) = \frac{100}{S^2(S+2)(S+5)}$. **06**

UNIT - III

4 a) Examine stability of a system with characteristics equation $F(s)=s^6+3s^5+4s^4+6s^3+5s^2+3s+2=0$, examine stability. **06**

b) Sketch the root locus for a negative feedback control system having an open loop transfer function $G(s)H(s) = \frac{k}{s(s^2+6s+10)}$ for all values of k ranging from 0 to ∞. **10**

c) Explain the significance of an auxiliary equation **04**

UNIT - IV

5 a) Using Nyquist stability criterion, investigate the stability of a closed loop System whose open loop transfer function is given by, **10**

$$G(s)H(s) = \frac{100}{(s+1)(s+2)(s+3)}$$

b) Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies. **10**

$$G(s)=\frac{10}{s(1+0.4s)(1+0.1s)}$$

OR

6 a) The open loop transfer function of a unity feedback system is given by $G(s)=\frac{1}{s(1+s)(1+2s)}$. Sketch the polar plot and determine the gain margin and phase margin. **12**

b) The asymptotic approximation of the log-magnitude versus frequency plot of a certain system is shown in figure 6b, compute its transfer function **08**

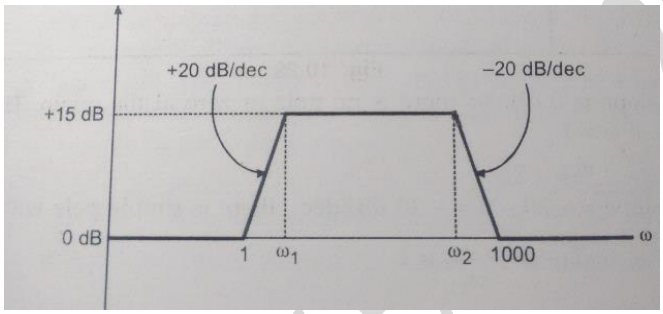

Figure 6b

UNIT - V

7 a) Enlist the advantages of state space analysis over the conventional control system **04**

b) Obtain the state model of the network shown in fig.7b **08**

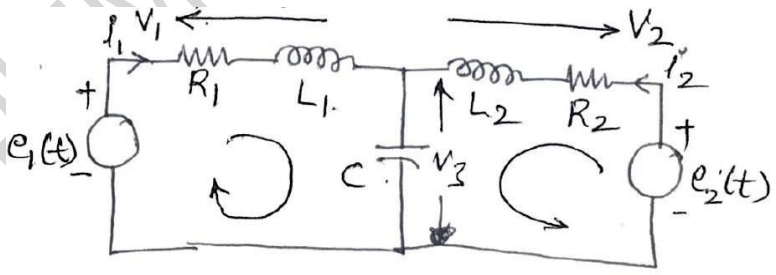

Figure 7b

c) Consider a system having state model **08**

$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-5 & -1\\ 3 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}2\\ 5\end{bmatrix}$ u , $\begin{bmatrix}y_1\\ y_2\end{bmatrix}=[1 \quad 2]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$. Find the transfer function.

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