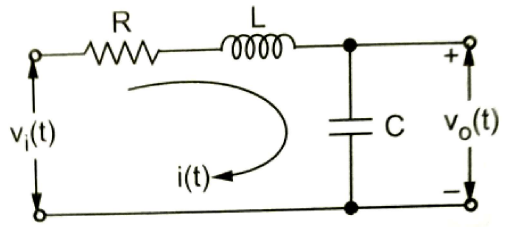

8. Determine the controllability and observability of the system described by 7+7=14

$$\dot{x} = \begin{bmatrix} -3 & 1 & 1 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} x + \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 2 & 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} x$$

UNIT-V

9. What is compensation? Why do we need compensation in a control system? Derive the transfer function of phase lead compensator. Also derive the relation between ϕ_m and α for the lead compensator. 1+2+5+6=14

10. What is a controller? What are differrent types of controllers? Describe briefly each type. 2+2+10=14

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B.Tech Even Semester Examination, May, 2025

Electronics & Communication Engineering

(6th Semester)

Course No: ECC-601

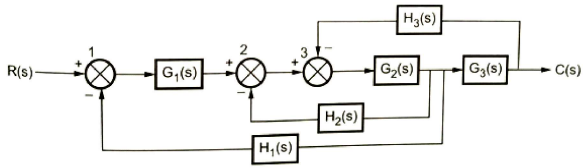
(Control System)

Full Marks: 70
Pass Marks: 28
Time: 3 hours

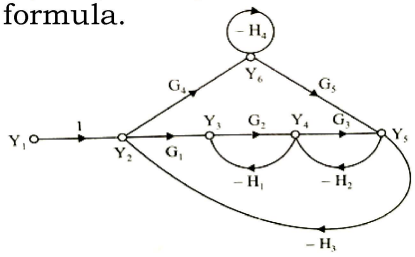
Note:
1. Attempt any five questions taking one from each unit.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

UNIT-I

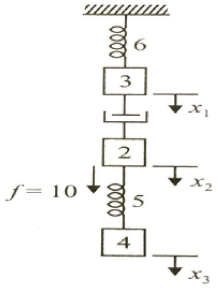
1. a) Determine $\frac{C(s)}{R(s)}$ for the block diagram given below using block reduction technique.



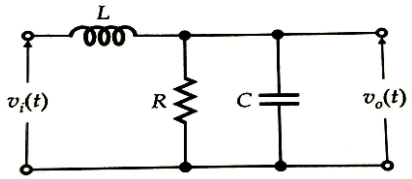
b) Find the gain of the signal flow graph using Mason's gain formula.



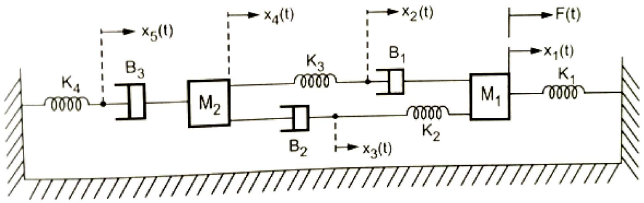
c) Write simultaneous differential equations for the translational mechanical system shown below. Also Laplace transform the equations assuming all initial conditions to be zero. 5+5+4=14



2. a) Obtain the transfer function $\frac{V_0(s)}{V_i(s)}$ for the network shown in the figure below.



b) For the mechanical system shown, obtain the F-V analogous electrical network. 5+9=14



UNIT-II

3. Sketch the root locus for the product and comment on stability. 14

$$G(s) = \frac{K}{s(s+3)(s^2+3s+11.25)}$$

4. What do you mean by transient response and steady state response? Derive the time response of a second order system for different values of ξ for unit ramp input signal. 2+12=14

UNIT-III

5. The open loop transfer function of a unity feedback system is

$$G(s)H(s) = \frac{K}{s(s+2)(s+10)}$$

Construct Bode plots and determine

I. Limiting value of K for system to be stable

II. Value of K for gain margin to be 10 dB

III. Value of K for phase margin to be 50^0 14

6. a) Draw the polar plot for the given system

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

b) The open-loop transfer function of a unity feedback system is

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

Comment on the stability using Nyquist plot. 4+10=14

UNIT-IV

7. a) Define the following terms

i)State ii) state space iii) state vector iv) state variables

b) Obtain the state model of the given electrical system.