B.E. / B.Tech. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester-V

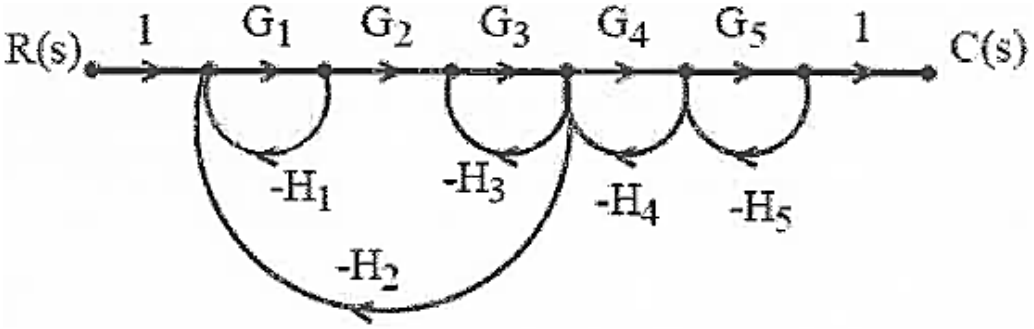
TE105 / CONSYSBTECH1 - Control Systems

P. Pages : 3 **GUG/S/25/13868**

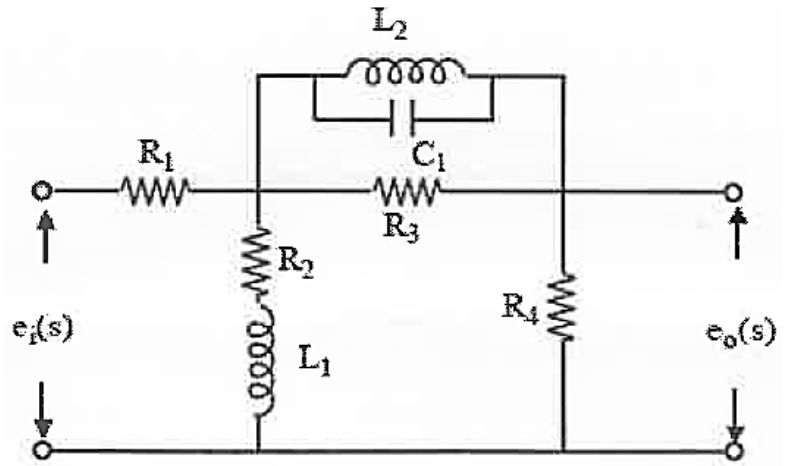
Time : Three Hours * 2 3 0 3 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Diagrams and Chemical equation should be given wherever necessary.
6. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration chart is permitted.
7. Use of Non-programmable calculator is permitted.

1. a) Obtain the overall transfer function C(S)/R(S) from the signal flow graph shown. **8**



b) Find transfer function $E_o(s)/E_i(s)$ for electrical system. **8**

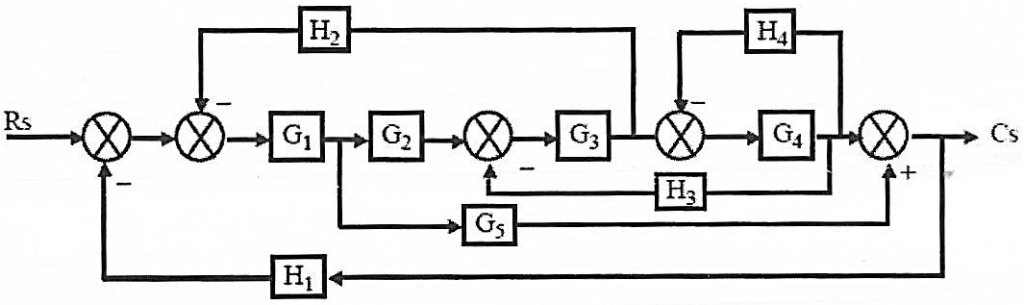


OR

2. a) Find the Laplace transfer of the differential equation given below and hence evaluate the time solution of the same given that $y(0^+) = 0$ and $y'(0^+) = 6$. **8**

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = 12e^t$$

b) Find transfer function of block diagram by block reduction method. **8**



3. a) A unity feedback system has- **8**

$$G(s) = \frac{36}{s^2(s+9)}$$

Find steady state Error and Error constant value for a step, ramp and parabolic input of 5 units.

b) A system is described by the following equation. **8**

$s^6 + 5s^5 + 6s^4 + 8s^3 + 7s^2 + 9s + k = 0$

Find the range of 'k' for stability.

OR

4. a) Discuss the advantages and disadvantages of proportional, proportional derivative, proportional integral control system. **8**

b) A unity feedback system is characterized by an open loop transfer function **8**

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

Determine gain 'K' so that system will have a damping ratio of 0.5. For this value of 'K' determine settling time, peak overshoot and time to peak overshoot for a unit step input. Also obtain closed loop response in time domain.

5. a) Explain the steps for the construction of Root Locus. **8**

b) Find the range of K for stability of the system with a unity feedback system has **8**

$G(S) = K/[s(s^2 + 4s + 5)(s + 2)]$

OR

6. a) Define the terms (i) Absolute stability (ii) Marginal stability (iii) Conditional stability. (iv) Stable system (v) Critically stable system (vi) Conditionally stable system? **6**

b) Define BIBO Stability. What is the necessary condition for stability? **2**

c) Sketch the root locus for the system **8**

$$G(S)H(S) = \frac{K}{S(S^2 + 6S + 10)}$$

7. a) Define gain margin and phase margin? **4**

b) Write short notes on various frequency domain specifications. **4**

c) Sketch the Bode plot for the open loop transfer function **8**

$$G(s)=\frac{40(s+5)}{s(s+10)(s+2)}$$

Also find:
(i) Gain margin (ii) Phase margin and (III) Gain cross over frequency

OR

8. a) Draw the polar plot for open loop transfer function for unity feedback system. **8**

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

Determine gain margin, phase margin?

b) The open loop transfer function of a system is **8**

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

Determine the value of K such that (i) Gain Margin = 10dB and (ii) Phase Margin = 50 degree.

9. a) Write a state model for a system whose output equation is given by- **8**

$$\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+10\frac{dy}{dt}+25\,y(t)=50\,u(t)$$

b) Define state of a system, state variable, state space and state vector. Give Block Diagram representation of State Space Model. **8**

OR

10. a) The transfer function of system is given as- **8**

$$T(s)=\frac{s+3}{s^3+5s^2+8s+4}$$

Obtain the state variable model of the system.

b) The State space representation of a System is given below: Obtain the transfer function **8**

$$X(t)=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}X(t)+\begin{bmatrix}2 & 1\\ 0 & 1\end{bmatrix}R(t)$$

$$Y(t)=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}X(t)$$

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