

(3 Hours)

[Total Marks : 80

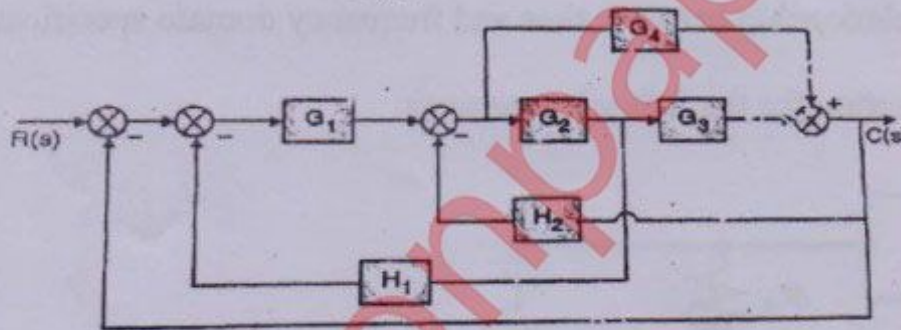
- N.B.: (1) Question No. 1 is compulsory.
 (2) Solve any three questions from remaining five question .
 (3) Draw neat diagrams and assume suitable data wherever necessary. Justify your assumptions.

1. Attempt any four: 20
- (a) Explain the terms i) Centroid ii) Angle of Asymptotes iii) Breakaway point
 (b) State and explain Mason's gain formula.
 (c) Explain the effect of addition of poles and zeroes to a system.
 (d) Discuss the stability of the system for the given characteristics equations using Routh-Hurwitz Criterion:

$$s^4 + 7s^3 + 10s^2 + Ks + K = 0$$

 (e) Differentiate between analog and digital control system.

2. (a) Find the transfer function $\frac{C(s)}{R(s)}$ using Block Diagram Reduction Technique: 8



- (b) Differentiate between Lead and Lag Compensator. 4
 (c) The open loop transfer function of a unity feedback system is $G(s) = \frac{100}{s(s+10)}$ 8

Find the static error constants and steady state error, when the system is subjected to an input $1 + 8t + \frac{18t^2}{2}$

3. (a) For a particular unity feedback system, $G(s) = \frac{242(s+5)}{s(s+1)(s^2+5s+121)}$ 12

Sketch the Bode Plot. Find gain cross over frequency, phase cross over frequency, gain margin, phase margin. Comment on the stability.

- (b) A second order system is given by $\frac{C(s)}{R(s)} = \frac{25}{s^2+6s+25}$ 8

Find its rise time, peak time, peak overshoot and settling time if subjected to unit step input. Also find the expression for output response.

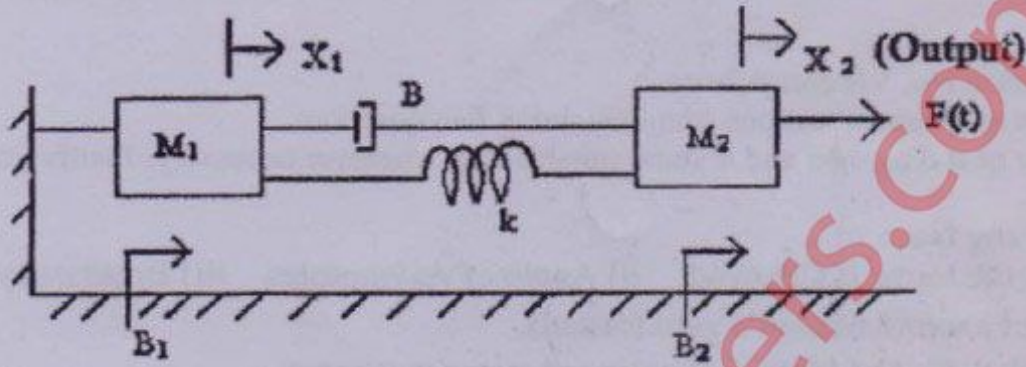
4. (a) if $G(s)H(s) = \frac{K(s+1)}{s^2(s+2)(s+4)}$ then find range of K for stability using Polar Plot. 8

- (b) Plot the Root Locus for the system whose forward path transfer function is given by: 12

$$G(s)H(s) = \frac{K(s+1)}{s(s+2)(s^2+7s+5)}$$

5. (a) Find the transfer function for the following mechanical system:

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- (b) Construct the signal flow graph and hence the block diagram for following set of equations:

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$$Y = (2s)X - (4)Z - (5)U$$

$$Z = (4)Y - (5)W$$

$$W = (2)Z$$

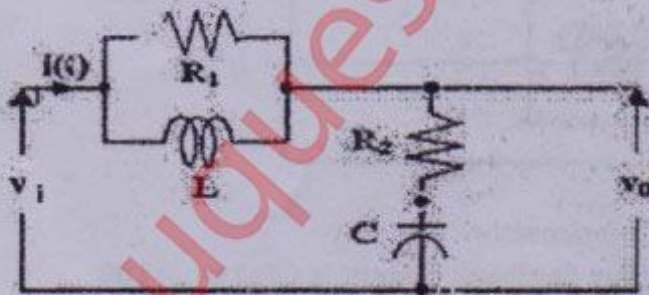
$$U = (3)W + (s)Z$$

- (c) Determine the relationship between time and frequency domain specifications.

4

6. (a) Find transfer function for the following network:

8



- (b) Discuss Conditional and Marginal stability.

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- (c) Discuss the effect of ζ (damping ratio) on a second order system.

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