09/06/2025 TE ELECTRICAL SEM-V C-SCHEME CS QPCODE: 10086899

Time: 3 Hrs   **Marks: 80**

N.B: (1) Question No. 1 is compulsory.

    (2) Attempt any three from the remaining questions.

    (3) Figures to the right indicate full marks.

    (4) Use Graph paper and semi log paper wherever necessary.

1. Attempt any four

    (A) What are the different element of a closed loop control system.

    (B) Derive force to voltage analogy between mechanical and electrical system.

    (C) Explain Nyquist criterion for stability.

    (D) Explain advantages of state space approach over conventional approach.

    (E) Find break away point for root locus of open loop transfer system

       $G(s) = K/S(S+8)(S+2)$

2. (A) For a unity feedback system with open loop transfer function

    $G(s) = 100(s+5)/S(S^2+7S+20)(S+10)$, Determine order, type of system, kp, kv, ka and steady state error for unit ramp input.

    (B) Determine the range of operating values of K so that system will be stable for the unity feedback system having characteristic equation as $S^4+5S^3+5S^2+4s+k = 0$ by Routh Hurwitz Method.

3. (A) For the unity feedback system find the steady state error for the following test input of 6t for $G(s) = 1000(S+6) / (S+7)(S+10)$.

    (B) For the unity feedback system with open loop transfer function $G(s) = K/S(S+10)$ Determine K, peak overshoot, settling time, time to peak overshoot for step input if damping factor is 0.5.
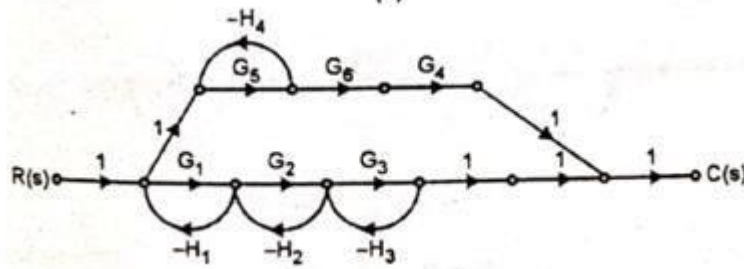
4. (A) Determine gain margin, phase margin, gain crossover frequency and phase cross over frequency for following transfer function:

$$G(s) = \frac{80}{s(s+2)(s+20)}$$

    (B) Sketch the root locus for unity feedback system for the transfer function given below:

$$G(s) = \frac{K}{S(S+2)(S+4)}$$

86899   **Page 1 of 2**

5. (A) Use Mason gain formula to find C(s)/R(s) of following signal flow graph:

(B) Represent the following system in state space in phase variable form and draw its state model.

$$G(s) = \frac{20(s+5)}{s(s+1)(s+4)}$$

6. Write notes on any two:

(A) Write a short note on Time response specifications.
(B) Define Gain Margin, Phase Margin, Phase cross over frequency and gain Cross over Frequency in frequency domain
(C) Write a short note on State Transition Matrix.