**(3 Hours)**   **Total 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**   **20**
  (A) Sketch the polar plot of Transfer Function $G(s)=1/S^2$
  (B) Differentiate between open loop and closed loop.
  (C) Find the transfer function $X(s)/F(s)$ for the system.
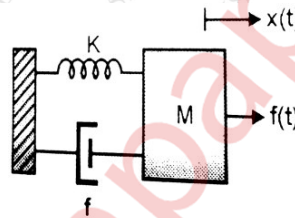
  (D) Explain transient response specification.
  (E) How to convert a system represented in state space to transfer function.

2 (A) Consider a unity feedback system with closed loop transfer function
  $C(s)/R(s)=2/(s^2+3s+7)$. Find open loop transfer function. Show that the steady state
  error in the unit step response is 0.714.   **10**

2. (B) Determine the range of operating values of K so that system will be stable for the unity
  feedback system having characteristic equation as $S^4+4S^3+5S^2+4s+k = 0$ by Routh
  Hurwitz Method.   **10**

3. (A) For the unity feedback system find the steady state error for the following test input of
  2+6t for $G(s)=1000(S+6)/(S+8)(S+10)$.   **10**

3. (B) The unity feedback system is characterized by an open loop transfer system   **10**
  $G(s)= 10/(S+2)(S+5)$.Determine damping ratio, undammed natural frequency
 of oscillation. What is the percentage overshoot of the response to a unit step input?

4 (A) Determine gain margin, phase margin, gain crossover frequency and phase cross over frequency for following transfer function: **10**

$$G(s) = \frac{100(s+2)}{s(s+1)(s+4)}$$

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

$$G(s) = \frac{20}{S(S+2)(S+4)}$$ **10**

5. (A) Reduce the block diagram shown to a single block representing the transfer function C(s) / R(s) **10**
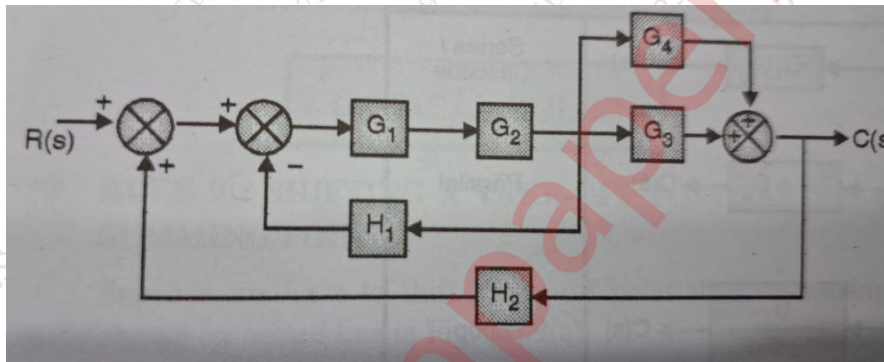
5. (B) Represent the following system in state space in phase variable form and draw its state model. **10**

$$G(s) = \frac{100(s+5)}{s(s+1)(s+4)}$$

6. Write notes on **any two**: **20**

(A) Write a short note on State Transition Matrix.
(B) (i) State and explain Nyquist criterion stability
(ii) With the help of polar plot explain the effect of adding poles.
(C) Explain Type 2 system with Step and Ramp input.

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