4-Jun-19
68938

Time: 3 Hours   **Marks: 80**

N.B.   **(1) Question number 1 is compulsory.**
           (2) Attempt any 3 questions from remaining.
           (3) Assume suitable data if required.
           (4) Figure to the right indicates full marks.

Q1. Attempt any four questions .   **[20]**

a) Explain needs of compensation in control system also explain different types of Compensation
   with suitable example.
b) What are the properties of state transition matrix?
c) Define Gain margin and Phase margin. Explain how these margins are used for
stability analysis
d) Give comparison between open loop and closed loop control systems.
e) Explain the effect of addition of pole and zero to a system.

Q2. A) Find the transfer function C(s)/R(s) of the following system using block diagram technique.   **[10]**
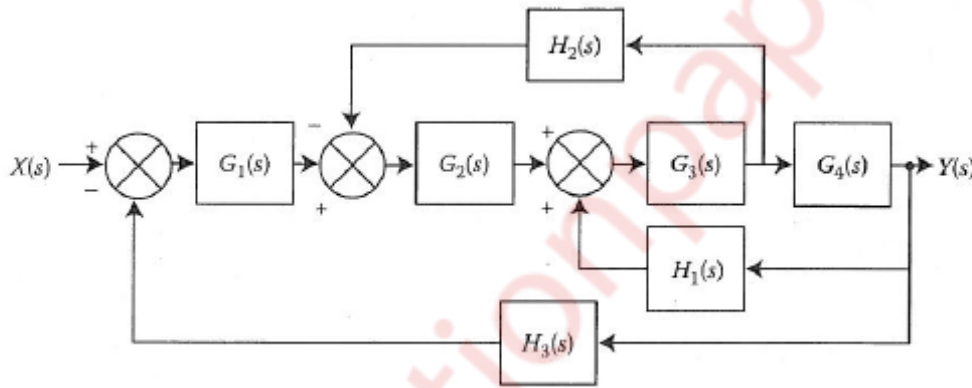
Q2. B) Determine breakaway points and break-in points for the characteristics equation given as   **[10]**

$$1 + \frac{K(s + 2)(s + 3)}{s(s + 1)} = 0$$

Plot the Root Locus for the system .

Q3. A) Derive an expression for peak time and settling time of an under damped second order   **[10]**
       system.

Q3. B) Obtain the state variable model of the transfer function –   **[10]**

$$\frac{Y(s)}{R(s)} = \frac{5s + 4}{s^2 + 4s + 3}$$

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Q4. A) Apply Kalmans test for checking the controllability of given state equation. **[10]**

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

Q4. B) Ascertain stability of the system whose characteristic equation is **[10]**
s6 + 3s5 + 5s4 + 9s3+ 8s2+ 6s + 4 = 0   . Also find the number of roots lying on the left half,
right half and imaginary axis of the s-plane.

Q5. A) Construct the Bode Plot for the following transfer function. Determine the following: **[10]**

i)   Gain Margin   ii) Phase margin   iii) Closed loop stabiity **[10]**

$$G(s)H(s) = \frac{4}{s(s+0.5s)(1+0.08s)}$$

Q5. B) List the performance specifications of Time Response Analysis and derive any four of them. **[10]**

Q6. A) State Adaptive Control System significance in engineering applications **[05]**

Q6. B) Explain PID Controller. **[05]**

Q6. C) Explain the effect of adding a pole to a system on time response. **[05]**

Q6. D) Draw polar plot for the transfer function given by **[05]**

$$G(s) = \frac{8}{s(1+s)}$$

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