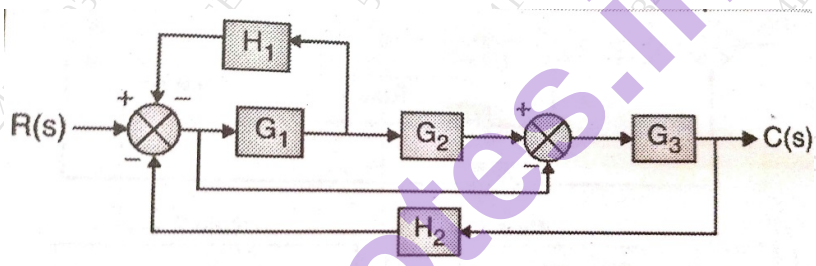
Time (3 Hours) **80 Marks**

Note: (1) Question no. 1 compulsory
(2) Attempt any 3 question out of remaining five questions.
(3) Draw neat diagram wherever necessary.

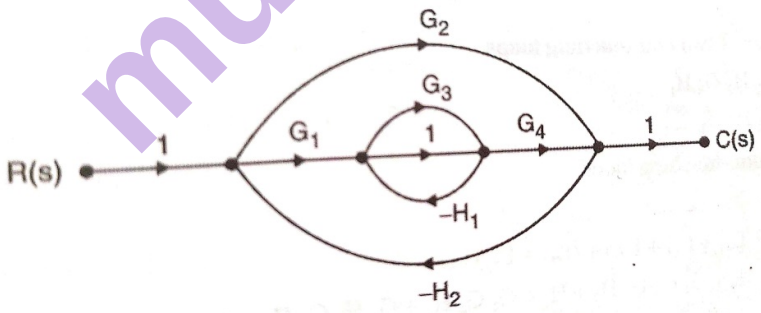
Q 1.Attempt any Four 20Marks

a. Explain the effects of addition of open loop poles and zeros on root locus and transient response.
b. Differentiate between open loop and closed loop system.
c. What ate the advantages of using state space analysis over classical approach?
d. Explain Nyquist Criterion for stability.
e. Explain force current analogy in mathematical modeling of control system.

Q 2.a. Obtain the transfer function for the following figure using Block Diagram Reduction method. 10 Marks



b. Obtain the transfer function for the following figure using Mason's gain formula 10 Marks



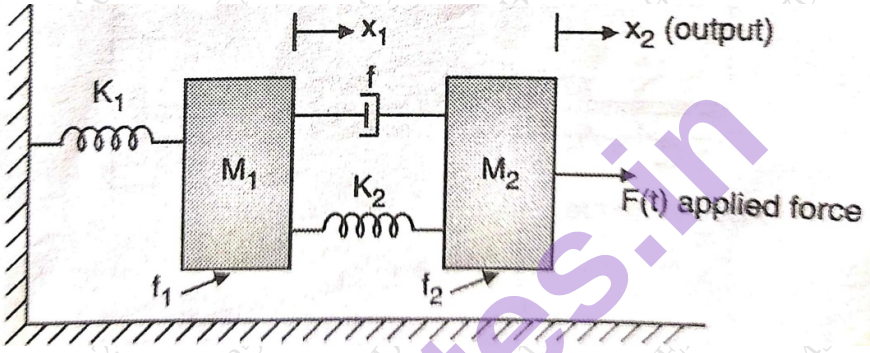
Q3. a. Given the unity feedback system that has the forward transfer function 10 Marks
G(s) = $\frac{k(s+2)}{s\,(s^2+4s+13)}$.Sketch the complete root locus.

b. For a system with characteristic equation: 10 Marks
F(s)=$s^4 + 2s^3 + 10s^2 + s + K = 0$,obtain the value of k for marginal stability and also find the frequency of oscillation at that value of k using Routh Hurwitz criteria.

Q4.a. A feedback control system has G(s) H(s) = $\frac{100}{s\,(s+0.5)\,(s+10)}$. Draw Bode plot And comment on stability. 10 Marks

b. For a unity feed back system has a forward path transfer function G(s)=(S+2)/S(S+1) Determine rise time, peak time, peak overshoot, settling time, delay time to unit step input 10 Marks

Q5. a. Find the transfer function X(s) / F(s) of the following system using mathematical modeling of the system. 10 Marks



B .Represent the following state space equation in phase variable form 10 Marks

and also draw its state model $\frac{C(s)}{R(s)} = \frac{10\,(s+2)(s+3)}{(s+1)(s+4)(s+5)}$

Q 6 a.The control system having unity feedback has G(s) = = $\frac{20(s+3)}{(1+s)\,(6+s)}$. 10 Marks

Determine (1)Type of system. (2) All error coefficient (3) error when subjected tostep of magnitude 2.

b. Explain AC servomotor and also draw the diagram. 10 Marks