B.Tech. Degree VI Semester (Supplementary) Examination, September 2008
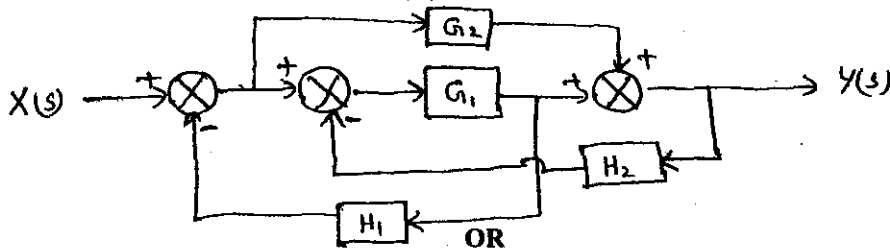
CS/EC/EB/EI 605 CONTROL SYSTEMS ENGINEERING
### (Common for 1999 and 2002 Schemes)

Time: 3 Hours
Maximum Marks: 100

I a) Distinguish between open loop systems and closed loop systems.
Give one example of each. (8)

   b) Obtain the transfer function $\dfrac{Y(S)}{X(S)}$ for the block diagram shown in figure. (12)

OR

II a) Find the inverse Laplace transform of

   i) $F(s) = \dfrac{S+4}{S(S-1)(S^2+4)}$

   ii) $F(s) = \dfrac{2S+12}{S^2+2S+5}$ (8)

   b) For the physical system shown in figure:
   i) form differential equations of motion
   ii) determine the transfer function $X_1(s)/F(s)$. (12)
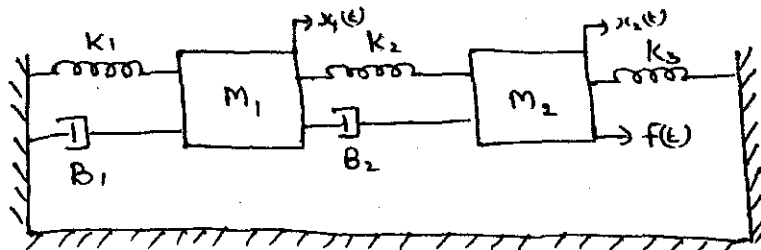
III a) Draw the response of a second order under damped system to unit step input.
Derive the expression for rise time t_r, peak time t_p and peak overshot M_p (10)

   b) A unity feed back control system has the open loop transfer function

   $G(s) = \dfrac{4(S+1)}{S^2(S+2)}$. Find the steady state error when the i/p is

   $R = \dfrac{3}{S} - \dfrac{1}{S^2} + \dfrac{1}{2S^3}$ (10)

OR

IV a) The open loop transfer function of a unity feed back system is given

by $G(s) = \dfrac{K}{S(S+3)(S^2+S+1)}$ Determine the value of K that will cause

sustained oscillations in the closed loop system. Also find the frequency of
oscillation. (10)

   b) What is meant by steady state error? What are static error coefficient? How will
you determine them? (10)

V a) A feedback control system is described by $G(s) = \dfrac{10}{S(1+0.2S)(1+0.01S)}$,

$H(s) = 1$. Draw the Bode plot and determine gain margin and phase margin (12)

   b) Explain M circles and N circles. (8)

OR

VI a) Explain frequency domain specifications. (8)

   b) Sketch the polar plot of a system with

$$G(s)H(s) = \dfrac{10(S+1)}{(S+10)}$$ (12)

VII a) Sketch the root locus plot for a unity feed back system with

$G(s) = \dfrac{K}{S(S+4)(S^2+2S+5)}$. Obtain the range of K for stability. (15)

   b) Explain how the break away points of the root locus can be determined. (5)

OR

VIII a) Explain the design procedure for a cascade lead compensator. (8)

   b) The open loop transfer function of a unity feed back control system is given

by $G(s) = \dfrac{K}{S(1+0.2S)}$. Design a suitable compensator such that the system

will have $K_v = 20$ and the phase margin $= 44"$ (12)

IX a) What are the advantages and disadvantages of state variable approach compared to
conventional approach? (8)

   b) Solve the state equation

$$\overset{\circ}{X} = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix} X \quad ; \quad X(0) = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$ (12)

OR

X Write *__short notes__* on:
   i)   AC servo motor
   ii)   Rotating amplifier
   iii) Magnetic amplifier
   iv)   Adaptive control systems (20)

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