B. Tech Degree VI Semester Examination, April 2010

CS/EC/EB/EI 605 CONTROL SYSTEMS ENGINEERING

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART – A

(Answer ***ALL*** questions)

(8 x 5 = 40)

I. (a) Find the inverse Laplace Transform of

(i) $\dfrac{s+4}{s(s-1)(s^2+4)}$ (ii) $\dfrac{5}{s(s^2+4s+5)}$

(b) Distinguish between open loop systems and closed loop systems. Give one example for each.

(c) With the help of a neat diagram explain time domain specifications.

(d) State and explain Routh – Hurwitz stability criterion.

(e) Explain frequency domain specifications.

(f) State and explain Nyquist stability criterion.

(g) Explain the properties of root loci.

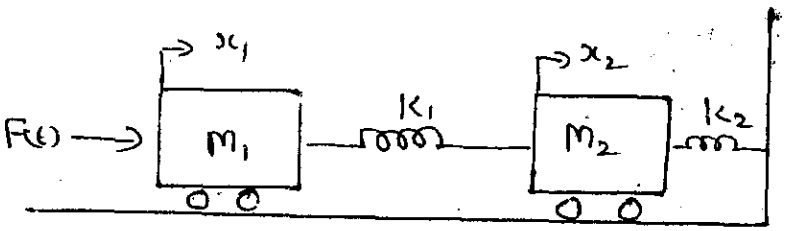
(h) Draw the circuit diagram of a phase-lead electrical network and derive the transfer function.

PART – B

(4 x 15 = 60)

II. (a) State and explain Mason's Gain Formula. (5)

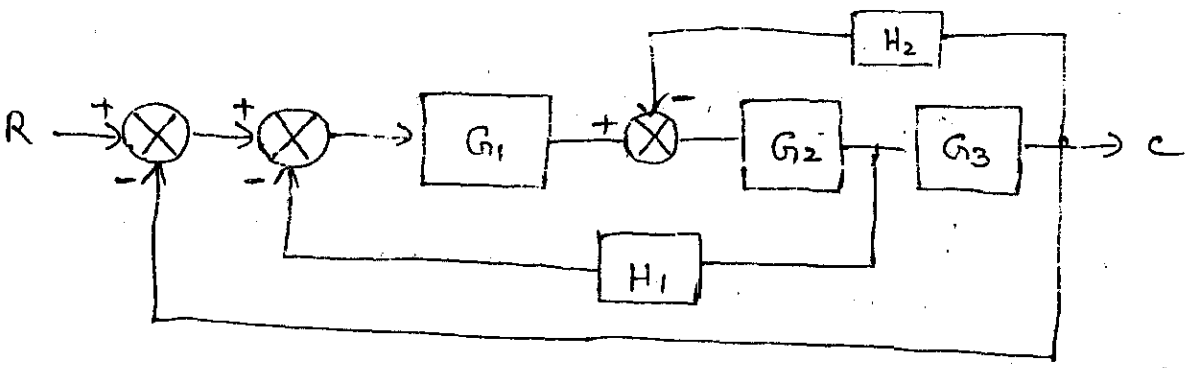
(b) Write the differential equations describing the dynamics of the systems shown in the figure and find the transfer function $X_2(s)/F(s)$. (10)



OR

III. (a) Explain force-voltage analogy. (5)

(b) Reduce the block diagram shown in the figure and find C/R. (10)



(Turn Over)

IV. (a) The unity feed back system is characterized by an open loop T.F $G(s)=\frac{K}{s(s+10)}$.

Determine the gain K so that the system will have a damping ratio of 0.5 for this value of K. Determine the peak overshoot and time for peak overshoot for unit step input. (5)

(b) Derive the expression for unit step response of a second order under damped system. (10)

OR

V. (a) Derive the expression for peak time. (5)

(b) Using Routh Hurwitz criterion for the unity feedback system with open loop transfer Function $G(s)=\frac{K}{s(s+1)(s+2)(s+5)}$

(i) find the range of K for stability

(ii) find the value of K for marginally stable.

(iii) Frequency of sustained oscillation when marginally stable. (10)

VI. Sketch the bode plot of the unity feed back system whose open loop transfer function is given by $G(s)=\frac{20}{s(s+2)(s+10)}$ and find the Gain margin and phase margin. (15)

OR

VII. Draw the Nyquist plot for the system whose open loop transfer function is given by $G(s)=H(s)=\frac{K}{s(s+2)(s+10)}$. Determine the range of K for which closed loop system is stable. (15)

VIII. Sketch the root locus for a unity feed back system with open loop transfer function is given by $G(s)=\frac{K}{s(s^2+8s+32)}$. (15)

OR

IX. The open loop transfer function of a unity feed back control system is given by

$$G(s)=\frac{K}{s(1+0.2s)}$$

Design a suitable compensator such that the system will have $K_g=10$ and phase margin = 50^0. (15)

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