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B.tech(EIC) 4th S... (...-...-2015)

Control System-1 (EIC-210)

Scheme-2010

Time: 3 hour | Maximum Marks: 60

Note: Attempt all questions. Part(A) is compulsory.Attempt any four questions from Part B.

1. Give short answers of the following questions.
   1. In Force -current analogy,write their equivalent terms: Masss, Spring Constt., Frictional damping.
   2. Write all the rules of block diagram reduction technique.
   3. Define K_p, K_v, & K_a for a unity feedback system.
   4. List various methods for finding absolute stability & Relative Stability.
   5. Define Gain Crossover frequency & Phase Crossover frequency in a Bode plot.
   6. Write the expressions for time response specifications of a second order system.
   7. What are the major effects of adding a lead compensator to a control system.
   8. Write down the state equation & output equation in state space model, naming all matrices.
   9. Define Sensitivity. What is the effect of feedback on parameter sensitivity of a control system?
   10. What is the difference between Type & Order of a system. What is the value of steady state error to a unit step input for a Type-1 system.

[2*10]

Part B

2. (a) The open loop transfer fn. is given by

$$G(s) = \frac{50}{(1+0.1s)(1+2s)}$$

Determine the steady state error for a unit step input,unit ramp input& accleration input $\frac{t^2}{2}$ [5]

(b)The open loop transfer fn. of a unity feedback system is given by

$$G(s) = \frac{100}{s(s+5)(s+2)}$$

Determine the time response of the closed loop system for $r(t) = 1$. Also determine the percentage overshoot. [5]

3. a) The chacterstic eq^n of feedback control system is

$$s^4 + 20s^3 + 15s^2 + 2s + k = 0$$

Determine the range of k for the system to be stable.what will be the frequency of oscillation if the system is marginally stable?

[5]

(b) Define Gain Margin, Phase Margin, Gain Crossover frequency and Phase Crossover frequency in a polar plot. [5]

4. (a)Show that the loci of constant phase angle of a closed loop system with unity feedback,is a family of circles whose centre is at

$x_0 = -\frac{1}{2}, y_0 = \frac{1}{2N}$ & radius is $\frac{(N^2+1)^{(\frac{1}{2})}}{2N}$

[5]

(b) Obtain the unit step response of a unity feedback system whose open loop transfer fn. is :

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

5. The open loop transfer function of a system is given by:

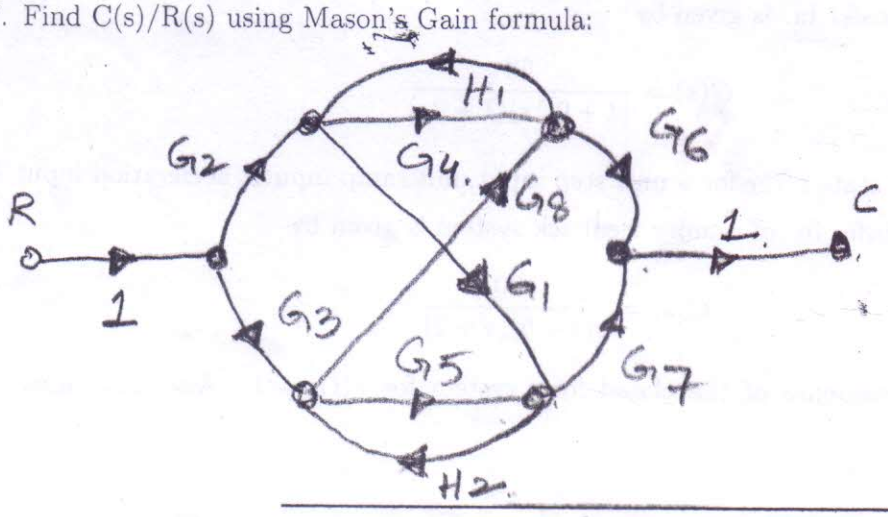
$$G(s)H(s) = \frac{K(s+4)}{(s+2)(s+3)}$$

Draw the complete Root Locus & comment on the stability of the closed loop system. [10]

6. (a) What is a lead compensator? Draw its pol zero configuration on S-plane. Derive the expression of the attenuation in terms of maximum phase lead angle. [5]

(b) Draw the ckt. of an auto-transformer. Explain & show how copper is saved in an auto-transformer as compared to a two winding transformer. [5]

7. Find C(s)/R(s) using Mason's Gain formula:



[10]