Registration No. :

Total number of printed pages – 3

B. Tech

P CEC 4303

Fifth Semester (Special / Back) Examination – 2013

CONTROL SYSTEM ENGINEERING

BRANCH : EC, ETC

QUESTION CODE : D 284

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2 ×10

    (a) Define transfer function. What are the assumptions made concerning the initial conditions ?

    (b) Write down Mason's gain formula for determining the transfer function of a signal flow graph, explaining the meaning of each term.

    (c) Define time constant of first order system.

    (d) What is the significance of breakaway point on the root locus ?

    (e) Define gain margin, phase margin.

    (f) In a Bode plot, what do you mean by the term 'corner frequency ?

    (g) What are the frequency domain specifications ?

    (h) What is the effect of negative feedback control on sensitivity of a system ?

    (i) Why are the systems of type more than 2 not used normally ?

    (j) State Nyquist stability criterion.
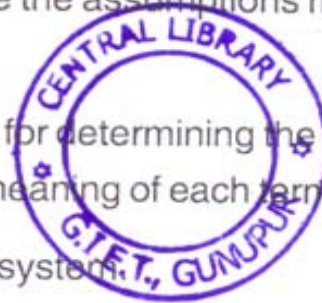
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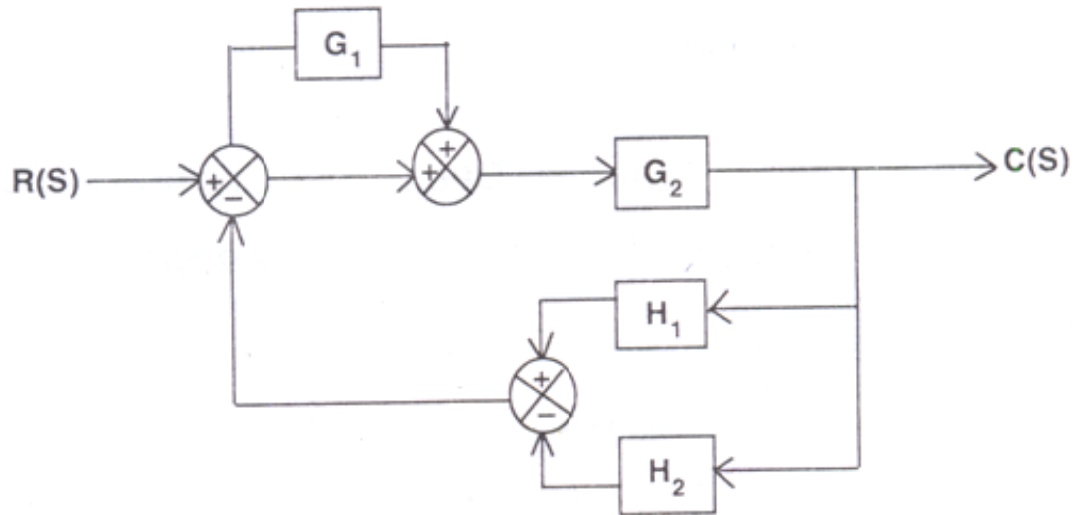2. (a) Derive the transfer function of system using block reduction techniques. 5

Fig (1)

(b) Determine $\dfrac{C}{R}$ of the system shown in Fig (1), using Mason's Gain Formula. 5

3. (a) State Routh's stability criterion. State their advantages. 5

(b) Determine the stability of the system whose characteristic equation is given as 5

$$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$$

4. (a) Explain about Force-Voltage and Force-current analogy. 5

(b) Plot the root loci for the closed loop control system with 5

$$G(S) = K / S (S+1)(S^2 + 4S + 5)$$

Sketch the root locus and also comment on the stability.

5. (a) A control system having a transfer function is $C(S) / R(s) = 10 / (S^2 + 2s + 10)$. Determine the expression for time response when the system is subjected to a unit step input and also for unit ramp input. 5

(b) A unity feedback control system has an open loop transfer function 5

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

Find the rise time, percentage peak overshoot, peak time and settling time for a step input of 10 units.

6. Sketch the Nyquist Plot and determine the stability of a unity feed back control system whose transfer function is given by $G(S) = 6/(S+1)(S+2)$. 10

7. (a) A unity feedback system has an open loop transfer function 5

$$G(s) = \frac{K}{s(s+a)^2}$$

Determine the values of K and a for which the gain margin is 9.54 dB and the phase crossover frequency is 3 rad /s ?

(b) Explain the working of synchro control transformer. 5

8. Write short notes on any **two** of the following : 5×2

(a) Amplidyne

(b) Static Error Constants

(c) Application of PID controller