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RN-6527-R

B. E. - II (Sem. IV) (IC) Examination

May / June – 2010

Control Theory

Time : **3** Hours] [Total Marks : **100**

Instruction :

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 2 (Sem. 4) (IC)**

Name of the Subject :

☛ **Control Theory**

☛ Subject Code No. : **6 5 2 7** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

SECTION - I

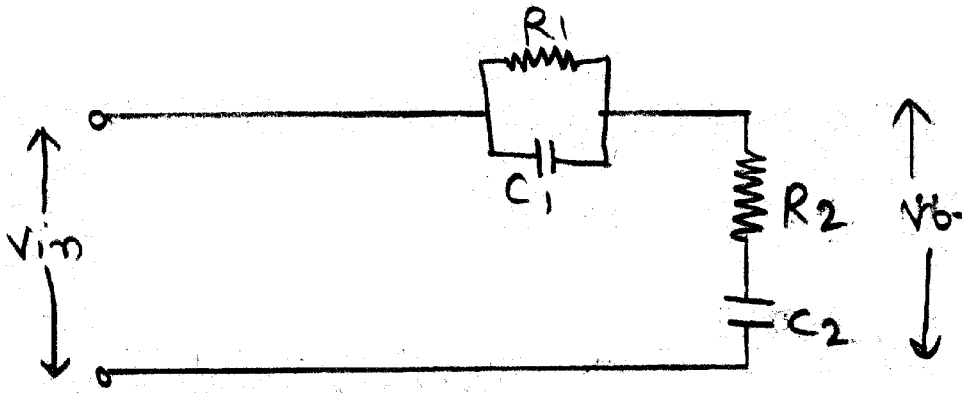
1 (a) Answer in brief : 10

(i) State Routh Hurwitz criterion for stability. 2

(ii) Define time constant. 1

(iii) If there are repeated poles on the imaginary axis, the system is_____. 1

(iv) Find the transfer function of the RC network shown below : 2



(v) Define the following : 2

(a) Rise time

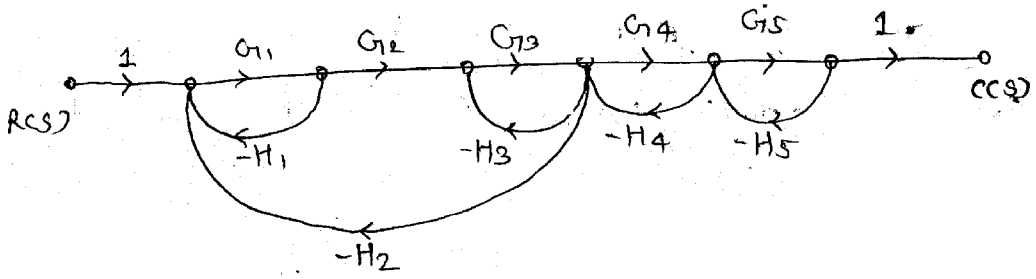
(b) Settling time.

(vi) What is the effect of adding poles on Bode plot? 1

(vii) What is the effect of adding poles on polar plot? 1

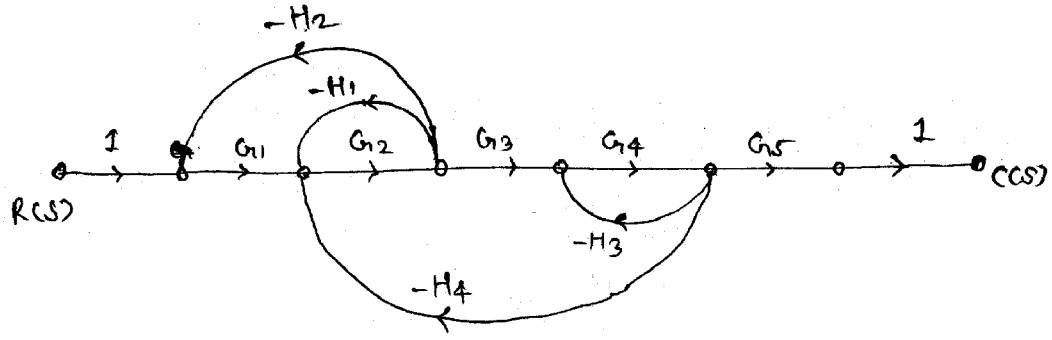
(b) State and define all frequency respone specifications. 8

2 (a) Find the Transfer function of the system given below by Mason's gain formula. 8

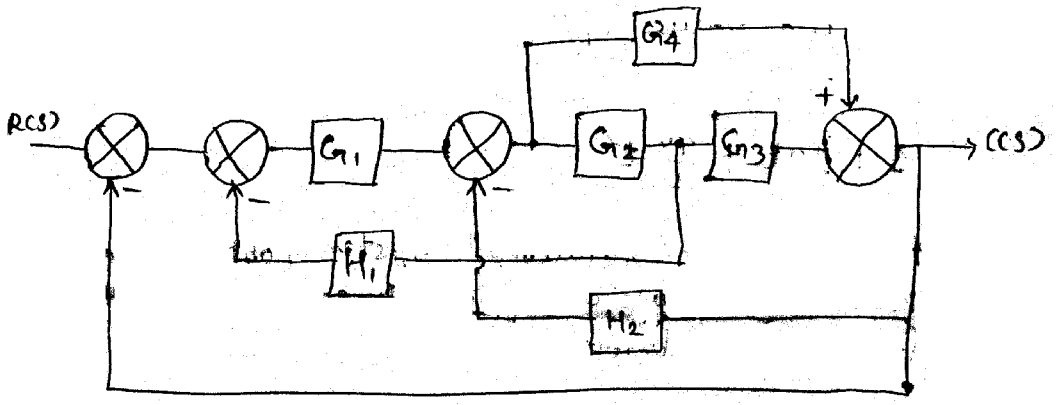


OR

(a) Find the transfer function of the system given below by Mason's gain formula. 8

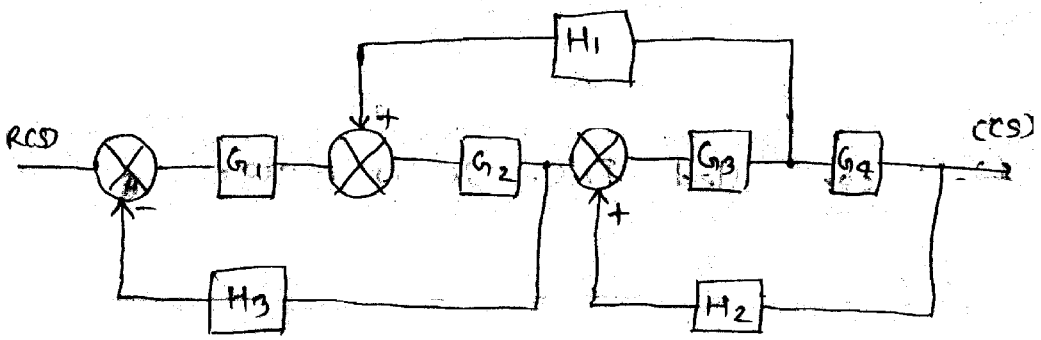


2 (b) Find the Transfer function of the following system using block diag. reduction method. 8



OR

(b) Find the Transfer function of the following system using block diag. reduction method. 8



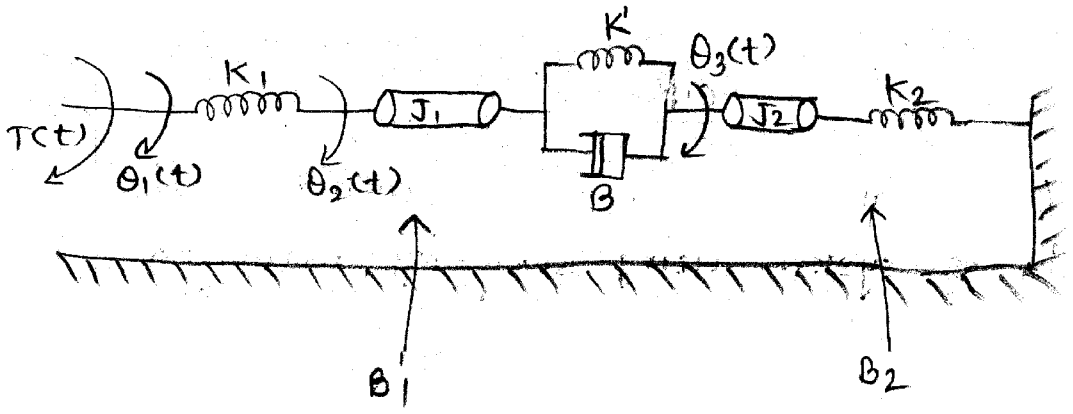
3 Attempt any two : 8x2=16

(i) For a system $G(s)\,H(s) = \dfrac{K}{s^2(s+2)(s+3)}$.

Find the value of k to limit steady state error to 10 when i/p to system is

$1 + 10t + \dfrac{40}{2}t^2$

(ii) For a given rotational system obtain the electrical analogous system based on inverse and direct analogous method.



(iii) Derive, the transfer function of a field controlled D.C. servo motor.

SECTION - II

4 (a) Answer in brief : 10

(i) An element which stores potential energy is 1

(a) Mass

(b) Spring

(c) Damper

(d) None of these

(ii) Damping is the property of the system to 1

(a) Reduce the oscillations

(b) Increase the oscillations

(c) Keep oscillations steady

(d) None of the above

(iii) Define the following terms : 2

(a) Transient response

(b) State state error.

(iv) Give two advantages of Bode plot. 2

(v) As compared to closed loop system, open loop system is 1

(a) More stable

(b) Less stable

(c) Equally stable

(d) None of above

(vi) Traffic light control system is an example of 1

(a) Open loop control system

(b) Closed loop control system

(c) Marginally stable system.

(vii) Give two disadvantages of open loop control system. 2

(b) (i) Explain Nyquist stability criterion. 4

(ii) Derive the equation for steady state error (e_{ss}) 4

5 (a) A feedback system has 10

$$G(s)\,H(s) = \frac{100(s+4)}{s(s+0.5)\,(s+10)}$$

Draw the bode plot and comment on stability.

OR

(a) For a unity feedback system **10**

$$G(s) = \frac{800(s+2)}{s^2(s+10)\ (s+40)}$$

Draw the bode plot. Comment on stability. 10

(b) For a system **6**

$$G(s)\ H(s) = \frac{K(s+1)}{s^2(s+2)\ (s+4)}$$

Draw the polar plot. What is the condition for stability in polar plot.

OR

(b) $G(s)\ H(s) = \dfrac{10}{s(s+2)\ (s+4)\ (s+8)}$ **6**

For the system given above, draw polar plot and whether it is stable or not.

6 Attempt any two : 8x2=16

(i) Sketch the root locus for the following system 8

$$G(s)\ H(s) = \frac{K}{s(s+1)\ (s+2)\ (s+3)}$$

Comment on the stability.

(ii) Sketch the root locus for the following system : 8

$$G(s)\,H(s) = \frac{K}{s(s+3)\,(s^2+3s+4.5)}$$

Comment on the stability.

(iii) Discuss the stability of the following system using Routh Hurwitz method : 8

$$s^6+4s^5+3s^4-16s^2-64s-48=0.$$