Seat No._____

GANPAT UNIVERSITY

B. TECH. SEMESTER IV ELECTRONICS & COMMUNICATION ENGINEERING

CBCS EXAMINATION, MAY / JUNE-2014

2EC 402: Control Systems

TIME: 3 HOURS TOTAL MARKS: 70

INSTRUCTIONS

1. Attempt all questions.
2. Answers to the two sections must be written in separate answer books.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

SECTION-I

Que-1 (A) What is the necessary condition to have all the roots of a characteristics equation in L.H.P of s-plane? 2

(B) State & explain the Hurwitz criterion 4

(C) The characteristics equation for a feed back control system is given by, 6

$$s^3 + 2ks^2 + 5s^2 + 10s + 15 = 0$$

Determine the range of k for which the system is stable.

OR

Que-1 (A) Determine the stability using epsilon & reverse coefficient method for following characteristics equation 8

$$s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$$

(B) Draw the polar plot for the following transfer function 4

$$G(s) = \frac{100}{(s+2)(s+4)(s+8)}$$

Que-2 (A) Sketch the bode plot for the transfer function 8

$$G(s)H(s) = \frac{10}{s(1+0.5\,s)(1+0.1s)}$$

(B) What is the angle of departure & angle of arrival in root locus? 3

OR

Que-2 (A) Draw the root locus for the system given below 8

$$G(s)H(s) = \frac{K}{s(s+3)(s+6)}$$

Determine the value of k for marginal stability & critical damping

(B) Explain the concept of Gain margin & Phase margin 3

Que-3 (A) Using the Routh-Hurwitz criterion, determine the stability of the system for given characteristic equation, 6

$$s^5 + 2s^4 + 24s^3 + 48s^2 - 25s - 50 = 0$$

Find no. of roots in RHP,LHP and on the jω axis

(B) Check the stability of unity feedback control system using Nyquist plot. 6

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

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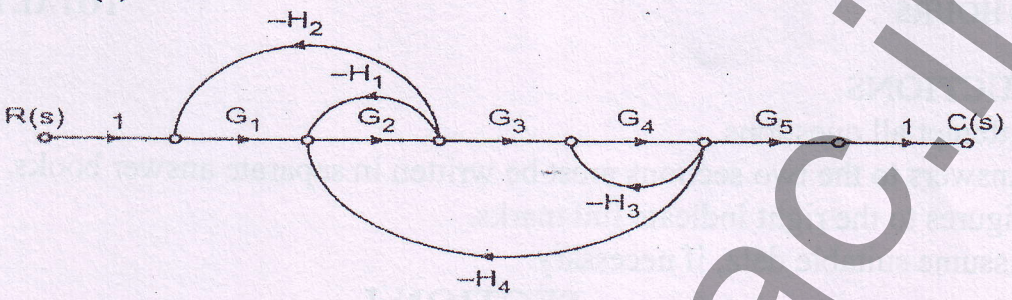
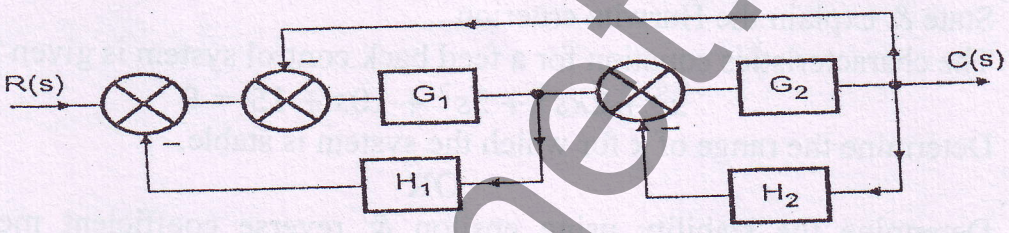
SECTION-II

Que-4 **(A)** Find $\frac{C(S)}{R(S)}$ for the following signal flow graph. **5**



(B) Draw the signal flow graph & find $\frac{C(S)}{R(S)}$ using Manson's gain formula **5**



(C) For following equations, construct Signal flow graph. **2**

$X_2 + 3X_3 - 3X_1 = 0$

$X_3 + 4X_4 - 4X_2 = 0$

$X_4 - 5X_3 = 0$

OR

Que-4 **(A)** Derive expression for Steady State error. **4**

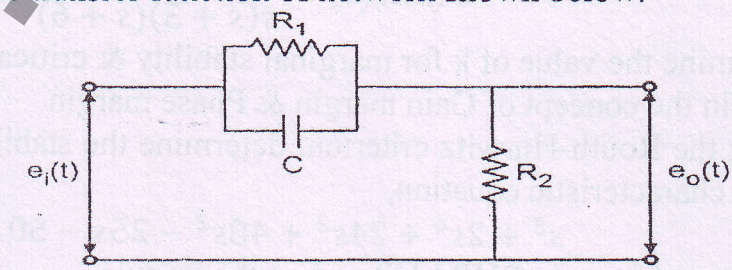
(B) State & explain the Mason's Gain formula. **4**

(C) The open loop transfer function of a system is **4**

$$G(S)H(S) = \frac{10}{S(S+2)(s+5)}$$

What will be the Steady State error if input signal is a step of magnitude 2?

Que-5 **(A)** Determine the transfer function of network shown below. **4**



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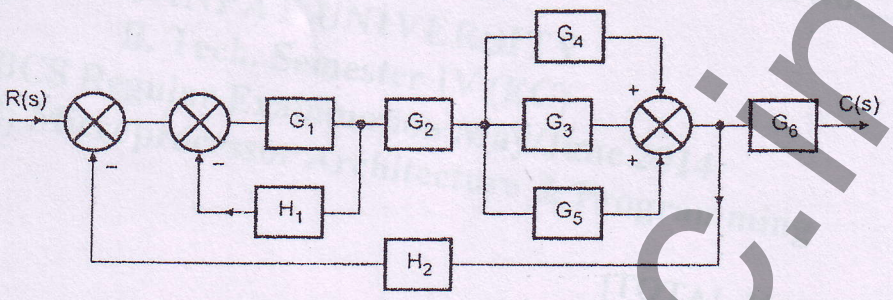
(B) Determine the overall transfer function $\frac{C(S)}{R(S)}$ for system shown below 5

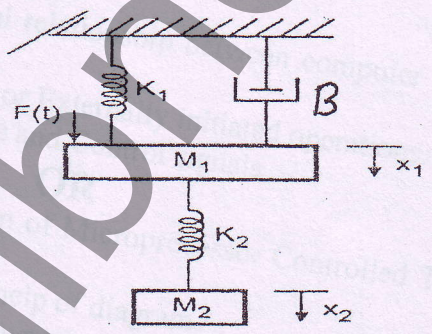


(C) What is the difference between steady state response and transient response of a control system? 2

OR

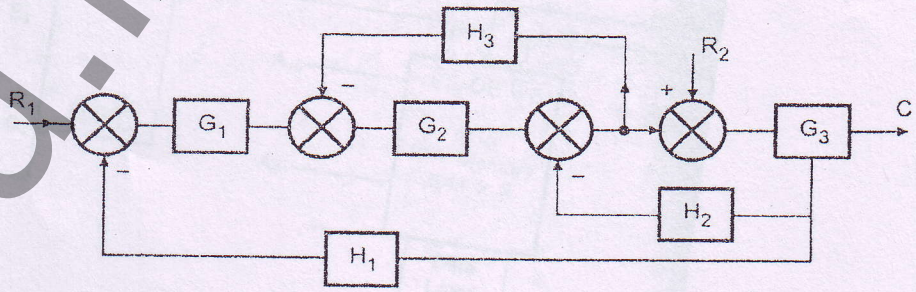
Que-5 (A) Write a short note on A.C. servomotors. 4

(B) For the mechanical system shown below, draw the mechanical network. Write the differential equation governing the behavior of the mechanical system. Also obtain the equivalent electrical circuit based on force voltage analysis. 5



(C) Define: Servomechanism 2

Que-6 (A) For the system shown in the figure determine either $\frac{C}{R1}$ or $\frac{C}{R2}$ using block diagram reduction. 6



(B) Define control system. Differentiate the open loop and closed loop control system with suitable example. 6

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