C 47570 (Pages 3)

Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2008

EE 2K 603—CONTROL SYSTEMS—I

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Find the transfer function of the network shown below :

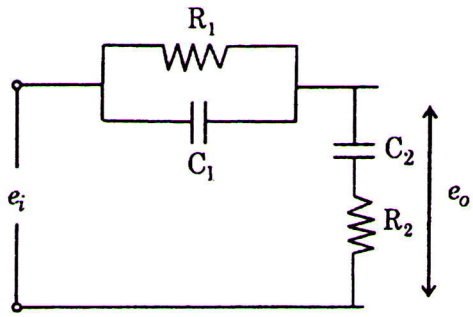

Fig. 1.

(b) What in diagonalization ? Explain with an example.

(c) Explain the necessity of hold circuits in the sampled data systems.

(d) Explain the mathematical model of zero and first order hold circuits.

(e) Derive static and dynamic error coefficients for a step input.

(f) Explain the concept of stability in the Z-plane.

(g) Define and explain gain margin and phase margin. Explain their significance.

(h) Give an account on Nichols chart.

(8 × 5 = 40 marks)

II. (a) (i) Derive Mason's gain formula. (7 marks)

(ii) For the signal flow graph shown in figure, find the Loop gain A = x_5/x_1 :

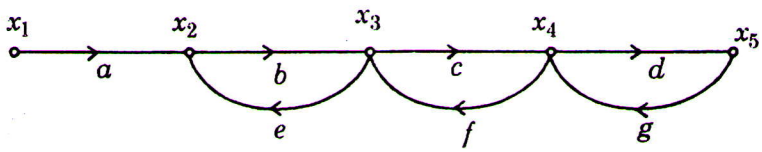

Fig. 2.

(8 marks)

Or

(b) (i) Find C/R for the block diagram shown in Figure.

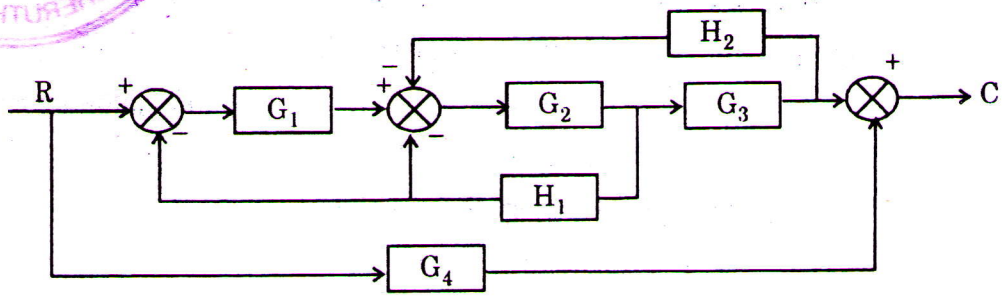

Fig. 3.

(7 marks)

(ii) Differentiate open loop control system from closed loop control system. (8 marks)

III. (a) (i) State and derive the properties of Z transform. (7 marks)

(ii) Find the Inverse Z transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$. (8 marks)

Or

(b) (i) Solve the difference equation :

$$x(k+2) - 3x(k+1) + 2x(k) = 4^k \; ; \; x(0) = 0 \text{ and } x(1) = 1.$$

(7 marks)

(ii) Explain the principle of a sampled data system with digital computer. (8 marks)

IV. (a) For a second order system whose open loop transfer function $G(s) = \frac{4}{s(s+2)}$ determine the maximum over shoot, the time to reach the maximum over-shoot when a step displacement of 18° is given to the system. Find the rise time and the settling time for an error of 7% and the time constant.

(15 marks)

Or

(b) (i) The open-loop transfer function of an unity feedback system is given by :

$$G(s) = \frac{K(s+2)}{s(s+1)(s+3)(s+5)}.$$

Determine the value of 'K' for which the system is just stable.

(7 marks)

(ii) Explain the properties of state transition matrix. (8 marks)

V. (a) **The open-loop transfer function of a control system is :**

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

(i) **Using the Nyquist criterion, determine whether the closed loop is stable or not .**

(ii) **Does the polar plot of the open-loop transfer function cross the real axis ? If so find the frequency at which it crosses ? If not explain, why ?**

(15 marks)

Or

(b) **For the unity feedback system** $G(s) = \frac{4}{(s + T_p) (s^3 + 2s + 2)}$, **plot the root contour diagram with** T_p **as the varying parameter.**

(15 marks)

[4 × 15 = 60 marks]