C 6270 **(Pages : 2)** **Name**.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2005

EE2K603. CONTROL SYSTEMS—I

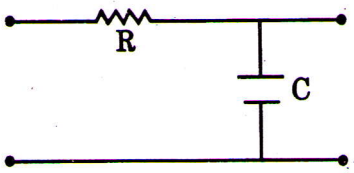
(New Scheme)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Nichol chart may be provided.
Polar plot chart may be provided.

1. (a) What is transfer function ? Explain the application of it in the system analysis.

   (b) Draw the signal flow graph and hence obtain the transfer function of the following network :



   (c) Explain the first order hold circuit in the sampling process.

   (d) What is the z-transform of

$$x(n) = (0.5)^n, \; n \geq 0$$
$$= 3^n, \quad n < 0.$$

   (e) Define and explain static error coefficients.

   (f) Explain the effect of addition of poles on root locus.

   (g) Define Phase margin and Gain margin.

   (h) Derive the equations for constant phase circles.

(8 × 5 = 40 marks)

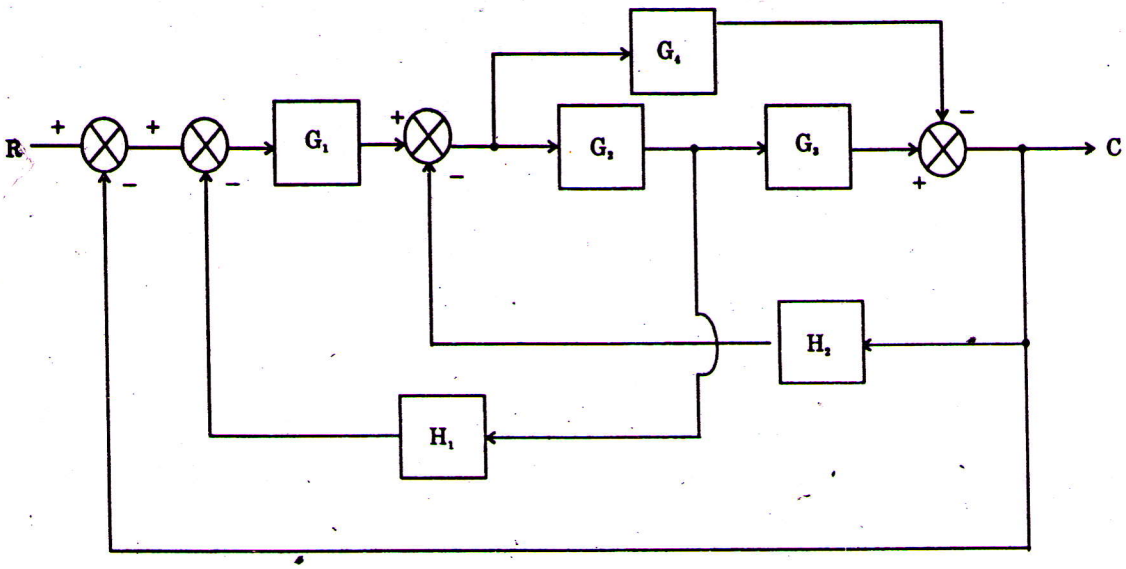
2. (a) A system is described by the following differential equation. Represent the system in state space and hence obtain its transfer function

$$\frac{d^3x(t)}{dt^3} + 3\frac{d^2x(t)}{dt^2} + 4\frac{dx(t)}{dt} + 4x(t) = u_1(t) + 3u_2(t) + 4u_3(t).$$

Or

Turn over

(b) Draw the signal flow and hence obtain $\frac{C}{R}$ for the block diagram shown below :



3. (a) Explain the mathematical analysis of the sampling process and reconstruction of data from samples.

Or

(b) What is pulse transfer function ? Obtain the pulse transfer function of the system described by the difference equation

$$y(nT) - \frac{1}{6}\, y\,(nT - T) + \frac{5}{6}\, y\,(nT - 2T) = x\,(nT)$$

and hence obtain its solution for $x\,(nT)$ = unit step input.

4. (a) Derive the time response of second order system with unit impulse input.

Or

(b) Check the stability of the system, having the following characteristic equation using Routh-Hurwitz criterion :

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

5. (a) Sketch the Polar plot for

$$G\,(s) = \frac{20}{s\,(s + 1)\,(s + 2)}.$$

Or

(b) The open loop transfer function of unity feedback system is

$$G\,(s) = \frac{ke^{-0.2s}}{s\,(1 + 0.25s)\,(1 + 0.1s)}$$

using Nichols chart, determine the value of "K" so that the gain margin of system is 4 dB.

(4 × 15 = 60 marks)