C 28726 **(Pages : 3)**

Name..............................

Reg. No..............................

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION JUNE 2012

EC 04 603—CONTROL SYSTEMS

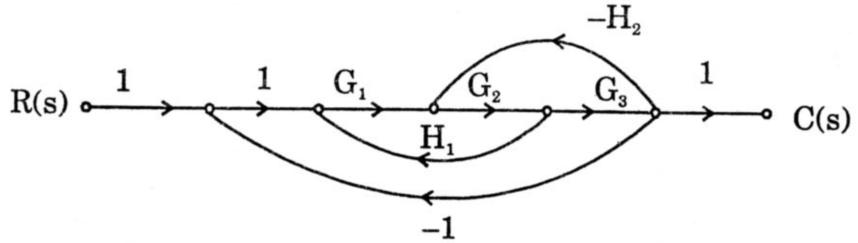
Time : Three Hours

Maximum : 100 Marks

Answer **all** *questions.*

I. (a) What are the merits of closed loop systems ?

(b) Obtain the closed loop transfer function by use of Mason's gain formula for the signal graph shown below :



(c) State and explain Routh Hurwitz criterion.

(d) Explain about Lag compensator.

(e) Explain about Jury's criterion.

(f) Obtain the Z-transformation of a^k, and A^k, where A is an $n \times n$ matrix.

(g) Explain the eigenvalues of a $n \times n$ matrix.

(h) Write down the state space representation of a RLC network.

(8 × 5 = 40 marks)

II. (a) (i) Derive the transfer function of positional servomechanism.

(9 marks)

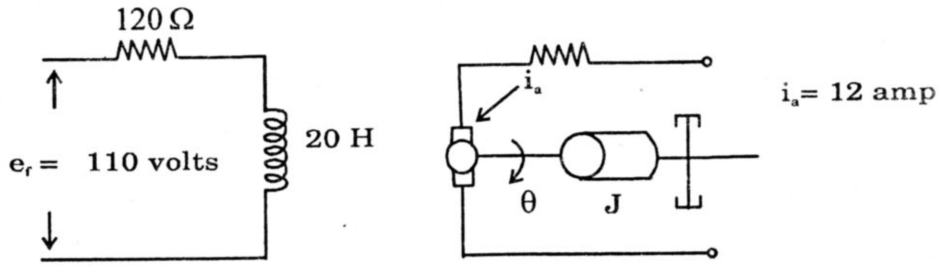
(ii) Draw the block diagram of home heating system. Explain it. What disturbances may exist in such a system ?

(6 marks)

Or

Turn over

(b) (i) Obtain the transfer function $\theta(s)/E_f(s)$ of the field controlled d.c. motor shown below. In the system assume J = 0.5 lb ft-sec^2, f = 0.2 lb-ft/rad/sec. and K_z = motor torque constant = 27.4 lb-ft/amp.



(9 marks)

(ii) Determine the Laplace transform of $f(t)=\frac{1}{a^2}$ and $f(t)=\sin\left(5t+\frac{\pi}{3}\right)$. (6 marks)

III. (a) (i) Analyse the step response of second order system. (7 marks)

(ii) Draw the Bode diagram of the following non–minimum phase system.

$$\frac{C(s)}{R(s)}=1-Ts.$$

(8 marks)

Or

(b) (i) Consider a unity feedback system whose open loop transfer function $G(s)=\frac{Ke^{-0.8s}}{s+1}$ Using the Nyquist plot, determine the critical value of K for stability.

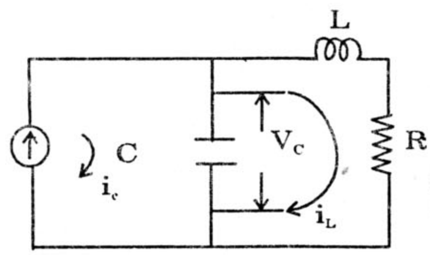
(10 marks)

(ii) Obtain the unit step response of unity feedback system whose open loop transfer function is $G(s)=\frac{4}{s(s+5)}$.

(5 marks)

IV. (a) (i) Describe the state space representation of a Linear time invariant system of SISO system. (10 marks)

(ii) Consider the network system shown below. Choose V_e and i_L as state variables, obtain the state equation of the system.



(5 marks)

Or

(b) (i) Find $x_1(t)$ and $x_2(t)$ of the system described by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 3 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \text{ where initial conditions are } \begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}.$$

(8 marks)

(ii) Explain the properties of state transition matrix.

(7 marks)

V. (a) (i) With an example explain bilinear transformation and stability of this system.

(8 marks)

(ii) Find the pulse transfer function for $G(s) = \dfrac{k}{s(s+a)}$.

(7 marks)

Or

(b) (i) Find the solution of the difference equation

$x(k+2) + 2x(k+1) + x(k) = u(k),\ x(0) = 0,\ x(1) = 0$ where $u(k) = k\ (k = 0, 1, 2....)$.

(10 marks)

(ii) Explain about sample and hold concept.

(5 marks)

[4 × 15 = 60 marks]