C 58371 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION JUNE 2009

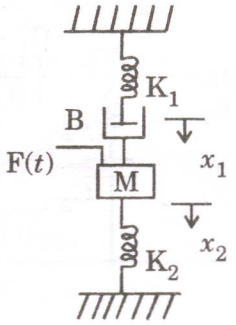
EE 04 603—CONTROL SYSTEM—I

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Consider the mechanical system shown in figure below. Write the state space equation.



(b) What is meant by zero state and zero input response ? Explain.

(c) Draw and explain sample and hold circuit.

(d) What id bilinear transformation ? Explain.

(e) What is Nyquist stability criterion ? Discuss in detail.

(f) Define : (i) resonant peak. (ii) resonant frequency. (iii) bandwidth.

(g) What is meant by lead compensation ? Explain.

(h) Explain the effect of phase lead network.

(8 × 5 = 40 marks)

[redacted]

Turn over

Part B

II. (a) Find the response of the system described by the state equation :

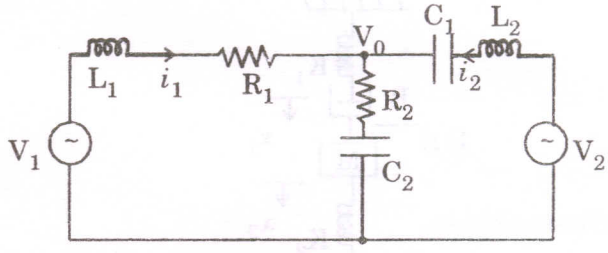
$$\dot{x}(t) = \begin{bmatrix} -1 & 1 \\ 0 & -2 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t).$$

$$x(0) = \begin{bmatrix} -1 \\ 0 \end{bmatrix}$$

whose $u(t)$ is unit step signal.

Or

(b) Consider the network shown below write the state space equation :



III. (a) (i) Explain the reconstruction of data. (5 marks)

(ii) Find the solution of the following difference equation using z-trasform :

$$y(n) - \frac{3}{2} y(n-1) + \frac{1}{2} y(n-2) = 0$$

$$y(-1) = 1,\ y(-2) = 0.$$

(10 marks)

Or

(b) (i) Using Routh's stability criterion, determine whether the system having characteristic equation is stable or not :

$$A(z) = 1 + \frac{13}{24} z^{-1} + \frac{5}{8} z^{-2} + \frac{1}{3} z^{-3}$$

(8 marks)

(ii) Find the inverse z-transform of :

$$X(z) = \frac{z}{1 + 2z - 3z^2}.$$

(7 marks)

IV. (a) For a unity feedback system the open loop transfer function is given by :

$$G(s) = \frac{K}{s(s+4)(s+5)}.$$

sketch the root locus as K-varies from 0 to ∞.

Or

(b) Draw the Bode Plot for the transfer function $G(s) = \frac{1000}{s(1+0.1s)(1+0.001s)}$.

V. (a) (i) Derive the transfer function of phase lead network. (8 marks)

(ii) Explain the effect of sampling period on time response. (7 marks)

Or

(b) Design a lag compensator for a system whose open loop transfer function is :

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

to meet the following specifications

Damping ratio = 0.5.

Settling time = 10 sec.

Velocity error constant ≥ 5.

Use root locus method.

(4 × 15 = 60 marks)

[redacted]