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Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2007

EC 04 603—CONTROL SYSTEMS

(2004 Admissions)

Time : Three Hours

Maximum : 100 Marks

Answer **all** *questions.*

Part A

I. (a) Explain what is meant by closed loop control systems with block diagram.

(b) Derive the transfer function of first order low pass RC circuit.

(c) Define standard test signals and explain.

(d) Explain the concept of lead compensator.

(e) State initial value theorem of Z-transform and prove it.

(f) What is meant by multirate sampling ? Explain.

(g) Explain the advantages of state space analysis.

(h) What is state transition matrix ? Explain its properties.

(8 × 5= 40 marks)

Part B

II. (a) (i) Explain what is meant by poles and zeros of a transfer function. (6 marks)

(ii) Write the differential equations describing the following systems in Fig. 1. (9 marks)

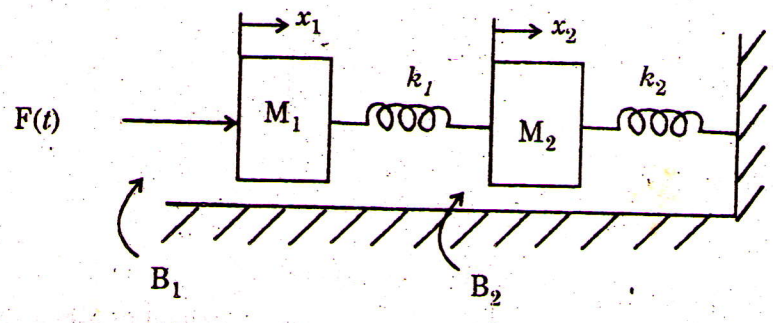

Fig. 1.

Or

(b) Using block diagram reduction rule, determine the transfer function of the following system in Fig. 2.

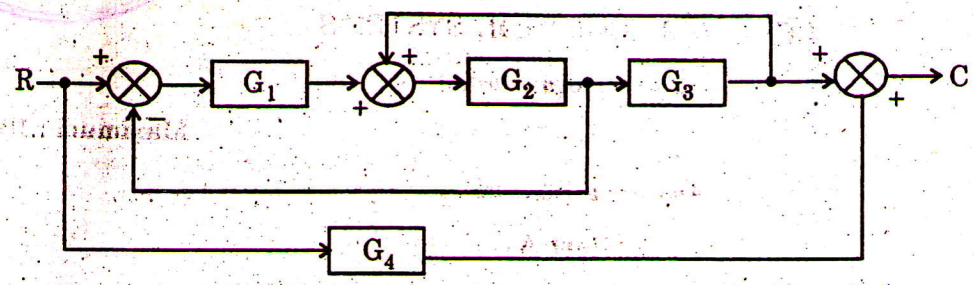

Fig. 2.

III. (a) Derive the time response of second order system for unit impulse.

Or

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

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

(7 marks)

(ii) Sketch the polar plot for $G(s) = \frac{1}{s(s+1)}$. (8 marks)

IV. (a) Find the solution of the following difference equation using z-transform :—

$$y(nT) - \frac{1}{4}y(nT - T) + \frac{1}{8}y(nT - 2T) = x(n)$$

where, $x(n) = \left(\frac{1}{2}\right)^n \cdot u(n)$

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

Or

(b) (i) Explain the mapping between s-plane and z-plane. (6 marks)

(ii) Using Jury's test, check the stability of the system described by the difference equation.

$$y(nT) = 0.7y(nT - T) - 0.12y(nT - 2T) + x(nT - T) + x(nT - 2T).$$

(9 marks)

V. (a) Consider the state equation of a system given below :

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

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

$$y = [1 \quad 0]\, x.$$

(i) Determine the stability of the system.

(ii) Find out the response of the system to unit step input.

Or

(b) Derive the solution of homogenous and non-homogeneous state equations.

(15 marks)

[4 × 15 = 60 marks]