OR

10. a) Explain the concept of controllability and observability. State the necessary conditions to be satisfied. 4

b) Obtain the time response of the following system

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 3\\ -2 & -5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 2\end{bmatrix}u$$

Where $u(t)$ is the unit step function occurring at $t = 0$. Assume zero initial conditions. 10

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Roll No .....

EC - 502

B.E. V Semester

Examination, December 2013

Control Systems

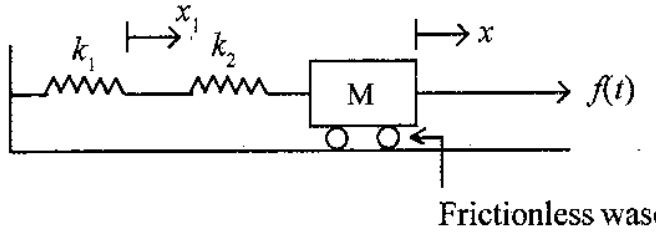
Time : Three Hours

Maximum Marks : 70

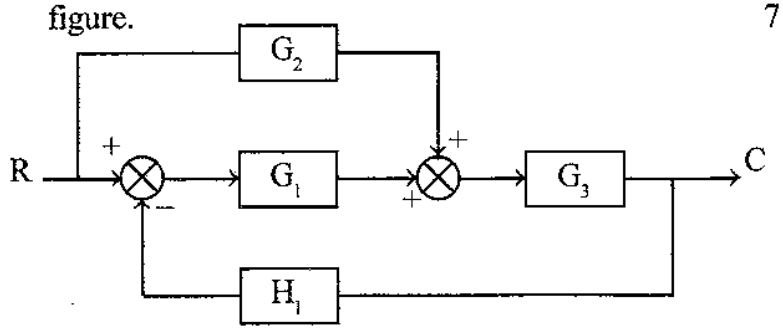
Note: Attempt any one question from each unit. All questions carry equal marks.

Unit - I

1. a) Obtain transfer function of the system shown in figure and draw its electrical analog. 7



b) Find closed loop transfer function of system shown in figure. 7



OR

2. a) Represent the following set of equations by a signal flow graph and determine the overall gain relating x_5 and x_1.

$$x_2 = ax_1 + fx_2$$

$$x_3 = bx_2 + ex_4$$

$$x_4 = cx_3 + hx_5$$

$$x_5 = dx_4 + gx_2$$ 7

b) How to reduce the parameter variations by using the feedback in a system. 7

Unit - II

3. a) Explain time response of first-order systems to the unit-step Input and unit-ramp Input. Find steady state error for both response. 8

b) What is effects of additions of poles and zeros to closed loop system. 6

OR

4. a) Find out the conditions for stability for the systems whose characteristics equations given below. The case where stability is suggested for real values of K. determine the values of K which will cause sustained oscillations. Find the frequency of oscillations. 8

$$S^4 + 20S^3 + 224S^2 + 1240S + 2400 + K = 0$$

b) Write down the guidelines for sketching root locus. 6

Unit - III

5. a) What is the correlation between transient response and frequency response. 7

b) State and explain the Nyquist stability criterion. 7

OR

6. a) Draw the polar plots of the following transfer function. Find out the magnitude and frequency at imaginary axis when the plot crosses. 7

b) The open-loop transfer function of closed loop system is

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

Determine stability. 7

Unit - IV

7. a) What is compensation? Discuss various types of compensators. 7

b) Draw a phase-lead network and explain phase-lead compensation. 7

OR

8. a) Solve the difference equation

$$x(k+2) - 3x(k+1) + 2x(k) = 4^k; x(0) = 0, x(1) = 1$$ 7

b) Write down the properties of Z-transform and define Z-transform. 7

Unit - V

9. For a system represented by the state equation $\dot{x} = Ax(t)$ the response is $x(t) = \begin{bmatrix} e^{-2t} \\ -2e^{-2t} \end{bmatrix}$ when $x(0) = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$ and $x(t) = \begin{bmatrix} e^{-t} \\ -e^{-t} \end{bmatrix}$ when $x(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

Determine the system matrix A and the state transition matrix. 14