Roll No ....

# EC - 502
B.E. V Semester
Examination, December 2014
Control Systems
Time : Three Hours

Maximum Marks : 70

Note: i)   Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii)   All parts of each questions are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a)   What do you understand by transfer function? Illustrate it with example.

    b)   Develop differential equation for mechanical model of mass-damper system.

    c)   What is mason gain formula? Explain each component of formula and mention its advantages over block diagram reduction methods.

    d)   Simplify the block diagram and evaluate transfer function.
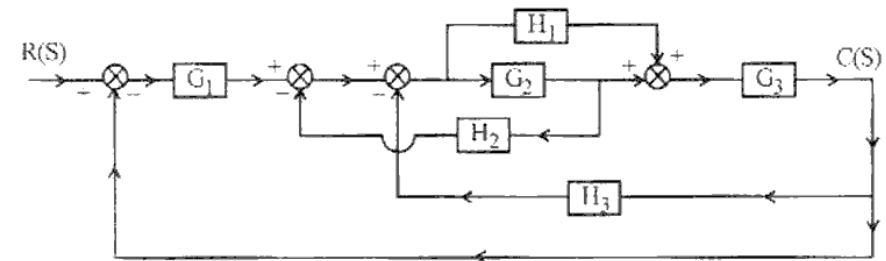
OR

For the system represented by following equations find the transfer function $X(S)/U(S)$ by signal flow graph technique. RGPVONLINE.COM

$$x = x_1 + \alpha_3 u$$

$$\dot{x}_1 = -\beta_1 x_1 + x_2 + \alpha_2 u$$

$$\dot{x}_2 = -\beta_2 x_1 + \alpha_1 u$$

Unit - II

2. a)   Discuss following test signals

      i)   Impulse

      ii)   Step

      iii) Ramp

    b)   What do you understand by steady state error?

    c)   What is the concept of stability for linear systems? Discuss effects of poles on the stability.

    d)   Define root locus, mention and explain the rules of and root locus sketching. How compensation is being performed with root locus method.

OR

The open loop system transfer function of a feedback control system is given by

$$G(S)H(S) = \frac{K}{S(S+4)(S^2+2S+2)}$$

Using Routh criterion evaluate value of K for stable system. RGPVONLINE.COM

Unit - III

3. a) What do you understand by all pass minimum phase systems?

b) Discuss the method of sketching of polar plot with example.

c) What do you understand by gain margin and phase margin.

d) Sketch the Bode plot for following open loop control system.

$$G(S) = \frac{K(1+0.2S)(1+0.025S)}{S^3(1+0.001S)(1+0.005S)}$$

OR

Ascertain stability by Nyquist criterion for following open loop control system.

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

Unit - IV

4. a) What do you understand by lead-lag compensation?

b) What is proportional plus derivative controller?

c) Discuss integral and PID compensation.

d) Obtain Z-transform for the following

i) $s(n)$

ii) $u(n)$

iii) $\cos \alpha n.\ u(n)$

OR

Obtain inverse Z- transform for the following

$$X(Z) = \frac{8Z-19}{(Z-2)(Z-3)}$$

Unit - V

5. a) What do you understand by state variable?

b) What is transition matrix mention its properties.

c) Discuss relationship between state equation and transfer function.

d) Discuss concept of controllability and observability with example.

OR

Determine whether the system is controllable or not

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

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