

Roll No .....

**EC - 502****B.E. V Semester**

Examination, December 2014

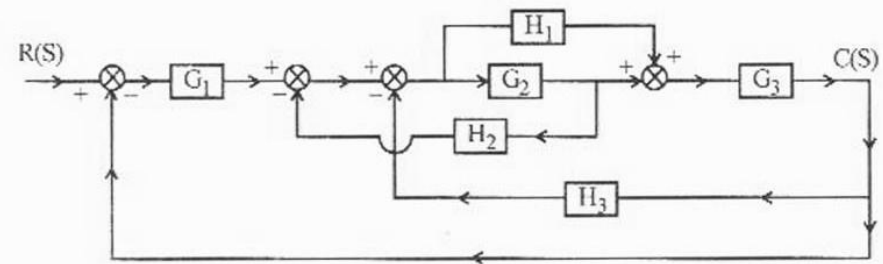
**Control Systems***Time : Three Hours**Maximum Marks : 70*

- 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.

[2]



OR

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

$$x = x_1 + \alpha_3 u$$

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

$$\dot{x}_2 = -\beta_2 x_2 + \alpha_1 u$$

**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

[3]

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?

[4]

- 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

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

\*\*\*\*\*