

6E3090

B.Tech VI Sem. (Main/Back) Exam. April- May 2012  
 Electronics & Communication  
 6EC5 Control Systems

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates:

Attempt any **five questions**, selecting one question from each unit.  
 All Question carry equal marks. Schematic diagrams must be shown  
 wherever necessary. Any data you feel missing suitably be assumed  
 and stated clearly.

Units of quantities used/ calculated must be stated clerly.

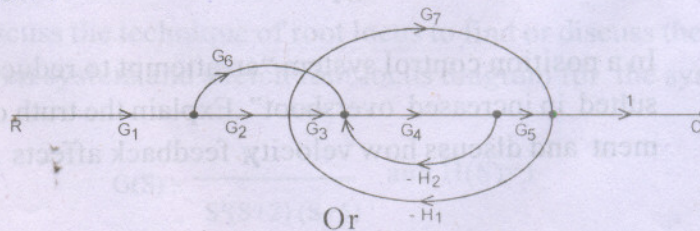
Use of following supporting material is permitted during examination. (Men-  
 tioned in form No. 205)

1. \_\_\_\_\_ Nil \_\_\_\_\_

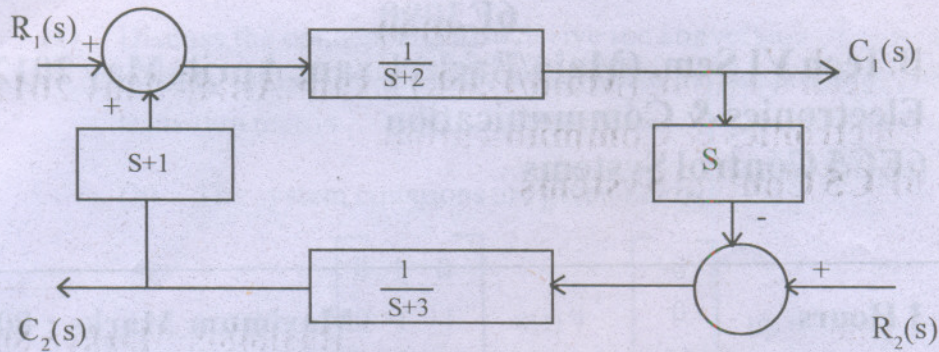
2. \_\_\_\_\_ Nil \_\_\_\_\_

### Unit -1

1. (a) Discuss the effect of feedback in a closed loop control system. 8  
 (b) Find the transfer function of the system whose signal flow graph is as  
 below. 8



1. (a) Explain what is meant by multivariable system. Also determine the  
 following for system shown in fig below. State the assumptions made  
 if any.  
 (i)  $\frac{C_2(S)}{R_1(S)}$  and  $\frac{C_1(S)}{R_2(S)}$  8



- (b) Find Z- transform of the following function.

$$f(t) = 1 - e^{-2t} \text{ and sampling time is taken as } 0.1 \text{ sec}$$

8

## Unit-2

2. (a) Determine the step, ramp and parabolic error contents of a unity feedback control system. The open loop transfer function of the system is given as.

$$G(S) = \frac{K(1+2S)(1+4S)}{S^2(S^2+2S+10)}$$

What is the value of steady state error when the input is a ramp? 8

- (b) A unity feedback system has an open loop transfer function as  $\frac{K}{S(S+5)}$ . Explain how variation in K affects the transient response of close loop system. 8

Or

2. (a) In a position control system "an attempt to reduce rise time resulted in increased overshoot". Explain the truth of above statement and discuss how velocity feedback affects this behavior. 8

- (b) The closed loop transfer of a system is given by

$$M(S) = \frac{400K}{S^2 + 40S + 400K}$$

Determine the percentage overshoot for  $K = 100$ , when the input is unit step. 8

### Unit-III

3. A servo mechanism has open loop transfer function

$$a(s) = \frac{10(1+0.5s)}{s(1+0.1s)(1+0.2s)}$$

Draw the Bode plot on semi log paper and determine phase and gain margins. 16

Or

3. Define and explain the design specification in frequency domain. Also derive their co-relation with time domain specifications. 16

### Unit-IV

- 4 (a) Explain stability of a system. Also differentiate between absolute and relative stability. 8

- (b) The characteristic equation of a certain closed loop system is given by -

$$S^3 + (K+4)S^2 + 6S + 12 = 0$$

Determine the range of K for this system is stable. 8

Or

4. Discuss the technique of root locus to find or discuss the stability of a given system and sketch root locus diagram for the system. 16

$$G(S) = \frac{K}{S^2(S+2)(S+5)} \quad \text{and} \quad H(S) = 1$$

## Unit -V

5. (a) Discuss the concept and also derive the conversion of state variable models to transfer function model. Also list the properties of state transition matrix . 8

(b) The system equations are given below:

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & -1 & 1 \\ 0 & -1 & -10 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 10 \end{bmatrix} u(t)$$

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

Find its transfer function .

8

Or

5. Define the controllability and observability of the system .Also test controllability and observability of the following system. 16

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

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