6E3090

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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.

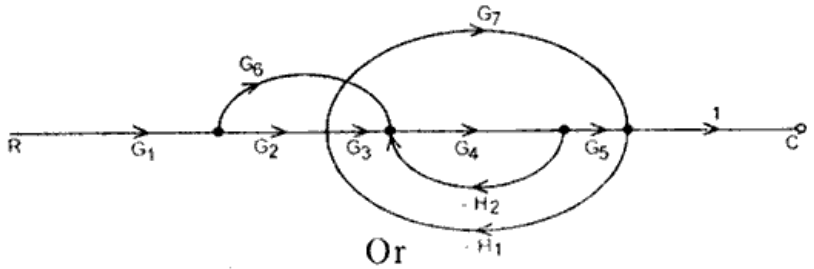
Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. **Nil** 2. **Nil**

Unit -1

1. (a) Discuss the effect of feedback in a closed loop control system. 8

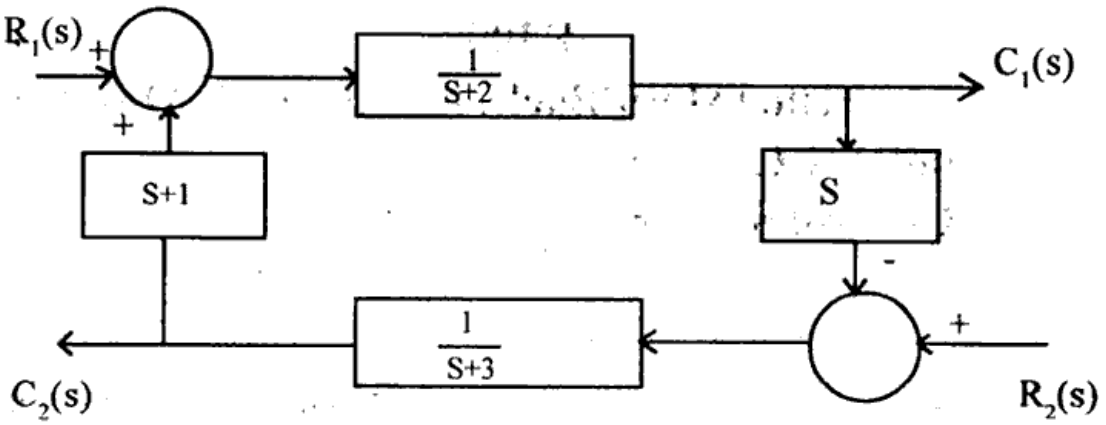
(b) Find the transfer function of the system whose signal flow graph is as below. 8



Or

1. (a) Explain what is meant by multivariable system. Also determine the following for system shown in fig below. State theassumtions 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.

$f(t) = 1 - e^{-2t}$ and sampling time is taken as 0. 1 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 dlscuss how velocity feedback affects this behavior. **8**

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

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

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

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

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:

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

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

Find its transfer function . 8

Or

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

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

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