6E 6055

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6E6055

B.Tech. VI Semester (Main/Back) Examination, May-June 2015

Electronics And Communication Engg.

6EC5A 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 questions 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 clearly.*

Unit - I

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

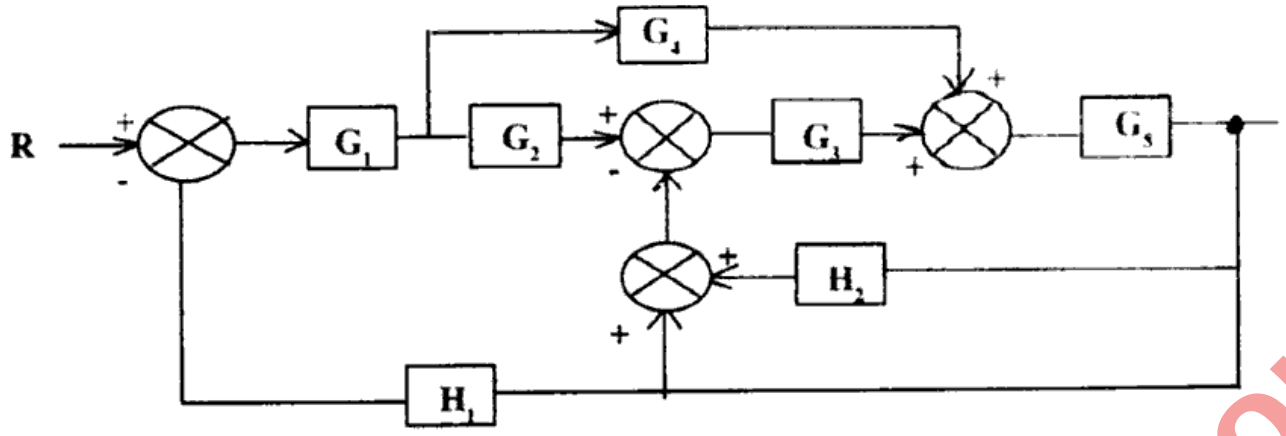
$x_2 = ax_1 + fx_2; x_3 = bx_1 + ex_2$

$x_4 = cx_3 + hx_5; x_5 = dx_3 + gx_2$ **(10)**

b) What is feedback and explain closed loop control system with example and also compare closed loop control system with open - loop control system. **(6)**

OR

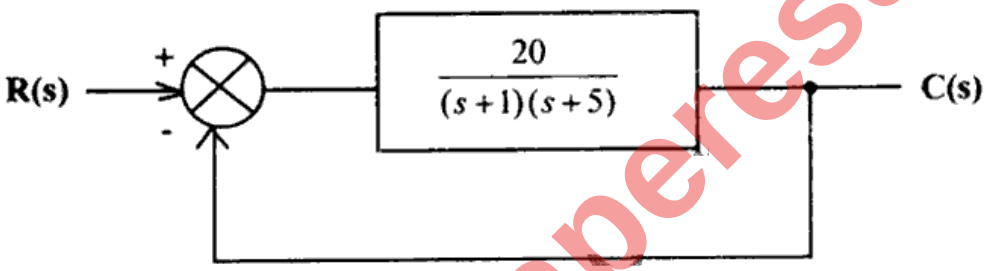
1. a) Apply mason's gain formula to determine the overall transfer function of a control system having the block - diagram given below in fig. **(10)**



b) Explain force - voltage and force - current analogy with complete details.

Unit - II

2. a) The block - diagram of a unity feedback control system is shown in



Determine the characteristics equation of the system, W_n, ζ, W_d, t_p time at which the first undershoot occurs, the time period of oscilla the number of cycles completed before reaching the steady state.

b) Explain asymptotic and relative stability.

OR

2. a) Determine the stability of a system having following characteristics e

$$s^6+s^5+5s^4+3s^3+2s^2-4s-8=0.$$

b) The closed - loop transfer function of a unity feedback control s given below:

$$\frac{C(s)}{R(s)}=\frac{Ks+\beta}{s^2+\alpha s+\beta}$$

Determine the steady - state error for unit ramp input.

Unit - III

3. a) Determine the critical values of k for the stability of a unity feedback control system whose open - loop transfer function is given by

$G(s) = \frac{Ke^{-0.5s}}{(s+1)}$. Use Nyquist plot method. **(12)**

b) Explain the salient features of root locus plot. **(4)**

OR

3. The transfer function of a unity feedback control system is given by

$$G(s) = \frac{K}{s(s+2)(s+4)}$$

Determine :

a) The value of k to have 40% over - shoot for unit step input. **(4)**

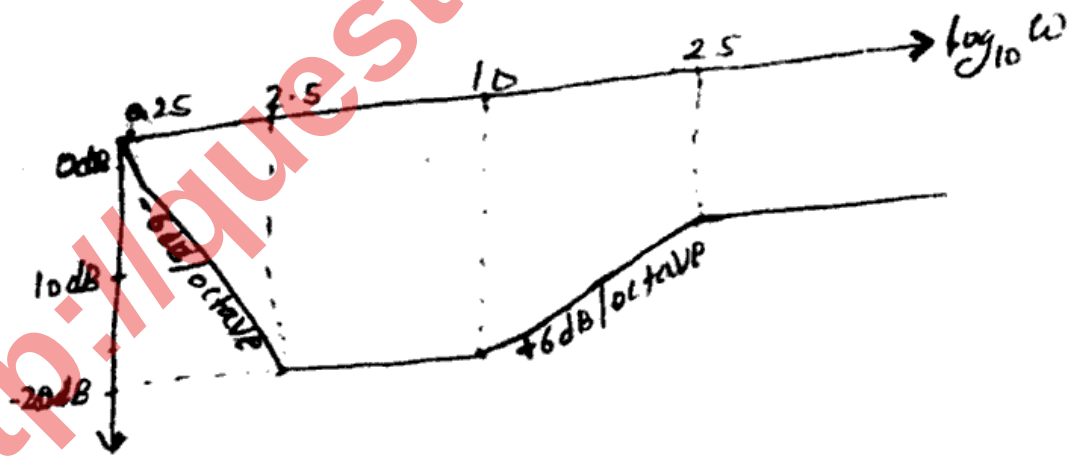
b) The value of k_v for sustained oscillations in output. **(4)**

c) The value of k_v corresponding to value of k as obtained in (a) **(4)**

d) The value of settling time t_s. Using root locus method. **(4)**

Unit - IV

4. a) Determine the transfer function for the bode plot shown in fig.



(8)

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

$$G(s)\,H(s) = \frac{K}{(s+1)(2s+1)(3s+1)}.$$

Find the value of K such that the gain margin is 20db.

OR

4. a) A unit step input is applied to a unity feedback control system whose loop transfer function is given by

$$G(S) = \frac{K}{S(ST+1)}$$

Determine the values of k & T given that maximum overshoot Mp = 2 resonant frequency W_r =8 rad/sec. Calculate the resonance peak l crossover frequency and phase margin.

b) Explain gain margin and phase margin with stability conditions.

Unit - V

5. a) Explain feedback compensation technique.

b) The state equations of a control system are given below:

Examine for complete state controllability.

$$\dot{x}_1 = \frac{-1}{T_1}x_1 + \frac{1}{T_1}u \qquad \dot{x}_2 = \frac{-1}{T_2}x_2 + \frac{1}{T_2}u.$$

OR

5. a) Obtain the state transition matrix in the e^{At} and determine the time res for the system, $\dot{X} = AX$

Where $A = \begin{bmatrix} 0 & 1 \\ -2 & 0 \end{bmatrix}$ & $x_1(0) = 1, x_2(0) = 1$.

b) What is controllers and explain PID controllers with effect of P, I, D indi