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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.

$$x_2 = ax_1 + fx_2; x_3 = bx_2 + ex_4$$

$$x_4 = cx_3 + hx_5; x_5 = dx_4 + gx_2$$ **(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)**

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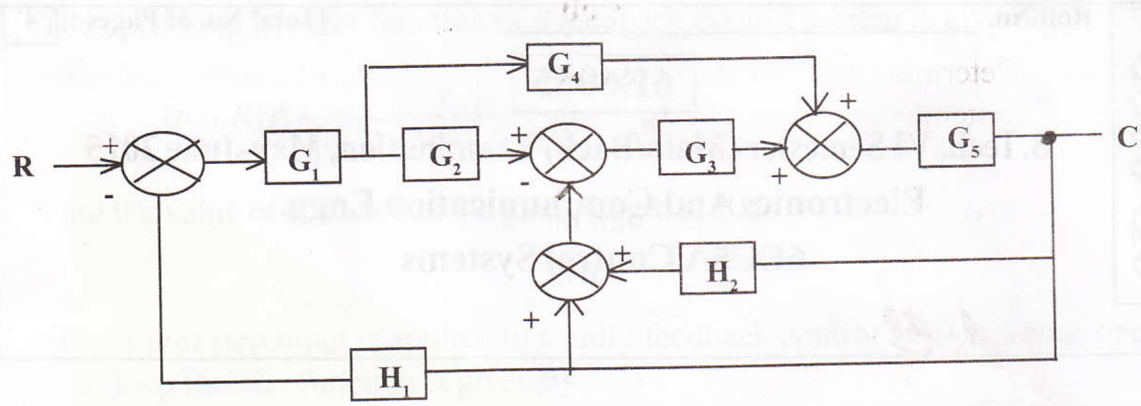
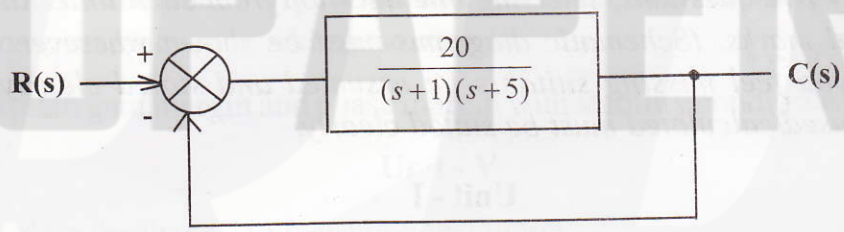


b) Explain force - voltage and force - current analogy with complete details. **(6)**

Unit - II

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



Determine the characteristics equation of the system, W_n, ξ, W_d, t_p, M_p, the time at which the first undershoot occurs, the time period of oscillations and the number of cycles completed before reaching the steady state. **(12)**

b) Explain asymptotic and relative stability. **(4)**

OR

2. a) Determine the stability of a system having following characteristics equations: **(8)**

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

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

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

Determine the steady - state error for unit ramp input. **(8)**

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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

$G(s) = \dfrac{Ke^{-0.5s}}{(s+1)}$. 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)**

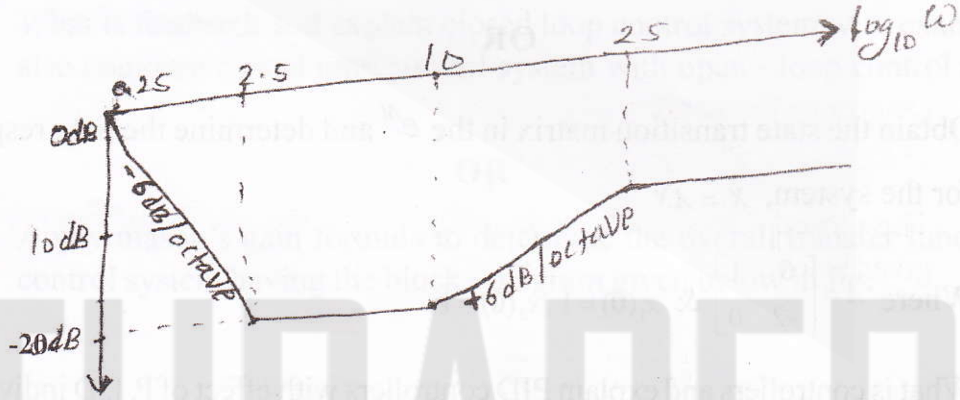
b) The value of k_v for sustained oscillations in output. **(4)**

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)

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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. **(8)**

OR

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

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

Determine the values of k & T given that maximum overshoot Mp = 25% and resonant frequency W_r =8 rad/sec. Calculate the resonance peak M_r gain crossover frequency and phase margin. **(12)**

b) Explain gain margin and phase margin with stability conditions. **(4)**

Unit - V

5. a) Explain feedback compensation technique. **(8)**

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

Examine for complete state controllability.

$$\dot{x}_1 = \frac{-1}{T_1} x_1 + \frac{1}{T_1} u \ \ \& \ \ \dot{x}_2 = \frac{-1}{T_2} x_2 + \frac{1}{T_2} u.$$ **(8)**

OR

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

Where $A = \begin{bmatrix} 0 & 1 \\ -2 & 0 \end{bmatrix}$ & $x_1(0) = 1, x_2(0) = 1.$ **(8)**

b) What is controllers and explain PID controllers with effect of P, I, D individually **(8)**

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