6E6055

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B. Tech. VI-Sem. (Main / Back) Exam., October - 2020
Electronics & Communication Engineering
6EC5A Control System

Time: 2 Hours **Maximum Marks: 48**
Min. Passing Marks: 16

Instructions to Candidates:

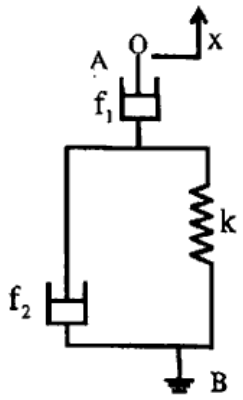
*Attempt **three questions,** selecting **one question each** from any three **unit.** All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.*
Use of following supporting material is permitted during examination. (Mentioned in form No.205)

1. NIL 2. NIL

UNIT- I

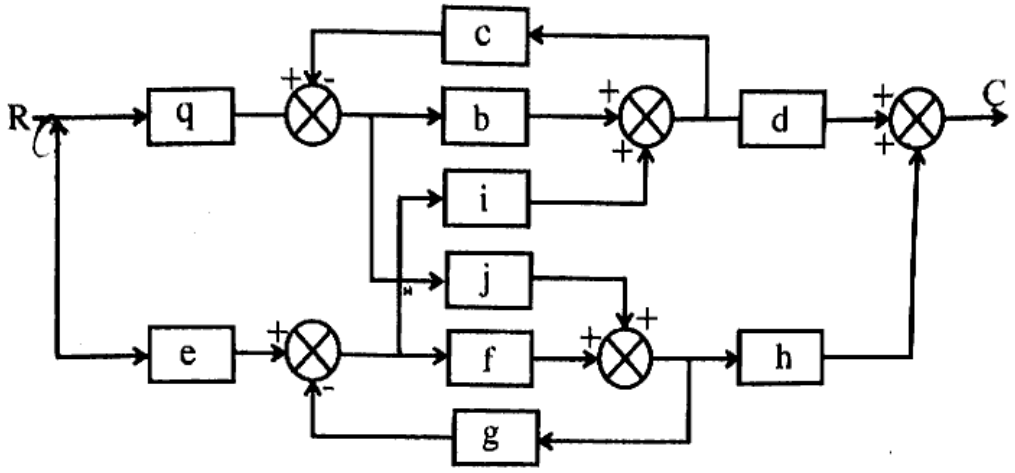
Q.1 (a) What is control system? Explain difference between open loop & closed loop control system with the help of block diagram. [10]

(b) Find the transfer function relating displacement y & x for the mechanical system of figure given below. [6]

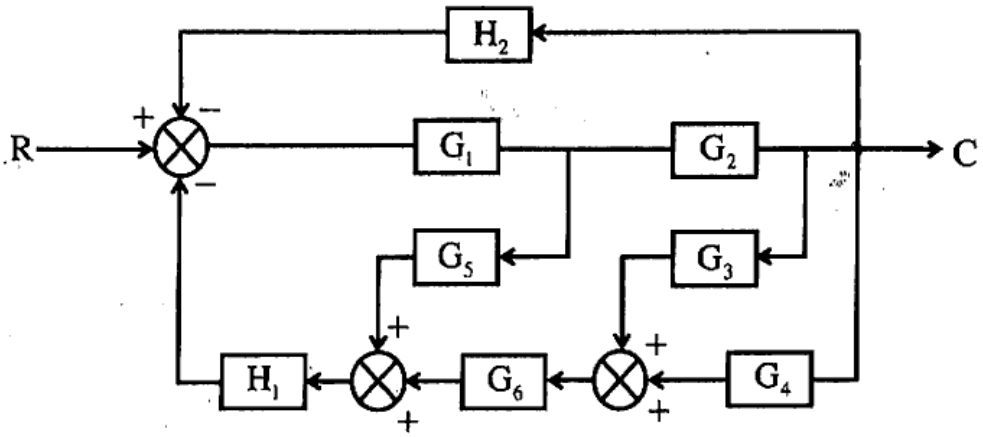


OR

Q.1 (a) Obtain the signal flow graph representation for a system whose block diagram is given. Specify forward patch, loops, etc. [8]



(b) Determine overall transfer function for the block diagram shown below. [8]



UNIT- II

Q.2 (a) Derive the expression for time response of second order control system subjected to unit step input function. [8]

(b) Consider a unity feedback system having open loop transfer function. [8]

$$G(s) = \frac{1}{(s^2 + 10s + 15)}$$

Calculate rise time, peak time, peak overshoot and settling time.

OR

Q.2 (a) With the help of Routh Hurwitz criterion, comment upon the stability of the system having following characteristic equation- [6]

$s^6 + s^5 - 2s^4 - 3s^3 - 7s^3 - 4s^2 - 4 = 0$

(b) What do you understand by stability? Explain the importance of stability, also give difference between absolute and relative stability. [10]

UNIT- III

Q.3 Sketch the root locus, if the transfer function (open loop) is - [16]

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

Write all the steps clearly, determine maximum values of gain 'K' ensuring closed loop stability.

OR

Q.3 (a) What is M & N circle? Explain the physical significance of this circle in stability criterion? [6]

(b) Using Nyquist criterion investigate the stability of a closed loop control system whose open loop transfer function is - [10]

$$G(s)\,H(s) = \frac{K}{s(1+sT_1)\,(1+sT_2)}$$

UNIT- IV

Q.4 A unity feedback system has open loop transfer function $G(s) = \frac{200}{s(s+1)\,(s+10)}$. Draw the Bode plot, determine gain margin, phase margin, gain and phase crossover frequencies, also discuss system stability. [16]

OR

Q.4 (a) Draw the Bode plot (magnitude only) for the following transfer function and determine the gain crossover frequency. $G(s) = \frac{10}{s(1+5s)\,(1+.25s)}$. [8]

(b) Define the following terms in reference of Bode plot for a given transfer function- [4×2=8]

(i) Phase crossover frequency

(ii) Gain crossover frequency

(iii) Phase margin

(iv) Gain margin

UNIT- V

Q.5 (a) Obtain the time response of following system. [8]

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 1\end{bmatrix}u(t)$$

$x^T(0) = [1\ \ 0]$ and u(t) is a unit step occurring at $t = 0$

(b) Consider a SISO system with the state variable description [8]

$\dot{x} = Ax + br$

$y = Cx$

$$A=\begin{bmatrix}0 & 1 & 0\\ 0 & -3 & -3\\ 1 & 0 & -1\end{bmatrix}. \qquad B=\begin{bmatrix}0\\ 3\\ 0\end{bmatrix}; C=[1\ \ 0\ \ 0].$$

Deduce the transfer function G(s).

OR

Q.5 Write short note on -

(a) Lead – leg compensation network [8]

(b) PID controllers in brief along with block diagram [8]