Seat No:-_____

GANPAT UNIVERSITY

B.Tech Semester: IV Electrical Engineering

Regular Examination May- 2014

2EE403: CONTROL SYSTEM ENGINEERING

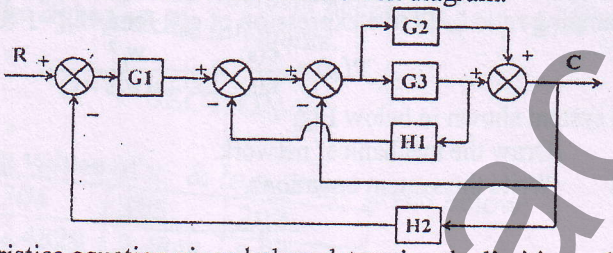
Time:-3 Hours **Total Marks-70**

Instructions:-

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Section-I

Que-1 (A) Determine the transfer function C/R from the block diagram. [7]

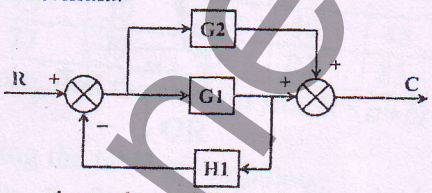


(B) For the characteristics equation given below determine the limiting value of K for stability. [5]

$$s^4 + 4s^3 + 6s^2 + (K+5)s + 2K = 0$$

OR

Que-1 (A) Draw the signal flow graph and find the overall transmittance of the following block diagram by Mason's gain formula. [5]



(B) Use Routh criterion to investigate the stability of a control system having open-loop transfer function given below. [7]

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

Que-2 (A) The open-loop transfer function of a control system is given below, [6]

$$G(s)H(s) = \frac{K(s+1)^2}{(s+2)^2}$$

Show that the root locus lies on a circle.

(B) Explain how to close the Nyquist plot from s = - j0 to s = + j0. [5]

OR

Que-2 (A) By using the Nyquist criterion examine the closed loop stability of a control system whose open-loop transfer function given below. [7]

$$G(s)H(s) = \frac{K}{s(sT-1)}$$

(B) Write any four salient features of root locus plot. [4]

Que-3 **Attempt any two.**

(A) What are the advantages of state space approach over the classical approach? [6]

(B) Explain the Nyquist criterion with example. [6]

(C) Find the diagonal form for the following state equation. [6]

$$\begin{bmatrix} \dot{x}1 \\ \dot{x}2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Section-II

Que-4 (A) The system equation is $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 8x$. [8]
Find the Time domain specifications for unit step input. (y → output, x → input)

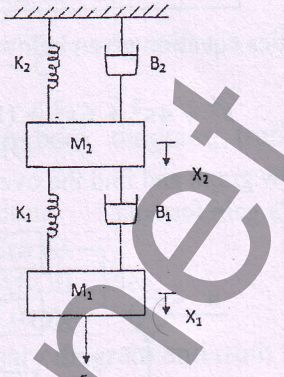
(B) Explain with example the first order system. [4]

OR

Que-4 (A) Derive expression of response c(t) of second order unity feedback system whose closed-loop transfer function is given below, for a unit step input as a function of time *t* and damping ratio ζ. Derive expression of c(t) for ζ<1, ζ=1 & ζ=0. [8]

$$T(s) = \frac{C(s)}{R(s)} = \frac{W_n^2}{S^2 + 2\zeta W_n S + W_n^2}$$

(B) For the system shown in below Fig. [4]
(i) Draw the mechanical network.
(ii) Write the system equations.

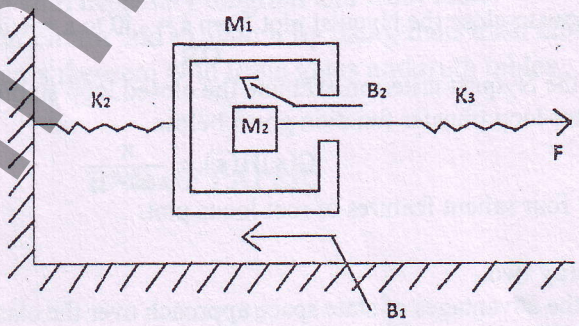


Que-5 (A) For the system having the open-loop transfer function $G(S)H(S) = \frac{10}{S(S+1)(S+10)}$. [8]
Determine the stability of the system by plotting the Bode Plot of the system.

(B) What are the advantages & disadvantages of Transfer Function? [3]

OR

Que-5 (A) For the system shown in below Fig. [8]
(i) Draw the mechanical network.
(ii) Write the system equations.
(iii) Draw the force voltage and force current analogous networks.



(B) Define following terms: [3]
(i) Rise time
(ii) Peak time
(iii) Delay time

Que-6 (A) Derive the Transfer Function for field controlled dc motor. [6]

(B) Derive the System equation for gear train system. [6]

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