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B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2011

ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH

FOURTH SEMESTER - (REGULATIONS 2008)

EC 9254 - CONTROL SYSTEMS

Time: 3 hr. (semi-log, polar sheet should be provided) Max.Mark:100

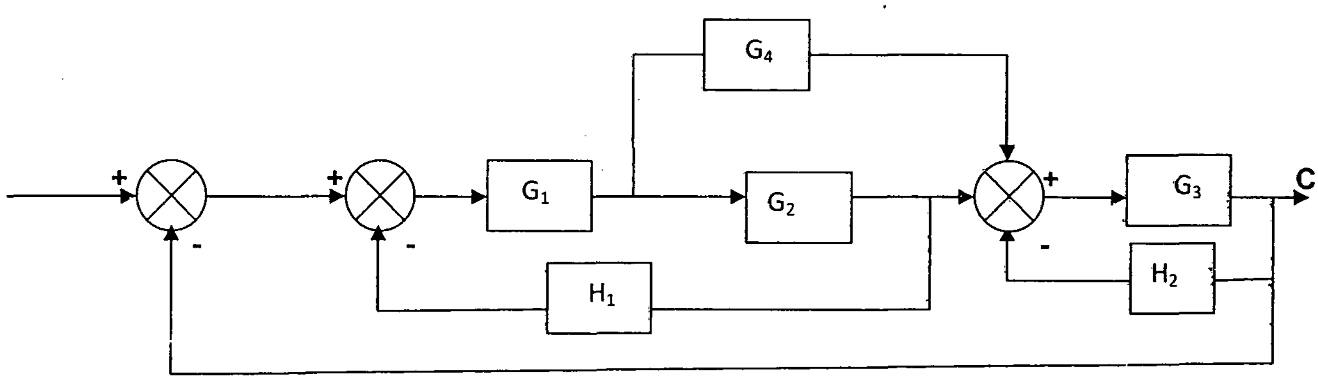
Answer ALL Questions

PART – A (10 X2= 20 Mark)

1. Define the Transfer function.
2. What are the different elements used in rotational system.
3. Define type and order of a system.
4. Find the step response of a system if its impulse response is $5e^{-10t}$.
5. State the Nyquist stability criterion.
6. What is the need for a compensator
7. State argument theory
8. Comment on relative stability.
9. Define state model.
10. List the advantages of sampled data control system.

PART – A (5 X 16= 80 Mark)

11. Find the transfer function of the system given below by block diagram reduction method and verify it by signal slow graph.



12. a) The overall transfer function of a unity feed back system is given by

$$\frac{C(S)}{R(S)} = \frac{10}{s^2 + 6s + 10}$$

Find i) The position, velocity and acceleration error constants. (6)

ii) The steady state error for the input $\mathbf{r(t) = 1 + t + t^2}$ (10)

(or)

b) For a unity feed back system back $G_S = \frac{36}{s(s+0.72)}$ Determine the characteristics equation and hence calculate i) Natural Frequencyii) Damping ratio iii) Peak time iv) Settling time(2%) v) Peak over shoot

13. a)Sketch bode plot for the given transfer function and determine the phase margin and gain margin.

$$G_s = \frac{75(1+0.2s)}{s(s^2+16s+100)}$$

(or)

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

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

Sketch the polar plot and determine the gain margin and phase margin.

14. a)Obtain the root Locus diagram for a Unity feed back system with the open loop transfer function

$$G(s) = \frac{K}{s(s^2+6s+10)}$$

(or)

b)i. Use Routh-Hurwitz criterion and comment on the stability of the system of characteristics equation

$s^5+4s^4+8s^3+8s^2+7s+4=0$ (6)

ii. Construct Nyquist plot for a feedback control system whose open loop transfer function is given by

$$G(s)H(s) = \frac{2}{s(1-2s)} \quad (10)$$

15. a)A system is characterized by the state variable model given below. Comment on the controllability and observability of the system

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix} = \begin{bmatrix}0 & 0 & 1\\ -2 & -3 & 0\\ 0 & 2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 2\\ 0\end{bmatrix}u$$

$$y = \begin{bmatrix}1 & 0 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

(or)

b)i.Construct a state model for a system characterized by the differential equation,

$$\frac{d^3y}{dt^3} + \frac{d^2y}{dt^2} + 11\frac{dy}{dx} + 10y - 8u = 0 \quad (8)$$

ii. The state equation and initial condition vector of a linear-time-invariant system are given below.Determine the solution of state equation.

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix};\ x_3 = \begin{bmatrix}1\\ 0\end{bmatrix} \quad (8)$$