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B.E./B.Tech DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2012

ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH

FOURTH SEMESTER-(REGULATIONS 2008)

EC 9254 - CONTROL SYSTEMS

Time: 3 hr. Max.Mark:100

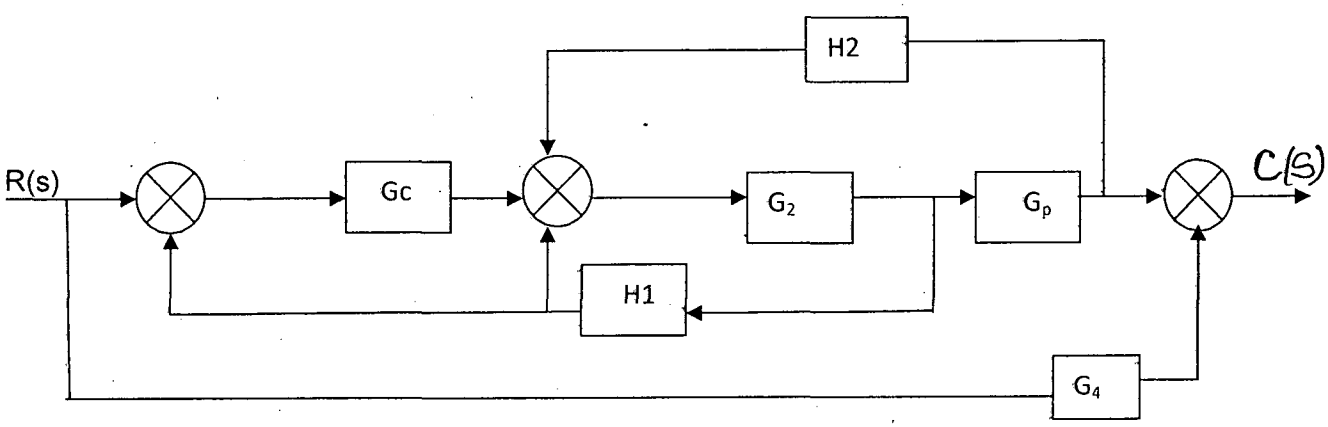
Answer ALL Questions

PART – A (10 X2= 20 Mark)

1. What is the significant of a Transfer function.
2. State Mason's gain formula.
3. Find the Transfer function of a system if its impulse response is e^{-3t} sin 2t.
4. Why derivative control is not employed in isolation?
5. The damping ratio of a system is 0.75 and the natural frequency of oscillation is 12 rad / sec determine the peak time.
6. What is Routh stability criterion
7. How the roots of characteristic equation are related to stability?
8. Define state model.
9. What are the properties of state transition matrix.
10. Write the advantages of sampled data control system

PART – B (5 X 16 =80 MARKS)

11. a.Determine the transfer function of the given system by block diagram reduction method and verify it with Mason's gain formula.



12. a.For the unity feedback control system the open loop transfer function $G(s) = \frac{15(s-2)}{s^2(s+1)}$

Find i)The position, Velocity and acceleration error constants.

ii) The steady state error when the input is $R(S) = \frac{3}{s} - \frac{3}{s^2} + \frac{3}{s^3}$

(or)

b. For a unity feed back system $\boldsymbol{G_s = \frac{36}{s(s+0.72)}}$ Determine the characteristics equation and hence calculate i) Natural Frequency ii) 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.

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

(or)

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

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

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

14. a. A system is given by $s^5 + 2s^4 + 24s^3 + 48s^2 - 25s - 50 = 0$. Check the stability of the system using Routh Criterion. If the system is marginally stable, find the frequency of oscillations.

(or)

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

$\boldsymbol{s^5+4s^4+8s^3+8s^2+7s+4=0}$

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

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

15. a. Determine the state equation and output equation of a system whose state space representation is

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix} = \begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -5 & -15 & -5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 0\\ 5\end{bmatrix}u \qquad y = \begin{bmatrix}1 & 0 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

(or)

b) A system is described by $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}1 & -1\\ 1 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$

$y = \begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$ Check the controllability and observability of the system.