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**Question Paper Code : 64027**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2010

Fourth Semester

Electronics and Communication Engineering

EC 2255 — CONTROL SYSTEMS

(Regulation 2008)

Time : Three hours

Maximum : 100 Marks

(Graph Sheets, Semi log sheets and polar charts are to be provided)

Answer ALL questions

PART A — (10 × 2 = 20 Marks)

1. Give the comparisons between open loop system and closed loop system.
2. Define the transfer function of a system.
3. What is meant by peak overshoot?
4. What is meant by steady state error?
5. List the advantages of Nichol's Chart?
6. What are the specifications used in frequency domain analysis?
7. What is meant by BIBO stability?
8. Using Routh criterion, determine the stability of the system represented by the characteristic equation  $S^4 + 8S^3 + 18S^2 + 16S + 5 = 0$ . Comment on the location of the roots of characteristics equation.
9. What is meant by sampling theorem?
10. Mention the need for state variables?

PART B — (5 × 16 = 80 Marks)

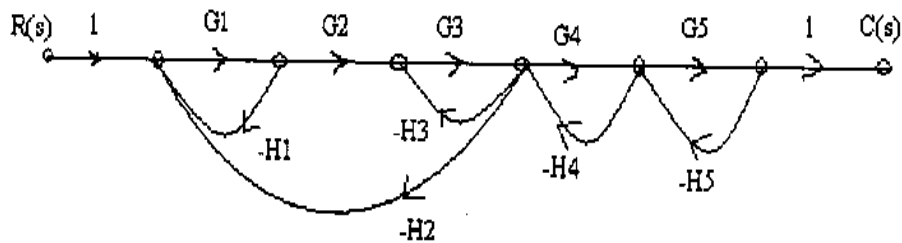
11. (a) (i) The transfer function of a system is given by,

$$T(s) = \frac{K(s+6)}{s(s+2)(s+5)(s^2+7s+12)}$$

Determine

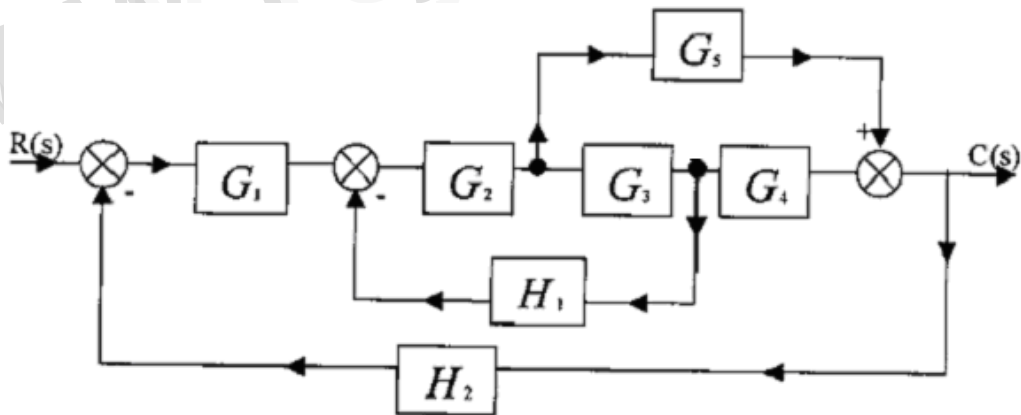
- (1) Poles
- (2) Zeros
- (3) Characteristics equation
- (4) Pole-zero plot in s-plane. (8)

- (ii) Find  $\frac{C(s)}{R(s)}$  for the signal flow graph shown below. (8)



Or

- (b) (i) Reduce the block diagram to its canonical form and obtain  $C(s)/R(s)$ . (10)



- (ii) Give the comparison between block diagram and signal flow graph methods. (6)

12. (a) The open loop transfer function of a unity feedback system is given by  $G(s) = K/s(sT+1)$ , where K and T are positive constant. By what factor should the amplifier gain K be reduced, so that the peak overshoot of unit step response of the system is reduce from 75% to 25%. (16)

Or

- (b) Explain in detail the system response with, PI, PD and PID controllers. (16)

13. (a) Sketch Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad/sec

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}. \quad (16)$$

Or

- (b) The open loop transfer function of a unity feedback system is given by  $G(s) = \frac{1}{s^2(1+s)(1+2s)}$ . Sketch the polar plot and determine the gain margin and phase margin.

14. (a) Sketch the root locus of the system whose open loop transfer function is  $G(s) = \frac{K}{s(s+2)(s+4)}$ . Find the value of K, so that the damping ratio of the closed loop system is 0.5. (16)

Or

- (b) Construct the Nyquist plot for a system whose open loop transfer function is given by  $G(s)H(s) = \frac{K(1+S)^2}{S^3}$ . Find the range of K for stability. (16)

15. (a) (i) Explain in detail the state space representation for continuous time systems. (8)
- (ii) Explain in detail the state space representation for discrete time systems. (8)

Or

- (b) Determine the state controllability and observability of the system

described by  $\dot{\bar{x}} = \begin{bmatrix} -3 & 1 & 1 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} \bar{x} + \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 2 & 1 \end{bmatrix} u$   $y = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \bar{x}$ . (16)