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Question Paper Code: 44522

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Electronics and CommunicationEngineering

14UEI422–LINEAR CONTROL ENGINEERING

(Regulation 2014)

Duration: Threehours — Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which of the following is an open loop control system?

   (a) Field controlled D.C. motor (b) Ward leonard control
   (c) Metadyne (d) Stroboscope

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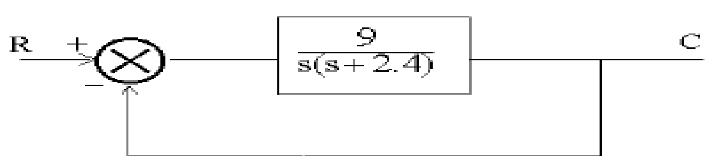
3. The damping ratio of a system having the characteristic equation $s^2+2s+8=0$ is

   (a) 0.353 (b) 0.330 (c) 0.300 (d) 0.250

4. Considering the unity feedback system of Fig.2, the settling time of the resulting second order system for 2% tolerance band will be



   (a) 3.33 (b) 4.5 (c) 2.25 (d) 2.84

5. If the Nyquist plot of the loop transfer function G(s)H(s) of a closed-loop system encloses the (−1, j0) point in the G(s)H(s) plane, the gain margin of the system is

(a) zero (b) greater than zero
(c) less than zero (d) infinity

6. Which of the following is the time domain method of determining stability of a control system

(a) Bode plot (b) Nyquist plot
(c) Root locus (d) Nichols chart

7. The equation $2S^4 + S^3 + 3S^2 + 5S + 10$ has _________ number of roots in the left half of s–plane.

(a) One (b) Two (c) Three (d) Four

8. Consider the following statements regarding root loci:

1. All root loci start from the respective poles of G(s) H(s).
2. All root loci end at the respective zeros of G(s) H(s) or go to infinity.
3. The root loci are symmetrical about the imaginary axis of the s-plane.

On these statements:

(a) 1, 2 and 3 are correct (b) 1 and 2 are correct
(c) 1 and 3 are correct (d) 2 and 3 are correct

9. The state space approach is applicable to the control systems which are

(a)Time variant (b)Time invariant
(c)Both (a) and (b) (d) None of these

10. For a control system to be completely controllable, it should be

(a) Input controllable (b) Gain controllable
(c) State controllable (d) State and output controllable

PART - B (5 x 2 = 10 Marks)

11. Why negative feedback is invariably preferred in closed loop system?

12. Define steady state error.

13. List out the different frequency domain specifications.

14. How the roots of characteristic equation are related to stability?

15. State the reason for using state space analysis rather than using transfer function method.

PART - C (5 x 16 = 80 Marks)

16. (a) Determine the transfer function $\frac{C(s)}{R(s)}$ for the block diagram shown in Figure.3 by first drawing its signal flow graph and then using the Mason's gain formula. (16)

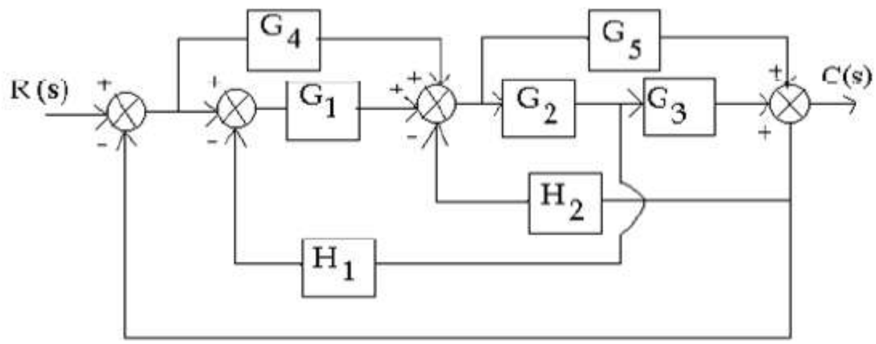
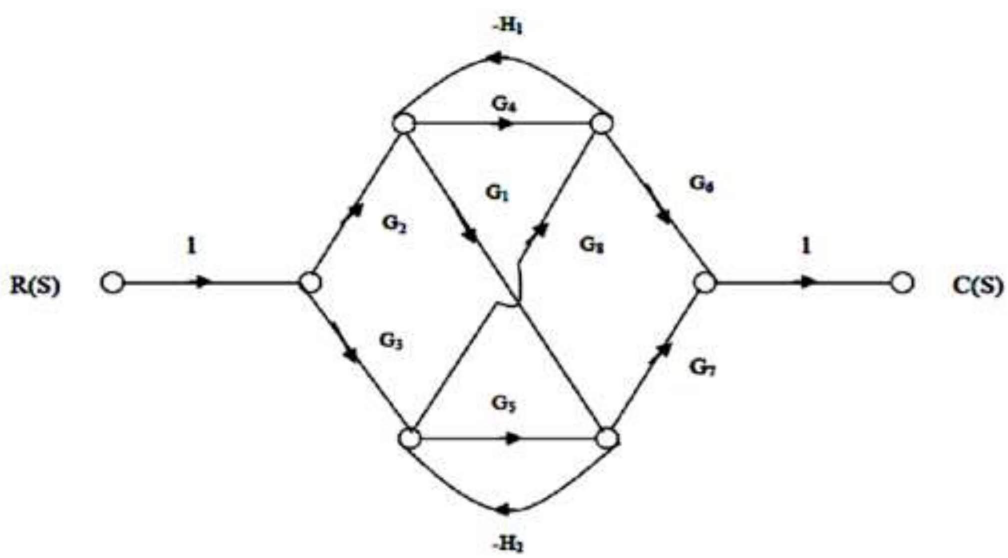


Figure 3

Or

(b) Evaluate the overall gain of the system whose signal flow graph is shown in figure (16)



17. (a) Briefly explain the effects of adding poles and zeros to second order systems. (16)

Or

(b) The open loop transfer function of a servo system with unity feedback system is $G(s)=\frac{10}{s(0.1s+1)}$.Evaluate the static error constants of the system. Obtain the steady state error of the system when subjected to an input given by the polynomial r(t) = a0+a1t +a2 /2 t2. (16)

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

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

Or

(b) The open loop transfer function of a unity feedback system is $G(s)=\frac{400}{s(s+2)(s+10)}$.

Sketch the Polar plot and determine the Gain margin and Phase margin. (16)

19. (a) Using Routh criterion determine the stability of the system whose characteristics equation is $s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4 = 0$. Find the number of roots falling in the RHS plane and LHS plane.

Or

(b) The open loop transfer function of a unity feedback system is given by G(s)= $\frac{K}{s(s+1)(s^2+2s+2)}$. Sketch the root locus of the system. (16)

20. (a) A discrete system is described by the difference equation.

$$y(k+2)+5y(k+1)+6y(k)=u(k)$$
$$y(0)=y(1)=0;$$
$$T=1\text{sec}$$

(a) Find a state model in canonical form

(b) Find the state transition matrix. (16)

Or

(b) Find the state controllability for the systems represented by the state equation

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 1 \\ -1 \end{bmatrix} u \qquad (16)$$