Reg. No. : | | | | | | | | | | |

Question Paper Code: 44522

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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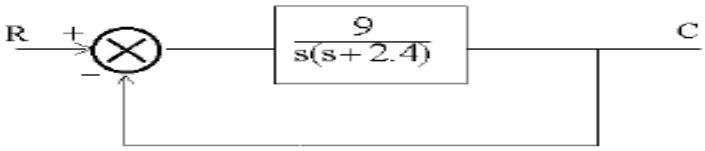
   (a) Field controlled D.C. motor (b) Ward leonard control
   (c) Metadyne (d) Stroboscope

3. The steady-state error of a feedback control system with an acceleration input becomes finite in a

   (a) Type 0 system (b) Type 1 system
   (c) Type 2 system (d) Type 3 system

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. As a root moves further away from imaginary axis, the stability

(a) increases (b) decreases
(c) not affected (d) none of these

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. The advantage of state space model is

(a) Applicable for linear and non-linear system
(b) Applicable for only linear system controllable
(c) Applicable for time invariant system only
(d) Applicable for continuous –time system only

PART - B (5 x 2 = 10 Marks)

11. Write Masons Gain formula

12. Define steady state error.

13. List out the 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)

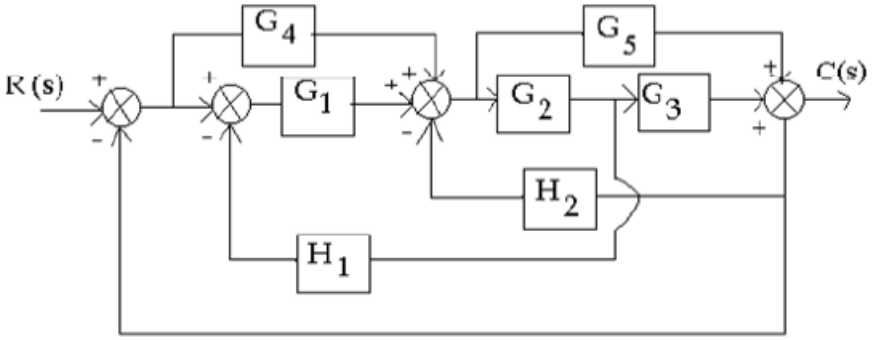


Figure 3

Or

(b) Write the differential equations governing the Mechanical system shown in figure and determine the transfer function. (16)

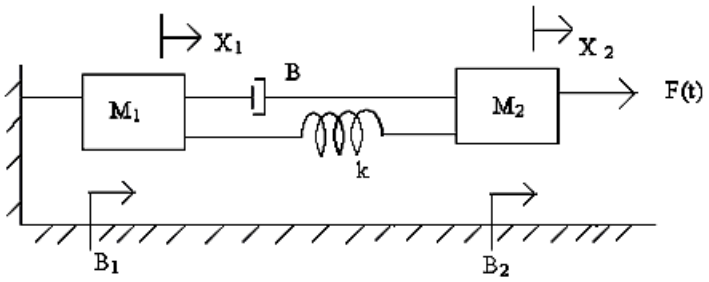


Figure 4

17. (a) A unity feedback systems has G(s)= $\frac{1}{s(1+s)}$. The input to the system is described by r(t)=4+6t+2t^3. Find the generalized error coefficients and steady state error. (16)

Or

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

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

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

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