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Question Paper Code: 54033

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fourth Semester

Electrical and Electronics Engineering

15UEE403 - CONTROL SYSTEMS

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Mass in mechanical translational system is analogous to which of the following quantities under mechanical rotational system

    (a) Torque
    (b) Angular velocity
    (c) Angular displacement
    (d) Moment of inertia

2. AC servomotor is basically a

    (a) Single phase induction motor   (b) Universal motor
    (c) Two phase induction motor   (d) Three phase induction motor

3. Given a unity feedback control system with G(s)=K/s(s+4) the value of K for a damping ratio of 0.5 is
    (a) 1   (b) 16   (c) 32   (d) 64

4. For a type one system, the steady – state error due to step input is equal to

    (a) Infinite
    (b) Zero
    (c) 0.25
    (d) 0.5

5. For a transfer function G(s)=S the bode plot will be

    (a) Zero magnitude and Zero phase shift
    (b) 20dB/decade and phase shift of 90 degree

(c) Constant magnitude and constant phase shift angle

(d) None of these

6. A phase lag lead network introduces in the output

   (a) Lag at high frequencies and lead at low frequencies
   (b) Lag at low frequencies and lead at high frequencies
   (c) Lag at all frequencies
   (d) None of these

7. The equation $2s^4+s^3+3s^2+5s+10=0$ have _____ Roots in the left half of s–plane

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

8. If the Nyquist plot of the loop transfer function G(s) H(s) of a closed-loop system encloses the (-1, jo) 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

9. The number of state variable of a system is equal to

   (a) the number of integrators present in the system
   (b) the number of differentiators present in the system
   (c) the sum of the number of integrators and differentiators present in the system
   (d) none of the these

10. An n x n matrix is said to be nonsingular if the rank of the matrix is r is

   (a) $r \neq n$ (b) r = n   (c) r = n/2   (d) r = 2n

<center>PART - B (5 x 2 = 10 Marks)</center>

11. Distinguish between open loop and closed loop system.

12. How the system classified according to damping factor.

13. Draw the polar plot of type Zero first order system $G(S) = 1 / (1 +ST)$.

14. Define Routh Hurwitz stability criterion.

15. What is state transition matrix? Write the properties of state transition matrix.

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16. (a) Write the dynamic equation in respect of the mechanical system given in Figure Then using force-voltage analogy obtain the equivalent electrical network. (16)
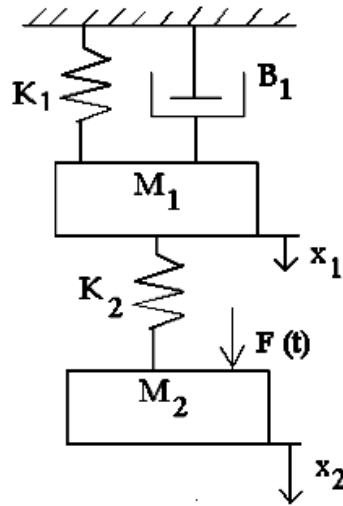
Or

(b) Convert the block diagram to signal flow graph and determine the transfer Function using Mason's gain formula (16)
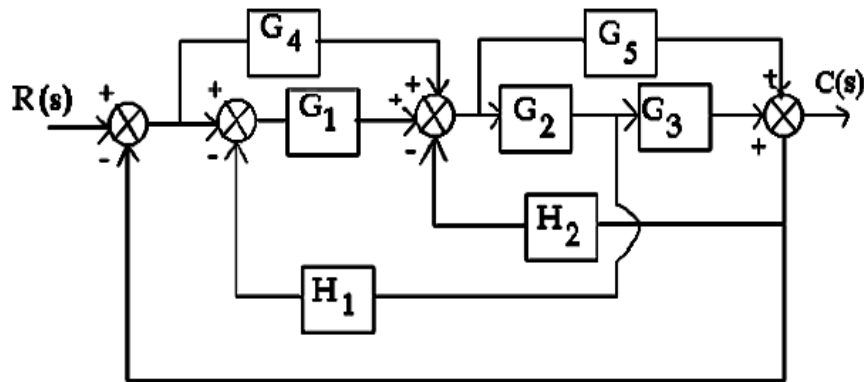
17. (a) A unity feedback system has an open loop transfer function $G(s)=K/s(s+10)$ Determine the gain K, So that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak overshoot and time at peak overshoot for a unit step input. (16)

Or

(b) For a unity feedback system has $G(s) =1/s(1+s)$ the input signal is $r(t) = 4+6t+2t^3$ Find generalized error coefficients and steady state error. (16)

18. (a) Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies. $G(s)=10/s(1+0.4s)(1+0.1s)$. (16)

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Or

(b) What is meant by lead compensator? Explain the realization of lead compensator using electrical network. (16)

19. (a) The open loop transfer function of a unity feedback system is given by G(s) =K/(s+2) (s+4) (s2+6s+25). By applying the routh criterion, discuss the stability of the closed loop system as a function of K. Determine the value of K. (16)

Or

(b) Draw the complete Nyquist plot for a unity feedback system having the open loop function G(s)=6/s(1+0.5s)(6+s). (16)

20. (a) A discrete- time system has the transfer function

$Y(z)/U(z) = 4z^3-12z^2+13z-7/ (z-1)^2(z-2)$

Determine the phase model of the system in (a) Phase variable form and (b) Jordan canonical form. (16)

Or

(b) Write the state equations for the system shown in fig in which X1, X2 and X3 constitute state vector. Determine whether the system is completely controllable. (16)

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