Question Bank Linear Control System

1.What is control system?
2.What are the two major types of control system?
3.Define open loop control system?
4.Define closed loop control system?
5.What are the components of feedback control system?
6.Define transfer function?
7.What are the basic elements used for modeling mechanical translational system?
8.What are the basic elements used for modeling mechanical rotational system?
9.Name two types of electrical analogous for mechanical system?
10. What is block diagram?
11.What is the basis for framing the rules of block diagram reduction technique?
12.What is a signal flow graph?
13. What is transmittance?
14.What is sink and source?
15.Define non-touching loop?
16.Write Masons Gain formula?
17.Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system?
18.Write the analogous electrical elements in force current analogy for the elements of mechanical translational system?
19.Write the force balance equation of M ideal mass element?
20. Write the force balance equation of ideal dashpot element?
21. Write the force balance equation of ideal spring element?
22.Distinguish between open loop and closed loop system?
23. What is servomechanism?
24. Why is negative feedback invariably preferred in closed loop system?
25. What is synchro?
26. What is servomotor?
27.(a) Derive the expressions and draw the response of first order system for unit step input. (b) Draw the response of second order system for critically damped case and when input is unit step
28. Derive the expressions for Rise time, Peak time, Peak overshoot, delay time?
29. Measurements conducted on a Servomechanism show the system response to be c(t)=1+0.2 ê -60t -1.2 ê –10 t. when subjected to a unit step. Obtain an expression for closed loop transfer function.
30. (i) A unity feedback control system has an open loop transfer function G(S)= 10/S(S+2).Find the rise time, percentage over shoot, peak time and settling time. (8) (ii) A closed loop servo is represented by the differential equation d 2 c/dt2 +8 dc/dt = 64 e Where c is the displacement of the output shaft r is the displacement of the input shaft and

e= r-c.Determine undamped natural frequency, damping ratio and percentage maximum overshoot for unit step input?

31. For a unity feedback control system the open loop transfer function G(S) = 10(S+2)/ S 2 (S+1).Find (a) position, velocity and acceleration error constants. (b)the steady state error when the input is R(S) where R(S) =3/S –2/S2 +1/3S3

32. The open loop transfer function of a servo system with unity feed back system is G(S) = 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 Polynomial r(t) = a +a t +a /2 t2

33. The unity feedback system is characterized by an open loop transfer function is 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 to Peak overshoot for a unit-step input.

34.(i) For a servomechanisms with open loop transfer function(S)=10/(S+2)(S+3).What type of input signal gives constant steady state error and calculate its value.

(ii) Find the static error coefficients for a system whose G(S)H(S)=10/ S(1+S)(1+2S)and also find the steady state error for r(t)=1+ t + t2 /2.

35.(i) Obtain the response of unity feedback system whose open loop transfer function is G(S) = 4 / S (S+5) and When the input is unit step. (ii) A unity feedback system has an amplifier with gain KA=10 and gain ratio G(S) = 1 / S (S+2) in the feed forward Path .A derivative feedback ,H(S)=S KO is introduced as a minor loop around G(S).Determine the derivative feed back constant ,KO ,so that the system damping factor is 0.6 (8)

36.(i) Explain P,PI,PID,PD controllers (ii) Derive the expressions for second order system for under damped case and when the input is unit step?

37.What is bandwidth

38.Define Cut-off rate?

39.Define –Gain Margin?

40.Define Phase cross over?

41.What are the main advantages of Bode plot?

42.Define Corner frequency?

43.What is Polar plot?

44.What is minimum phase system?

45.What is non-minimum phase transfer function?

46. What is minimum phase system?

47.What is non-minimum phase transfer function?

48. 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)

49. The open loop transfer function of a unity feed back system is G(S) = 1/ S(1+S) (1+2S). Sketch the Polar plot and determine the Gain margin and Phase margin.

50. Sketch the Bode plot and hence find Gain cross over frequency ,Phase cross over frequency, Gain margin and Phase margin. G(S) = 0.75(1+0.2S)/ S(1+0.5S) (1+0.1S)

51. Sketch the Bode plot and hence find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin. G(S) = 10(S+3)/ S(S+2) (S 2+4S+100)

52. Sketch the polar plot for the following transfer function .and find Gain cross over frequency ,Phase cross over frequency, Gain margin and Phase margin. G(S) = 10(S+2)(S+4)/ S (S 2 -3S+10)

53. Construct the polar plot for the function GH(S) =2(S+1)/ S 2 . find Gain cross over frequency ,Phase cross over frequency, Gain margin and Phase margin.

54. Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies G(S) =KS2 / (1+0.2S) (1+0.02S).Determine the value of K for a gain cross over frequency of 20 rad/sec.

55. Sketch the polar plot for the following transfer function .and find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin. G(S) = 400/ S (S+2)(S+10)

56. A unity feed back system has open loop transfer function G(S) = 20/ S (S+2)(S+5).Using Nichol's chart. Determine the closed loop frequency response and estimate all the frequency domain specifications.

57. Sketch the Bode plot and hence find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin. G(S) = 10(1+0.1S)/ S(1+0.01S) (1+S).

58.Explain in detail about M and N Circles with necessary equations?

59. What is the necessary and sufficient condition for stability?

60. Sketch the root locus of the system whose open loop transfer function is G(S)= K / S (S+4) (S 2+4S+20)?

61. A Unity feedback control system has an open loop transfer function G(S)= K (S+1.5) / S (S+1)(S+5).Sketch the root locus?

62. Draw the Nyquist plot for the system whose open loop transfer function is G(S)= K / S (S+2)(S+10).Determine the range of k for which closed loop system is stable?

63. Sketch the Nyquist Plot for a system with the open loop transfer function G(S) H(S)= K (1+0.5S)(1+S) / (1+10S)(S-1). Determine the range of k for which closed loop system is stable?

64. 10.(i) Construct Routh array and determine the stability of the system represented by the characteristics equation S 5+S 4+2S3+2S2+3S+5=0.Comment on the location of the roots of characteristic equation. (ii) Construct Routh array and determine the stability of the system represented by the characteristics equation S 7+9S 6+24S4+24S3+24S 2+23S+15=0comment on the location of the roots of characteristic equation?

65.What is compensation? Why it is need for control system? Explain the types of compensation? What is an importance of compensation?

66. Realise the basic compensators using electrical network and obtain the transfer function?

67. Design suitable lead compensators for a system unity feedback and having open loop transfer function G(S)= K/ S(S+1) to meet the specifications.(i) The phase margin of the system ≥ 45º, (ii) Steady state error for a unit ramp input ≤1/15, (iii) The gain cross over frequency of the system must be less than 7.5 rad/sec?

68. A unity feed back system has an open loop transfer function G(S)= K/ S(S+1) (0.2S+1). Design a suitable phase lag compensators to achieve following specifications Kv= 8 and Phase margin 40 deg with usual notation?
69. Explain the procedure for lead compensation and lag compensation ?
70. Explain the design procedure for lag- lead compensation ?