DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

AUTOMATIC CONTROLS

Q.1. Define transfer function. derive transfer function of an armature controlled D. C motor
Q.2. Comparison of Block diagram and signal flow graph method
Q.3. Differentiate between linear and non-linear system with examples
Q.4. Differentiate between continuous and discrete signal.
Q.5. Differentiate between time invariant and time varying system.
Q.6. Give the effect of parameter variation in closed loop system
Q.7. What is signal flow graph?
Q.8. What is a block diagram?
Q.9. What is system?
Q.10. What is control system?
Q.11. Define open loop and closed loop systems.
Q.12. Define closed loop systems.
Q.13. State principle of superposition theorem.
Q.14. What is time variant and Time invariant?
Q.15. Define transfer function.
Q.16. What is signal flow graph.
Q.17. Define non-touching loop.
Q.18. What is time response?
Q.19. What is transient response
Q.20. What is steady state response
Q.21. Name the test signals used in time response analysis.
Q.22. What is damped frequency of oscillation?
Q.23. List the time domain specifications.
Q.24. Define rise time, delay time.
Q.25. Define damping ratio.
Q.26. What is frequency response analysis?
Q.27. What is Nichol's chart?
Q.28. Define gain cross over frequency?
Q.29. Define Phase cross over frequency?
Q.30. Define Phase Margin?
Q.31. Define Gain Margin?
Q.32. List the Frequency domain specifications?
Q.33. What is corner frequency?
Q.34. What is Band width?

Q.35. Write a note on magnetic amplifier
Q.36. Write a note on A.C Servomoter
Q.37. Write a note on Bode Plot
Q.38. Write a note on Masons gain formula
Q.39. What do you mean by lead lag, lead lag compensator? Explain
Q.40. State and Explain Nyquist stability criterion
Q.41. What is the need of introducing compensating n/w in a system?
Q.42. Write a note on Servo mechanism.
Q.43. Write a note on Synchros
Q.44. Write a note on A.C and D.C tecogenerators?
Q.45. Write a note on P.I.D controller?
Q.46. Correlation between time domain &frequency Domain for second order control system?
Q.47. A unity feedback system is characterized by an open loop transfer function

$$G(S)=\frac{k}{s(s+10)}$$

Q.48. Determine the overall gain K, so that the system will have a damping ratio of 0.5 for this value of K, determine settling time, peak over shoot, rise time and time to peak overshoot for the step i/p
Q.49. Using Routh- Hurwitz criterion, find the stability of a linear control system with characteristic equation $S^5 +4s^4 +8s^2 +7s +4= 0$ for a system having $T.F\text{-}64/s^2 +5s+64$, for unity step i/p determine
a) w_n
b) w_d
c) time for peak overshoot
Q.50. Comment on the stability of the system?

$$S^4 +2S^3+6S^2 + 10S+ 3$$

Q.51. Examine stability

$$S^6+3S^5+4S^4 +5S^2+3S+2= 0$$

Q.52. For a unity feedback system

$G(S)=\frac{K}{S(S+4)(S+2)}$ Sketch the root locus

$G(S)H(S)=\frac{K(S+1)}{S(S-1)(S^2+5S+25)}$ sketch the root locus

Q.53. Draw the root locus plot of a feedback system with characteristic equation

$$\frac{1+K}{S(S+3)(S^2+2S+2)}=0$$

Q.54. A feedback system has $G(S)R(S)=\frac{100(S+4)}{S(S+5)(S+10)}$ Draw the bode plot and comment on stability

Q.55. Explain Nyquist stability criterion to determine the stability of closed -loop systems

Q.56. The open loop transfer function of a closed- loop systems is given by.

$$G(S)\ R(S) = 11\ S\ (S+1)\ (1+2S)$$

Q.57. Determine the stability using Nyquist stability criterion

Q.58. Sketch the bode plot for the system whose open loop transfer function is given by:

$$G(S)H(S)=\frac{2(S+0.25)}{S^2(S+1)(S^2+0.5)}$$

Q.59. Explain Nyquist Stability criterion. The open-loop transfer function of closed-loop system is given by

$$G(S)H(S) = \frac{4S+1}{S^2+(S+1)(2S+1)}$$

Q.60. The open loop transfer function of a unity feedback control system is given by

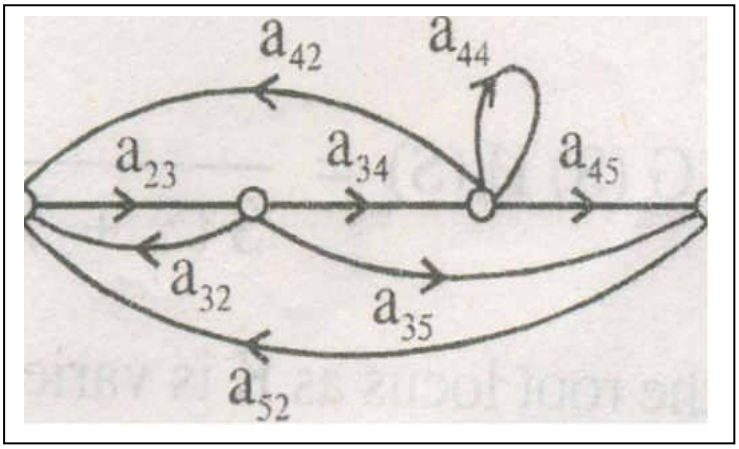
$$G(S) = \frac{K}{(S+2)(S+4)(S^2+6S+25)}$$

By applying Routh Stability criterion, discuss the stability of the closed-loop system as a function of K. Determine the values of K which will cause sustained oscillations in the closed-loop system. What are the corresponding oscillation frequencies?

Q.61. The open loop transfer of a servo system with unity feedback is $G(S)=\frac{10}{S(0.1S+1)}$ Evaluate the static error constants for the system

Q.62. Discuss the effects of feedback on sensitivity to parameter variations in control systems

Q.63. C /R from the signal flow graph given below:



Q.64. Find out the time response of a second order system due to unit step input. Draw the response for under damped case and find steady state error.

Q.65. determine the stability of a closed loop control system whose characteristics equation is $S^5+S^4+2S^2+11S+10=0$ using Routh array

Q.66. A unity feedback control system has its open –loop transfer function given by

$$G(S) = (4S+1)/4S^2$$

Q.67. Determine an expression for the time response when the system is subjected to

i. Unit impulse input function and
ii. Unit step function

Q.68. The forward path transfer function of a unity feedback control system is given by

$G(S)=\frac{2}{S(S+3)}$ Obtain an expression for the unit step response of the system.

Q.69. sketch the root locus plot for the system when open loop transfer function is given by

$$G(S)=\frac{K}{S(S+4)(S^2+4S+13)}$$

Q.70. The open loop transfer function of a unity feed back control system is given by

$$G(S)=\frac{K}{S\,(1+0.2S)}$$

Determine a suitable compensator such that the system will have K_v= 10 and P.M =50^0

Q.71. The open - loop transfer function of a feedback control system is given

$G(S)H(S)=\frac{K}{(S+1)(2s+1)(3s+1)}$ Find the value of K such that the gain margin is 20db

Q.72. What do you mean by rise time, time-delay, peak overshoot and steady state error in second –order system?

Q.73. Distinguish between

a. Linear and non-linear control systems
b. Time invariant and time varying system'
c. Continuous and discrete data control system

Q.74. A unity feedback system is characterised by an open loop transfer function

$$G(S)=\frac{k}{s(s+10)}$$

Determine the gain K so that system will have a damping ratio of 0.5. For this value of K,

Q.75. Determine settling time, over shoot, rise time and time peak overshoot for a unit step i/p

Q.76. Determine the stability of a system using Nyquist stability criterion .Examine the stability of a system having open loop transfer function as

$$G(S)H(S)=\frac{4s+1}{S^2(s+1)(2s+1)}$$

Q.77. What is the need of introducing compensating networks in a system? Describe Phase –Lead compensation in detail

Q.78. Illustrate the effect of integral control action on second order system

Q.79. For the block diagram given in fig1 draw the signal flow graph and derive the

expression for C/R using masons gain formula

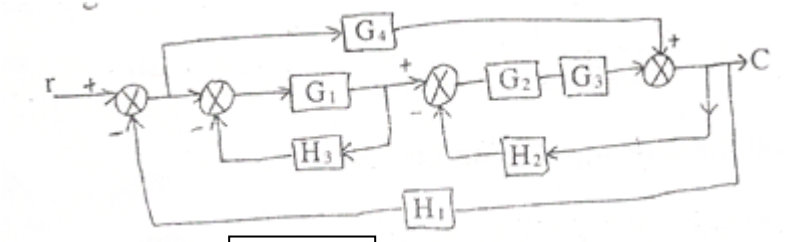
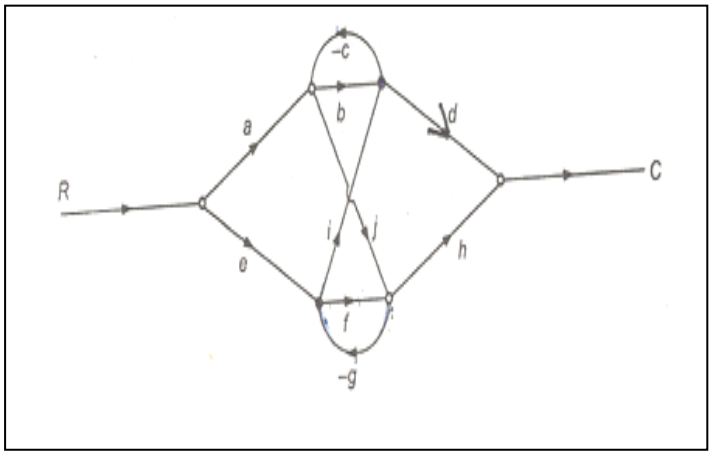


Fig 1

Q.80. Derive the expression for C/R for the fig given blow using masons gain formula



Q.81. Plot the root locus for a system whose open loop transfer function is given below

$$G(S)H(S)=\frac{k}{s(s+4)(s^2+4s+20)}$$

Q.82. Plot the root locus for a system whose open loop transfer function is given below

$$G(S)H(S)=\frac{k}{s(s+10)(s^2+4s+8)}$$

Q.83. Using the block diagram reduction techniques, calculate the transfer function as shown in fig 2

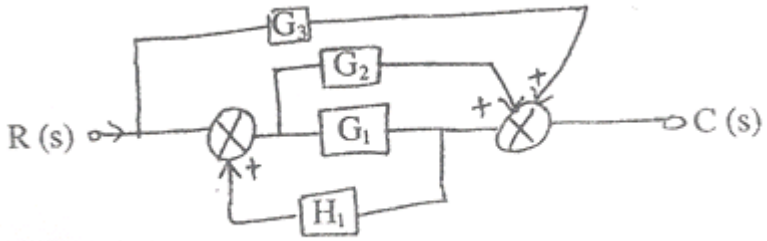
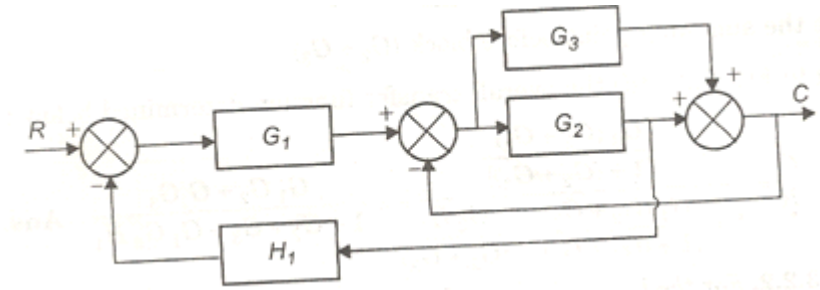


Fig. 2

Q.84. Using the block diagram reduction techniques, calculate the transfer function of the

fig given below



Q.85. Sketch the Nyquist Plot for a system with the open loop transfer function $G(S)H(S)=\frac{K(1+0.5S)(1+S)}{(1+10S)(S-1)}$ Determine the range of k for which closed loop system is stable.

Q.86. Construct Nyquist Plot for a system with the open loop transfer function $G(S)H(S)=\frac{5}{s(1-s)}$ .Comment on the stability of open loop and closed loop system.

Q.87. By Nyquist stability criterion determine the stability of closed loop system, whose open loop transfer function is given by, G(S) H(S)= (s+2)/(s+1)(s-1)

Q.88. Construct Routh array and determine the stability of the system represented by the characteristics equation $S^5+S^4+2S^3+2S^2+3S+5=0$.Comment on the location of the roots of characteristic equation.

Q.89. Construct Routh array and determine the stability of the system represented by the characteristics equation $S^7+9S^6+24S^4+24S^3+24S^2+23S+15=0$comment on the location of the roots of characteristic equation.

Q.90. Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies. $G(S)H(S)=\frac{10}{S(1+0.4S)(1+0.1S)}$. 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.

Q.91. Sketch the Bode plot and hence find Gain cross over frequency ,Phase cross over frequency, Gain margin and Phase margin.

$$G(S)=\frac{0.75(1+0.2S)}{S(1+0.5S)(1+0.1S)}$$

Q.92. Sketch the Bode plot and hence find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin. $G(S)=\frac{10(S+3)}{S(S+2)(S2+4S+100)}$

Q.93. Sketch the polar plot for the following transfer function .and find Gain cross over frequency,Phase cross over frequency, Gain margin and Phase margin.

$$G(S)=\frac{10(S+2)(S+4))}{S\,(S^2-3S+10)}$$

Q.94. Construct the polar plot for the function $G(S)H(S)=\frac{2(S+1)}{S^2}$. find Gain cross over frequency,Phase cross over frequency, Gain margin and Phase margin.

Q.95. Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies $G(S)=\frac{KS^2}{(1+0.2S)\,(1+0.02S)}$.Determine the value of K for a gain cross over frequency of 20 rad/sec

Q.96. Sketch the polar plot for the following transfer function .and find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin.

$$G(S)=\frac{400}{S\,(S+2)(S+10)}$$

Q.97. A unity feed back system has open loop transfer function $G(S)=\frac{20}{S\,(S+2)(S+5)}$.Using Nichol's chart. Determine the closed loop frequency response and estimate all the frequency domain specifications.

Q.98. Construct Nyquist plot for a feedback control system whose open loop transfer function is given by $G(S)H(S)=\frac{5}{S(1-S)}$.Comment on the stability of open loop and closed loop transfer function.

Q.99. Sketch the Bode plot and hence find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin.

$$G(S)=\frac{10(1+0.1S)}{S(1+0.01S)\,(1+S)}$$

Q.100. Draw a signal flow graph and evaluate the closed loop transfer function of a system whose block is shown in fig.