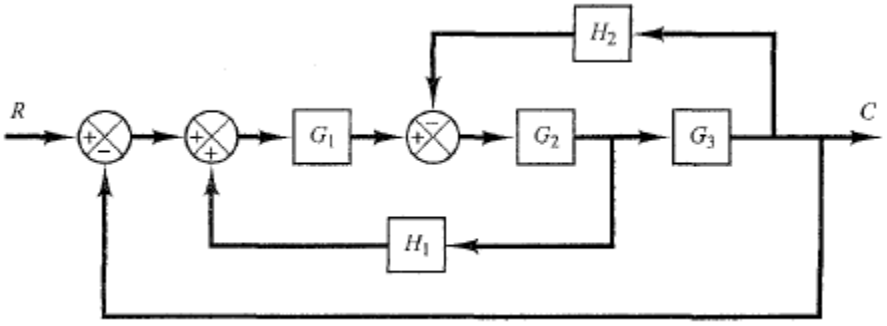
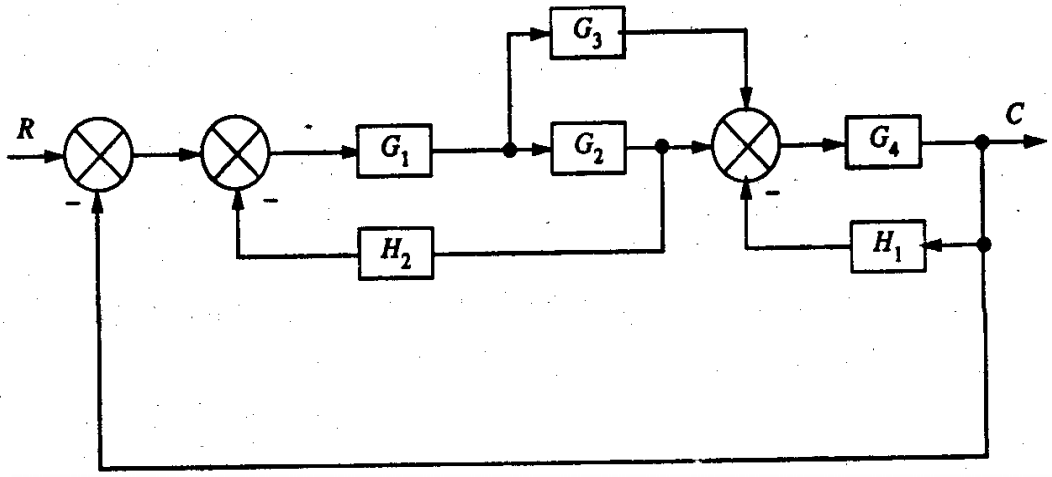
JAYA ENGINEERING COLLEGE
DEPARTMENT OF ECE
EC6405 – CONTROL SYSTEM ENGINEERING
II YEAR / IV SEM

UNIT I

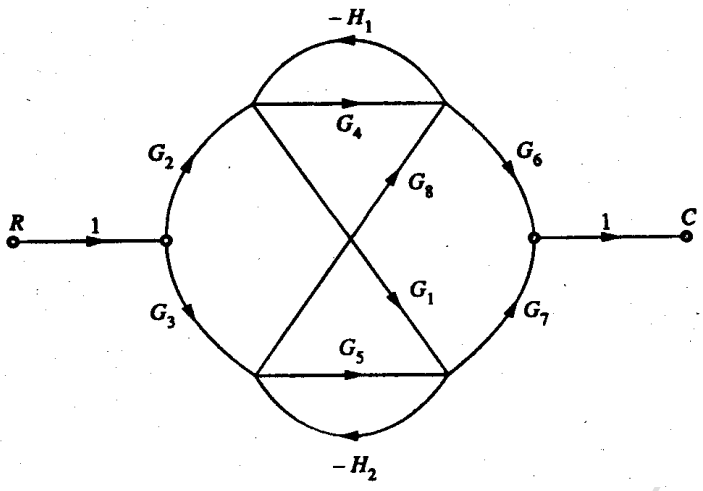
1. Write the differential equations governing the Mechanical system shown in fig .and determine the transfer function.



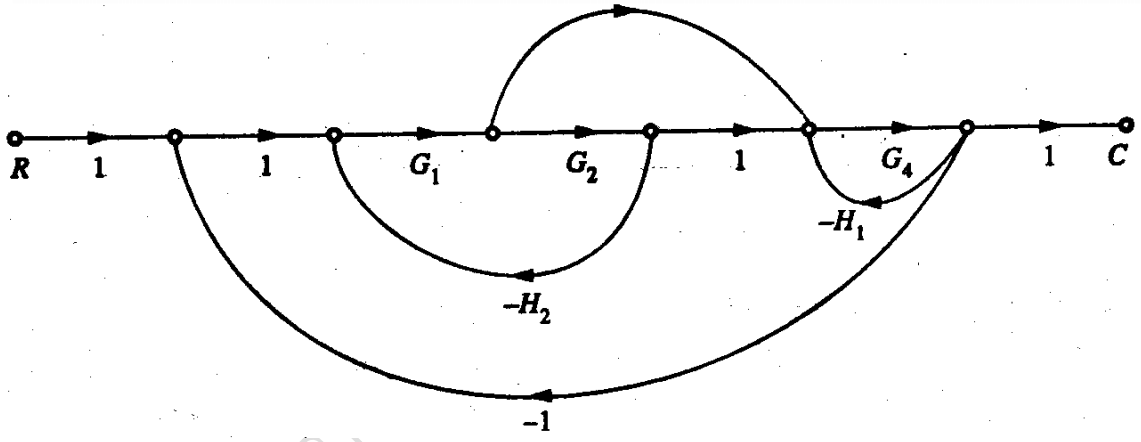
2. Determine the transfer function Y2(S)/F(S) of the system shown in fig.



3. Find the overall gain of the system whose signal flow graph is shown in fig.



4. Draw a signal flow graph and evaluate the closed loop transfer function of a system shown in fig.



UNIT II

5.Derive the expressions and draw the response of first order system for unit step input.
6.Draw the response of second order system for critically damped case and when input is unit step.
7. Derive the expressions for Rise time, Peak time, Peak overshoot.
8. Measurements conducted on a Servomechanism show the system response to bec(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.
9.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.
10.For a unity feedback control system the open loop transfer functionG(S) = 10(S+2)/ S2 (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

11. 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 by the polynomial
r(t) = a0 +a1t +a2 /2 t2 .

UNIT III

12. 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)
13. 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.
14. 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)
15. 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) (S2+4S+100)
16. 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 (S2 -3S+10) (16)
17 Construct the polar plot for the function GH(S) =2(S+1)/ S2. Find Gain cross over frequency ,Phase cross over frequency, Gain margin and Phase margin.
18. 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.
19. 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)
20. 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.
21. 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).
22. What is compensation? Why it is needed for control system? Explain the types ofcompensation?
23. Explain the design procedure for lag- lead compensation.
24. Consider a type 1 unity feed back system with an OLTF Gf(S) =K/S (S+1) (S+4).

UNIT IV

25. Using Routh criterion determine the stability of the system whose characteristicsequation is S4+8S3+18S2+16S+5 =0 .
26. F(S)=S6 +S5-2S4-3S3-7S2-4S1-4 =0.Find the number of roots falling in the RHS plane and LHS plane.
27. Draw the Nyquist plot for the system whose open loop transfer function is G(S)H(S) =K/S (S+2) (S+10).Determine the range of K for which closed loop system is stable.

28. Construct Nyquist plot for a feedback control system whose open loop transfer function is given by G(S)H(S) =5/ S(1-S).comment on the stability of open loop and closed loop transfer function.
29. 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 values of K for which the system is stable.
UNIT V
30. Write notes on controllability and absorbability.
31. Explain sampling theorem briefly and sample & hold operation.
32. Given the transfer function of a system, determine a state variable representation for the system Y(S) / U(S) = 1/ (S+2)*(S+3)*(S+4)
33. Determine the state variable representation of the system whose transfer function is given as $Y(S) / U(S) = 2S^2+8S+7 / (S+2)^2*(S+1)$
34.Detremine controllability
$X_1=x_1+x_2+x_3+u(t)$
$X_2=2x_1+2x_2+2x_3$
$X_3=1x_1+2x_2$
35.Determine obsevability
$X_1=x_1+x_2+x_3+u_1(t)$
$X_2=2x_1+2x_2+2x_3+2u_2(t)$
$X_3=1x_1+2x_2+1u_3(t)$