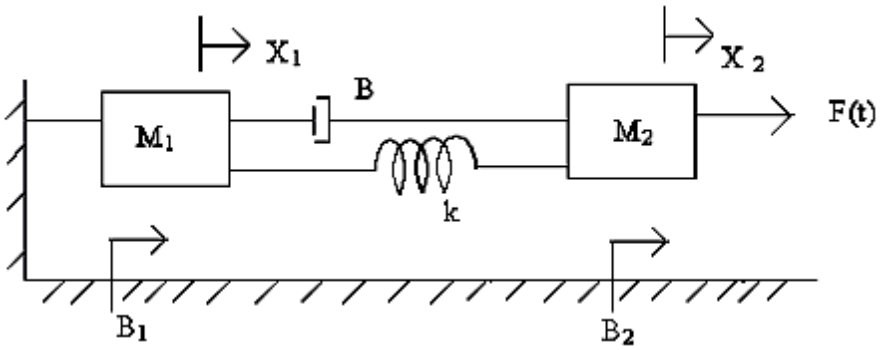
EEE- V Sem
Control System Question Bank

Unit-1

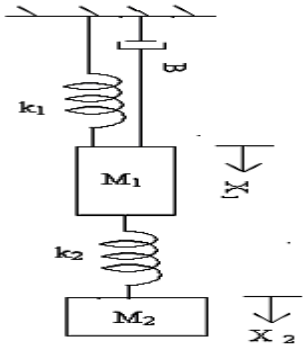
Q.1 Explain Following

(a). Define open loop control system.
(b). Define closed loop control system.
(c). Define transfer function.
(d). What is block diagram?
(e). What is the basis for framing the rules of block diagram reduction technique?
(f). What is a signal flow graph?
(g). Define non- touching loop.
(h). Write Masons Gain formula.

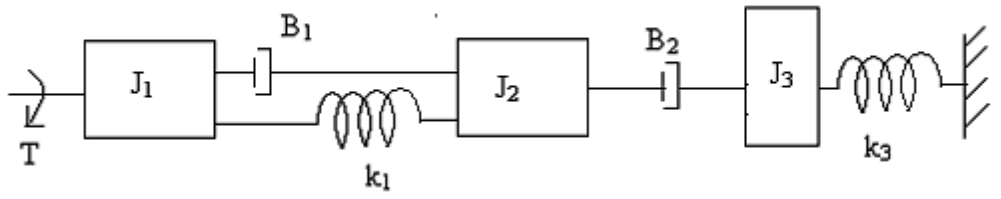
Q.2 Write the differential equations governing the Mechanical system shown in fig.and determine the transfer function.



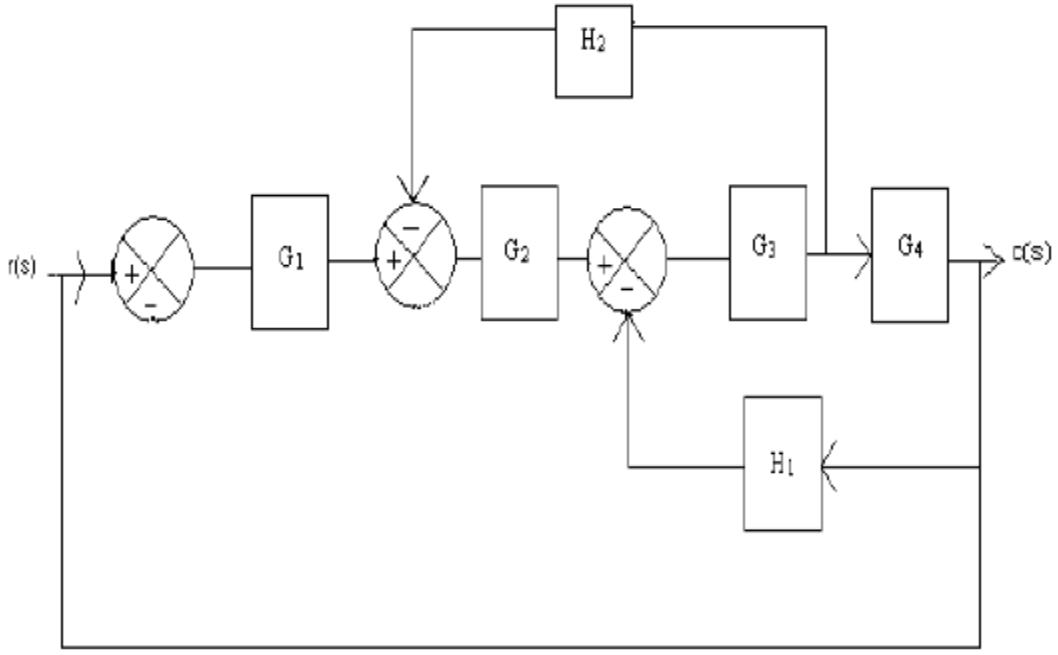
Q.3 Determine the transfer function Y2(S)/F(S) of the system shown in fig.



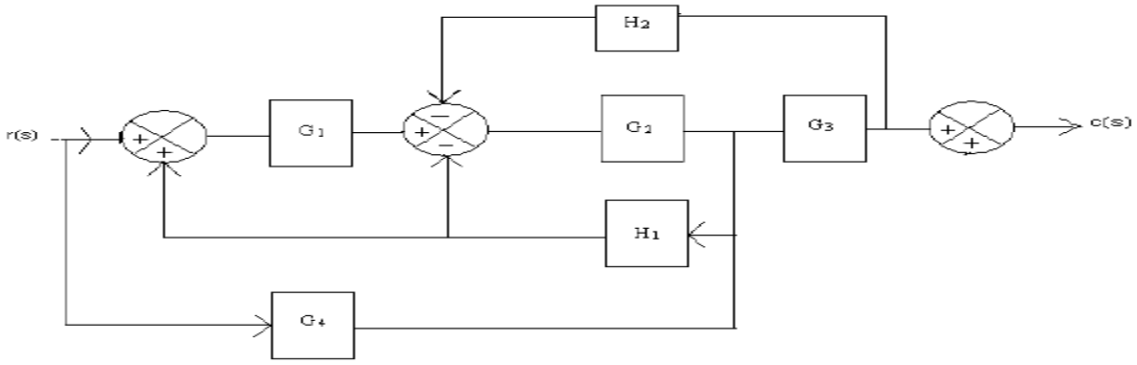
Q.4 Write the differential equations governing the Mechanical rotational system shown in fig. Draw the Torque-voltage and Torque-current electrical analogous circuits



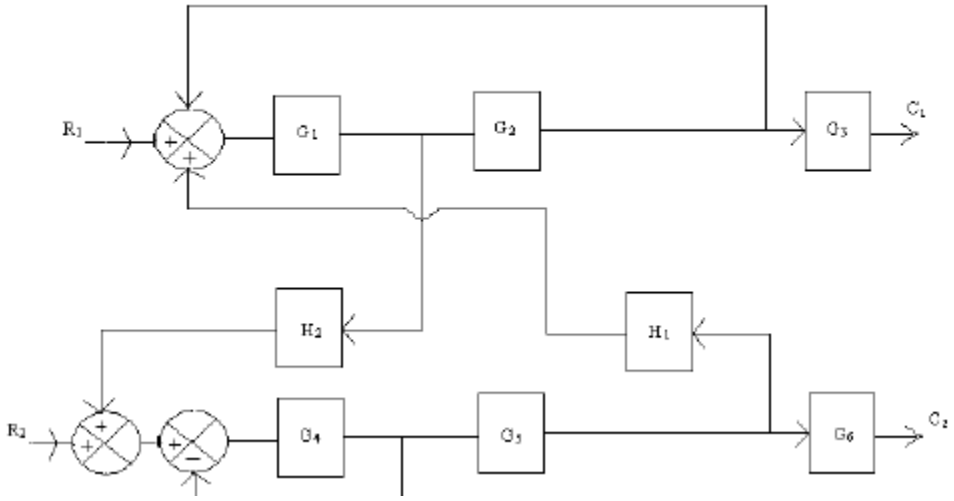
Q.5 Determine the overall transfer function C(S)/R(S) for the system shown in fig.



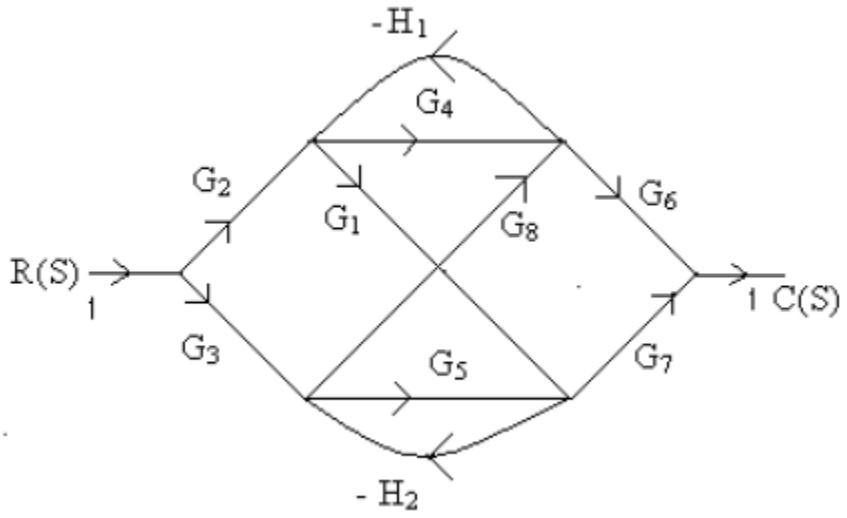
Q.6 Obtain the closed loop transfer function C(S)/R(S) of the system whose block diagram is shown in fig.



Q.7 For the system represented by the block diagram shown in fig. Determine C1/R1 and C2/R1.



Q.8 Find the overall gain of the system whose signal flow graph is shown in fig



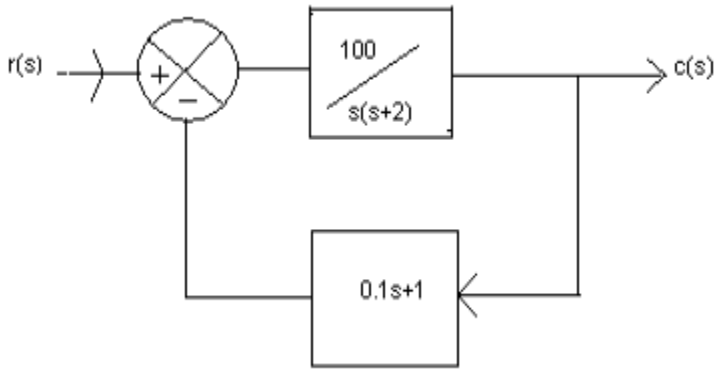
Unit-2

Q.1 .

(a) What is the advantage and disadvantage in integral controller?
(b) What is PI controller?
(c)What is PD controller?
(d)What is PID controller?
(e) What is time response?
(f) What is transient and steady state response?
(g) What is the importance of test signals?

(h) Name the test signals used in control system.
.:
Q.2. Give the expression for damping ratio of mechanical and electrical system.
Q.3 How the system is classified depending on the value of damping?
Q.4 What will be the nature of response of a second order system with different types of
damping?
Q.4. Sketch the response of a second order under damped system.
Q.5.What is damped frequency of oscillation?
Q.6 List the time domain specifications:
Q.7 Define Delay time.
Q.8. Define rise time.
Q.9 Define Peak time.
Q.10 Define Peak overshoot.
Q.11 Define settling time.
Q.12 What is type number of a system? What is its significance?
Q.13 . Distinguish between type and order of a system:
Q.14 . What is steady state error?
Q.15. Define acceleration error constant:
Q.16. What are generalized error coefficients?

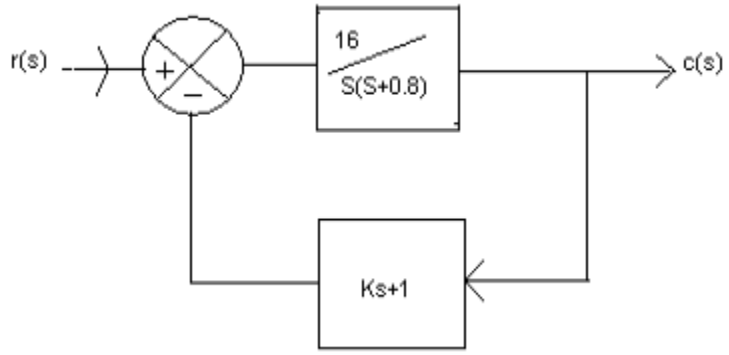
Q.17 Derive the expressions and draw the response of first order system for unit step input.
Q.18 Draw the response of second order system for critically damped case and when input is unit step.
Q.19 Derive the expressions for Rise time, Peak time, and Peak overshoot. (16)
Q.20. A potential control system with velocity feedback is shown in fig. What is the response of the system for unit step input?



Q.21 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.

Q.22 A positional control system with velocity feedback is shown in fig. What is the response c(t) to the unit step input. Given that ξ=0.5.and also calculate rise time,peak time, Maximum overshoot and settling time.

Q.23 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.



Q.24 A closed loop servo is represented by the differential equation, 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.

Q.25. For a unity feedback control system the open loop transfer function G(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

Q.26 The open loop transfer function of a servo system with unity feedback 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-3

Q1. Explain following
(a) phase margin.
(b) phase and Gain cross-over frequency?
(c) corner frequency.

(d) Nichols plot?
(e) are M and N circles?

Q.2 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)
Q.3. The open loop transfer function of a unity feedback system is
G(S) = 1/ S (1+S)(1+2S) Sketch the Polar plot and determine the Gain margin and Phase margin.

Q.4. 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)

Q.5 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)

Q.6 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)

Q.7 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

Q.8 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.

Q.9 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)

Q.10 A unity feedback 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

Q.11 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).

Q.12 Write short notes on correlation between the time and frequency response?

Q.13 What is compensation? Why it is needed for control system? Explain the types of Compensation

Q.14 Design a suitable lead compensators for a system with unity feedback and having open loop transfer function G(S)= K/ S(S+1) (S+4) to meet the specifications.
(i)Damping ratio=0.5 (ii) Undamped natural frequencyωn =2 rad/sec.

Q.15 A unity feedback system has an open loop transfer function
G(S) = K/ S(S+1) (0.2S+1).Design a suitable phase lag compensators to achieve the following specifications Kv= 8 and Phase margin 40 deg with usual notation

Q.16 Explain the procedure for lead compensation and lag compensation

Q.17 Consider a type 1 unity feedback system with an OLTF
G(S) =K/S (S+1) (S+4). The system is to be compensated to meet the following specifications Kv > 5sec and PM>43 deg. Design suitable lag compensators

Q.18 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.

Q.19 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

Q.20 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.

Q .21 Sketch the root locus for the open loop transfer function of unity feedback control system given below: G(S)H(S)=K/S(S+2)(S+4).

Unit-4

Q.1What will be the nature of impulse response if the roots of characteristic equation are lying on right half s-plane?
Q.2 What is principle of argument?
Q.3 What is the necessary and sufficient condition for stability?
Q.4. What is routh stability condition?
Q.5 In routh array what conclusion can you make when there is a row of all zeros?
Q.6. What is limitedly stable system? And Nyquist stability criterion?
Q.7. What is root locus? And How will you find root locus on real axis?
Q8. What is breakaway point and break in point and dominant pole?

Q.9 Using Routh criterion determine the stability of the system whose characteristics equation is $S4+8S3+18S2+16S+5 =0$

Q.10 $F(S)=S6 +S5-2S4-3S3-7S2-4S1-4 =0$.Find the number of roots falling in the RHS plane and LHS plane.

Q.11 Sketch the root locus for the open loop transfer function of unity feedback control system given below: $G(S)H(S)=K/S(S+1)(S+2)$.Also find K of breakaway point

Unit-5

Q.1 Explain
(a)state variables?
(b) What is the state space?
(c) What are phase variables?
(d). What is a state vector?
(e) Define Acquisition time.

Q.2 Explain the importance of controllability and observability of the control system model in the design of the control system.
Q.3 Explain the solution for state equation for discrete time system
Q.4. Explain state space representation for discrete time system
Q.5. Explain state space representation for continuous time system.
Q.6 Explain the solution for state equation for discrete time system.

Q.7. Given the transfer function of a system, determine a state variable representation for the system $Y(S) / U(S) = 1/ (S+2) * (S+3) * (S+4)$

Q.8. Determine the state variable representation of the system whose transfer function is given as (S) / U(S) = 2S2+8S+7 / (S+2)2 *(S+1)
Q.9. Discuss the advantage of state space techniques over the transfer function techniques of analyzing the control system .
Q.10. Explain the procedure of deriving the state space representation of a system whose dynamics has been expressed in the form of a differential equation.

Q.11 Test the controllability & observability of the system whose state space representation is given as ,

$$\begin{pmatrix} X_1 \\ X_2 \end{pmatrix} = \begin{pmatrix} 2 & 1 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} X_1 \\ X_2 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix} \begin{pmatrix} U_1 \\ U_2 \end{pmatrix}$$

$$\begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix} = \begin{pmatrix} 1 & 1 \end{pmatrix} \begin{pmatrix} X_1 \\ X_2 \end{pmatrix}$$