Dhanalakshmi Srinivasan Engineering College , Perambalur

Department of EEE

QUESTION BANK

Control Systems

UNIT – I

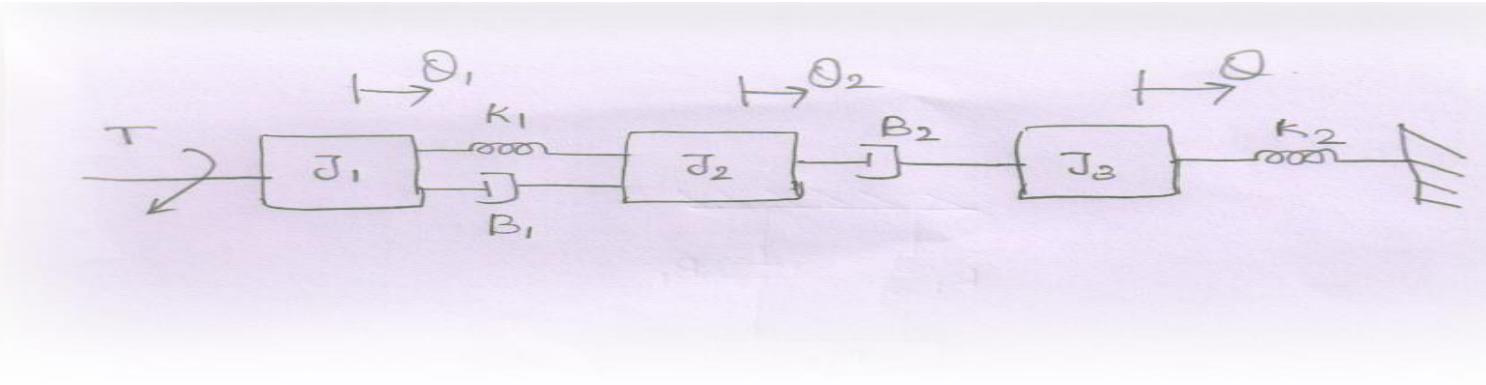
Systems and their representation

Part - A

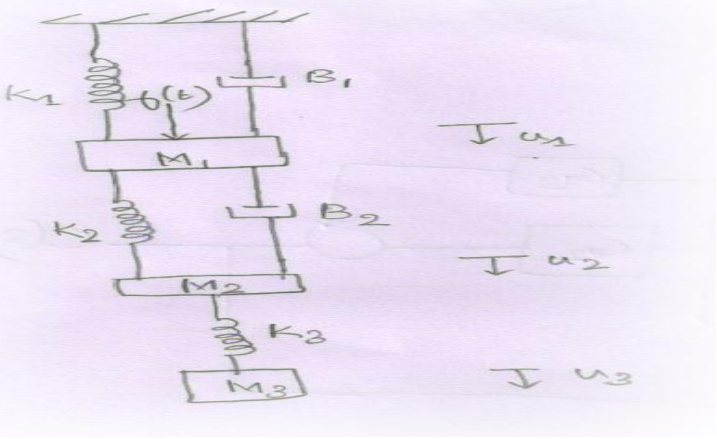
1. What is control system?
2. Define open loop and closed loop control system?
3. What is feed back?Explain characteristics.
4. What are the components of feed back control system?
5. Define transfer function.
6. What are the basic elements used for modeling mechanical and electrical system?
7. Explain: block diagram.
8. What are the basic components of block diagram?
9. What is signal flow graph?
10. Define non touching loop.
11. What are the basic properties of signal flow graph?
12. Write the Mason's gain formula.
13. Difference between open loop and closed loop control system?
14. State the principle of super position.
15. What is synchro?
16. What is synchro pair?

Part-B

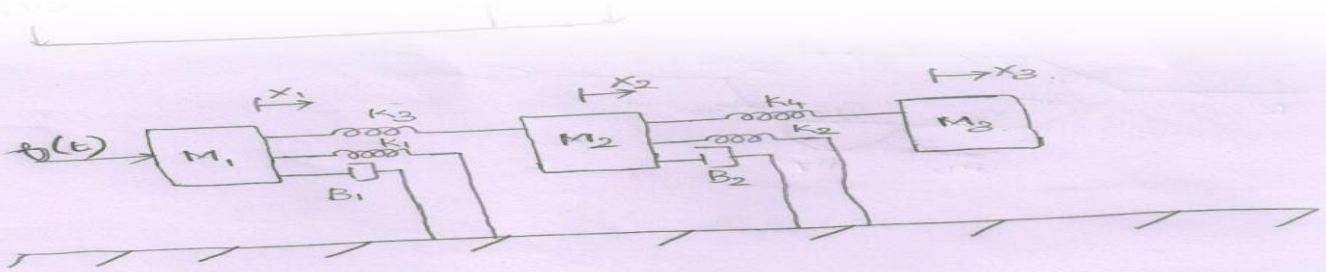
1. Derive the transfer function for armature controlled DC motor.
2. Derive the transfer function for field controlled DC motor.
3. Explain about Synchros.
4. Determine the transfer function of the system shown in below.



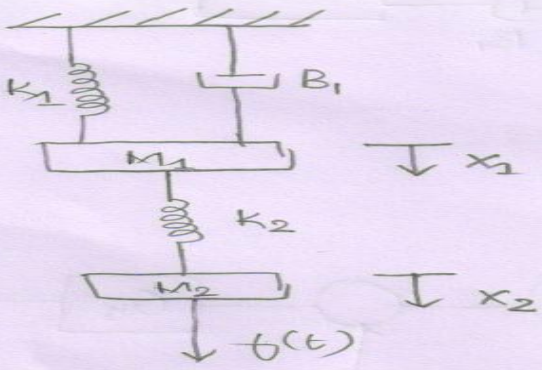
5.Determine the transfer function of the system shown in below.



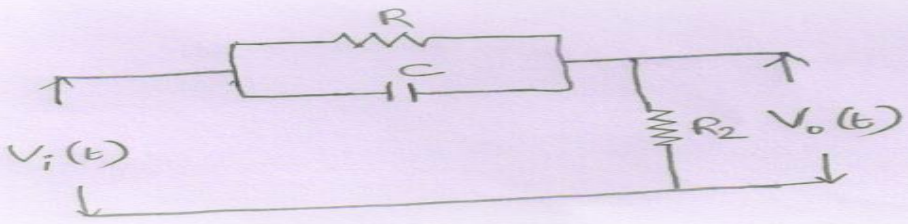
6. Determine the transfer function of the system shown in below.



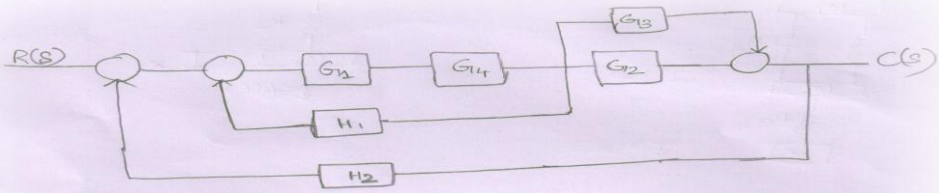
7. Determine the transfer function of the system shown in below.



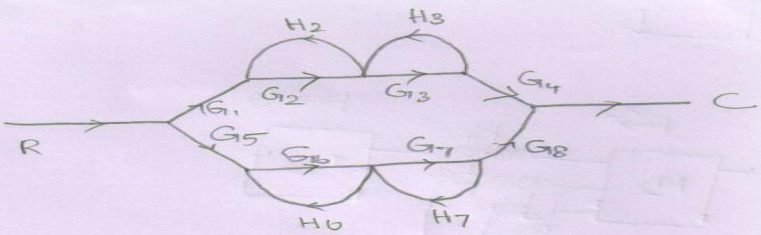
8. Determine the transfer function of the system shown in below.



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



10. Using Mason's gain formula,find C/R of the signal flow graph shown in fig.



11.Explain in detail about AC servomotor and DC servomotor.

UNIT – II
Time response

Part - A

1.What is time response?
2.Define:Steady state and transient state response.
3.Name the test signals used in control system.

4.What is the order of a system?
5.Define : Damping ratio.
6.List the time domain specifications.
7.What is type number of system?
8.What is steady state error?
9.Define K_P ,K_V and K_A constant.
10.What are generalized error coefficients?
11.Give the relation between generalized and static error coefficients.
12.What is the effect of P controller on the system performance?
13.What is the effect of PI controller on the system performance?
14.Why derivative controller is not used in controller system?

Part-B

1. How are the controllers are classified?Explain each controller action with block diagram and also derive the expression for transfer function of each controller.
2. Derive an expression for the error constants.K_P,K_V and K_A for a unity feedback sustem having open loop transfer function G(s).
3. Derive the expression for delay time , rise time ,overshoot and steady state error.
4. Obtain an expression for unit step response of a scond order system.
5. For an unity feed back system having an open loop transfer function ,$G(s) = \frac{k(s+2)}{s^2(s^2+7s+12)}$. Determine 1.the type of the system, 2.K_P,K_V and K_A 3.Steady state error for unit parabolic input.
6. The open loop transfer function of a system with unity feed back is given by $G(s) = \frac{10}{s(0.5s+1)}$.Determine the damping ratio, damped and undamped natural frequencies of the system. Find the maximum overshoot to a step input.
7.A unit step input is applied to the unity feedback system for which open loop transfer function$G(s) = \frac{16}{s(s+8)}$. Find 1.its closed loop transfer function. 2.Natural frequenciesω_n 3.Damping ratioδ.
8.A second order system is given by $\frac{C(s)}{R(s)} = \frac{25}{s^2+6s+5}$.Find rise time , peak time ,peak overshoot and settling time of subjected to unit step input.Also calculate expression for its output response.

UNIT – III
Frequency response

Part – A

1. What is frequency response?
2. List out the advantages of frequency response analysis.
3. What are frequency domain specifications?
4. Define bandwidth.
5. Define gain margin and phase margin.
6. What is phase and gain cross over frequency?
7. Write the expression for resonant peak and resonant frequency.
8. What is bode plot?
9. Define corner frequency.
10. State the advantages of bode plot.

11. What is polar plot?
12. Define minimum phase system.

Part-B

1.Sketch the bodeplot of the following transfer functions and from the plot determine the phase margin and gain margin.

(a) $G(s) = \frac{100(1+0.1s)}{s(1+0.2s)(1+0.5s)}$

(b) $G(s) = \frac{s^2(s+10)}{(s+5)^2(s+0.1)}$

(c) $G(s) = \frac{50(1+0.1s)}{(1+0.01s)(1+s)}$

(d) $G(s) = \frac{30(1+0.1s)}{s(1+0.01s)(1+s)}$

(e) $G(s) = \frac{30}{s(1+0.5s)(1+0.25s)}$

(f) $G(s) = \frac{100}{s(1+0.1s)(1+0.5s)}$

2. Sketch the polar plot of the following transfer functions.

(a) $G(s) = \frac{10(s+1)}{(s+10)^2}$

(b) $G(s) = \frac{200(s+2)}{s(s^2+10s+100)}$

(c) $G(s) = \frac{1}{s(1+2s)(1+s)}$

(d) $G(s) = \frac{k}{s(1+0.1s)(1+0.05s)}$

UNIT – IV
Stability of control system

Part - A

1. What is impulse response?
2. What is characteristic equation?
3. Write the necessary condition for stability.
4. What is principle of argument?
5. What is the necessary and sufficient condition for stability?
6. State routh stability criterion.
7. What is limitedly stable system?
8. State Nyquist stability criterion.
9. What is root locus?
10. How will you find the gain K at a point on root locus?
11. How to find the crossing point of root locus in imaginary axis?
12. What is dominant pole ?
13. How the roots of characteristic equation are related to stability?

Part-B

1. Using routh criterion determine the locations of the roots of the following characteristic equations and comment on the stability of the system.

(a) $2s^5 + 2s^4 + 5s^3 + 5s^2 + 3s + 5 = 0$

(b)$s^5 + s^4 + 4s^3 + 24s^2 + 3s + 63 = 0$

(c)$s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$

(d)$3s^4 + 10s^3 + 5s^2 + 5s + 3 = 0$

(e)$s^4 + 3s^3 + 3s^2 + s + k = 0$

(f)$s^5 + s^4 + s^2 + s + k = 0$

2. The transfer functions of certain unity feed back systems are given below.Sketch the root locus of each system.

(a) $G(s) = \frac{k(s+4)}{s(s+0.5)(s+2)}$

(b) $G(s) = \frac{k}{s(s+3)(s^2+2s+2)}$

(c) $G(s) = \frac{k}{s(s^2+8s+20)}$

3. A unity feedback control system has $\frac{4}{s(1+0.1s)(1+0.2s)}$. Draw Nyquist path and find the stability of the system.

4. A unity feedback control system has $G(s) = \frac{1+4s}{2s^4+3s^3+s^2}$

UNIT – V

Compensator design

Part - A

1. What are the time domain specifications needed to design a control system?
2. What are the two methods of designing a control system?
3. What is compensation?
4. What is compensator? What are the different types of compensator?
5. What are the factors to be considered for choosing series (or) shunt feedback compensation?
6. When lag / lead / lag – lead compensation is employed?
7. Why compensation is necessary in feed back control system?
8. What is lag compensator?
9. What is lead compensator?
10. What is lag – lead compensator?
11. What is series compensation?
12. What is feed back compensation?

Part-B

1. What is compensation? Why it is need for control system? Explain the types of compensation?
2. Explain the design procedure for lead compensation and lag compensation.
3. Explain the design procedure for lag – lead compensation.
4. The open loop teransfer function of certain unity feed back control system is given by $G(s) = \frac{k}{s(0.1s+1)(0.2s+1)}$.It is desired to have the phase margin to be atleast 30 degree. Design a suitable phase lead series compensator.
5. Consider a unity feedback system with open loop transfer function, $G(s) = \frac{k}{s(2s+1)(0.5s+1)}$. Design a suitable lag – lead compensator to meet the following specifications.K_v=30 phase margin≥50