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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CONTROL SYSTEM

(Common to ECE, EEE, EIE, MECT, ETC)

V SEMESTER

QUESTION BANK

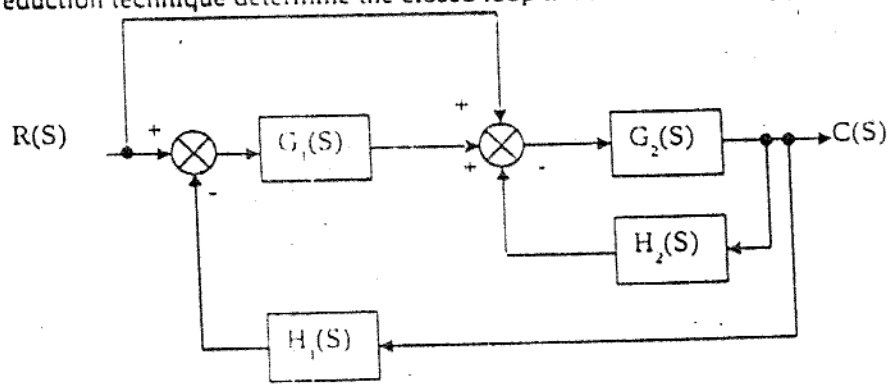
UNIT I

PART A

1. What is control system?
2. What are the two major types of control systems?
3. Explain open loop control system.
4. Define closed loop control system.
5. What are the components of feedback control system?
6. Distinguish between open loop and closed loop control system.
7. Define transfer function.
8. What are the basic elements used for modeling translational system?
9. Write the force balance equation of ideal mass, dash pot and spring.
10. What is block diagram?
11. What are the basic components of block diagram?
12. What is a signal flow graph?
13. Define non touching loop.
14. What are the basic properties of signal flow graph?
15. Write Mason gain formula and write the steps involve in signal flow graph
16. What are the types of systems?
17. Define feedback?
18. What are the types of mechanical systems?
19. Write the steps for block diagram reduction
20. Write the rule for eliminating negative feedback loop.

PART B

1) The block diagram of a closed loop system is shown in the figure using the Block reduction technique determine the closed loop transfer function C(s)/R(s).



UNIT-IV

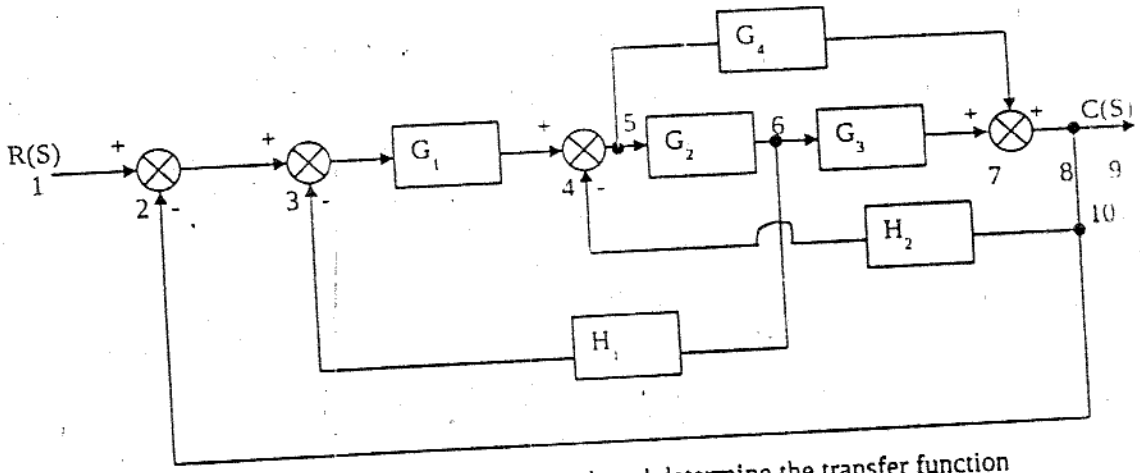
PART-A

1. What is meant by laser welding?
2. What is meant by laser trimming?
3. What are the industrial applications of laser?
4. What are the two modes of laser melting process?
5. What are types of laser welding?
6. What are the types of laser trimming?
7. List out the advantages of laser welding.
8. What is meant by industrial application of laser?
9. What are types of lasers are used for material removal and vapourisation.
10. What are the disadvantages of measurement of distance for laser?
11. What is the principal of measurement of velocity for laser?
12. List out the advantages of measurement of velocity for laser.
13. List out the disadvantages of measurement of velocity for laser.
14. What are the classifications of laser welding?
15. List out the advantages of laser trimming.
16. What is meant by industrial application of laser?
17. List out the modes of laser melting process.
18. Draw the diagram of material processing.
19. List out the advantages of measurement of velocity for laser.
20. What is meant by LIDAR?
21. List out the applications of LIDAR.
22. What are the classifications of LIDAR?
23. List out the disadvantages of measurement of velocity for laser.
24. List out the types of lasers is used for material removal and vaporization.
25. List out the goals of plastic surgery.

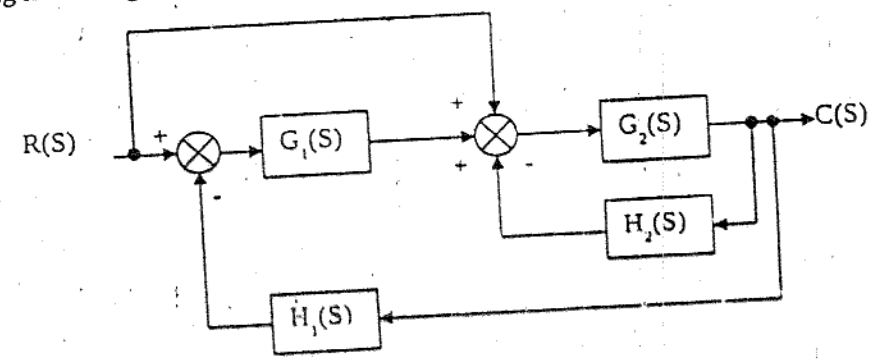
PART-B

1. Explain the principle of laser for the measurement of distance and velocity with neat diagram.
2. Explain the working principle of laser for the measurement of current and voltage with neat diagram.
3. Describe the principles of laser welding and melting.
4. Explain the principle of laser for the measurement of atmospheric effect with neat diagram.
5. Discuss the application of laser material processing.
6. Explain the application of laser in removal and vaporization of materials.
7. Describe the principle of LIDAR and the applications.
8. Describe in detail the principle of measurement of length, and acceleration.
9. Write short notes on irradiance and interaction time.
10. Describe the principles of cold atom gradiometer.

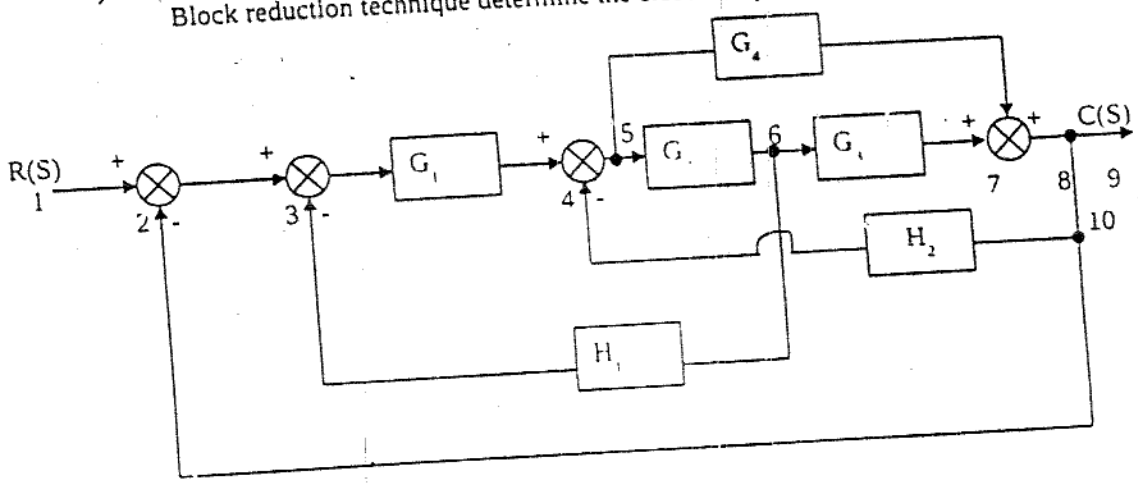
2) Convert the block diagram to signal flow graph and determine the transfer function using mason's gain formula.



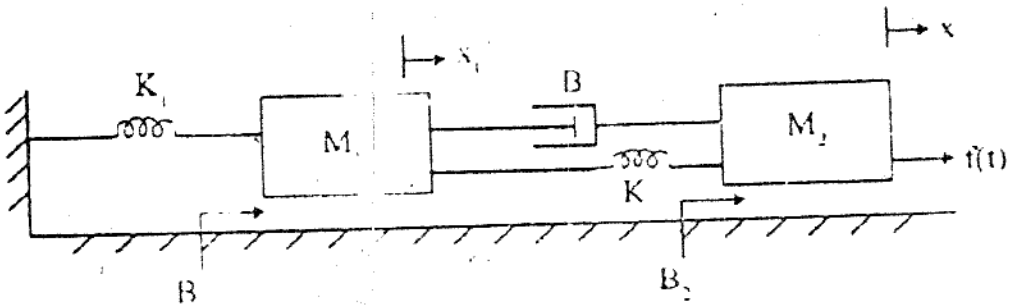
3) Convert the block diagram to signal flow graph and determine the transfer function using mason's gain formula.



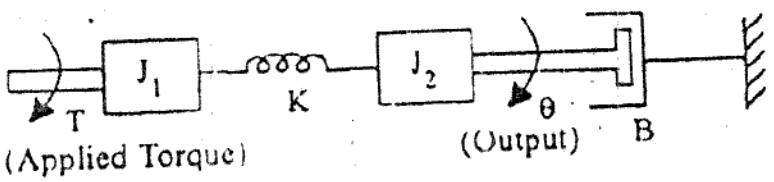
4) The block diagram of a closed loop system is shown in the figure using the Block reduction technique determine the closed loop transfer function C(s)/R(s).



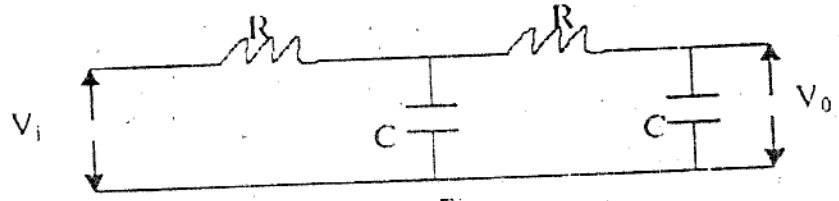
5) Write the differential equations governing the mechanical system shown in figure and determine the transfer function.



6. Write the differential equations governing the mechanical rotational system shown in figure. Obtain the transfer function of the system.



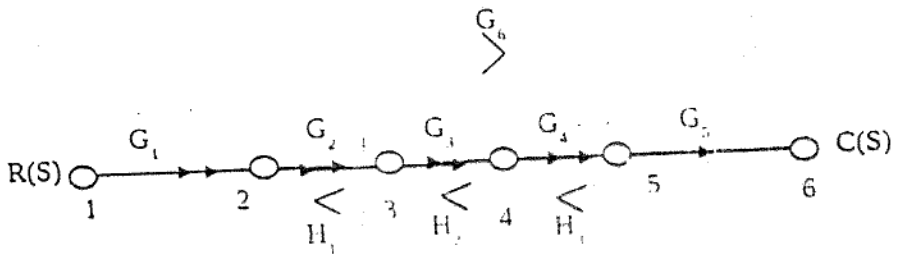
7. Derive the transfer function of the network shown in fig.



8. Derive the transfer function of armature controlled DC motor.

9. Derive the transfer function of field controlled DC motor.

10. The signal flow graph for a feedback control system is shown in fig. Determine the closed loop transfer function C(s) /R(s)



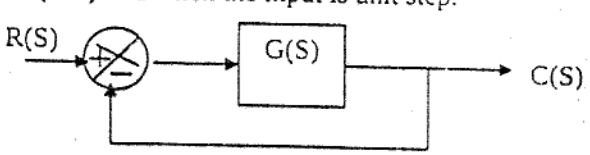
UNIT – II

PART – A

1. What is the order of a system?
2. How the system is classified depending on the value of damping?
3. The closed loop transfer function of second order system is $\frac{C(s)}{R(s)} = \frac{10}{s^2 + 6s + 10}$
   Find the error constant.
4. What is the type of damping in the system?
5. What is steady state error?
6. What are the generalized error coefficients?
7. Mention two advantages of generalized error constants over static error constants.
8. Define settling time.
9. Define parabolic signal.
10. Write the formula for finding the velocity error constant?
11. Why derivative controller is not used in control system?
12. What is a time response?
13. Name the test signals used in a control system.
14. Define step signal.
15. Define ramp signal.
16. What is an impulse signal?
17. Define damping ratio.
18. What is damping frequency of oscillation?
19. List the time domain specifications.
20. Sketch the response of a second order under damped system.
21. What is steady state error?
22. Mention two advantages of generalized error constants over static error constants.
23. What is the advantage in proportional controller?
24. What is the effect of PI controller on the system performance?
25. Why derivative controller is used in control systems?

PART – B

1. Obtain the response of unity feedback system whose open loop transfer function is G(S) = 4/s(s+4) and when the input is unit step.



2. Derive the expression for unit impulse response of a second order under damped system

$$G(s)=\frac{\omega_n^2}{s^2+2\xi\omega_n s+\omega_n^2}$$

3. Find the unit impulse response of the second order system whose transfer function.

$$G(s)=\frac{9}{S^2+4S+9}$$

4. Measurements conducted on a servomechanism show the system response to be $C(t) = 1+ 0.2\ e^{-60t} -1.2e^{-10t}$ when subject to a unit step input. Obtain an expression for closed loop transfer function. Determine the undamped natural frequency and damping ratio.

5. A unity feedback control system is characterized by the following open loop transfer function $G(s) = (0.4s + 1) / s\ (s + 0.6)$. Determine its transient response for unit step input and sketch the response. Evaluate the maximum overshoot and the corresponding peak time.

6. Derive the expression for steady state error of the closed loop system in terms of generalized error coefficients.

7. Derive the expression for peak time from the expression for step response of second order under damped system.

8. A unity feedback control system has an open loop transfer function, $G(s) = 10/ s(s+2)$. Find the rise time, percentage overshoot, peak time and settling time for a step input of 12 units.

9. Derive the expression for evaluation of generalized error coefficients.

10. Derive the expression for the response with P, PI and PID controllers.

UNIT III

PART A

1. What is frequency response?
2. What are the advantages of frequency response analysis?
3. What are the frequency domain specifications?
4. Define resonant peak.
5. What is resonance frequency?
6. Define bandwidth.
7. Explain gain margin
8. Define phase margin
9. What is the expression for resonant peak and resonant frequency?
10. What is a Nicholas plot
11. What are the advantage of polar plot
12. Define polar plot
13. Define bode plot
14. What are M and N circles?
15. What is cut off rate
16. What is gain cross over frequency
17. What is phase cross over frequency
18. Define corner frequency.
19. What is root locus?
20. What is magnitude criterion?

PART B

1. The open loop transfer function of a unity feedback system is given by $G(S)=1/S(1+S)(1+2S)$.Sketch the polar plot and determine the gain margin and phase margin.
2. Consider a unity feed back system having open loop transfer function $G(S) = 1/S^2(1+S)(1+2S)$. sketch pola plot find gain and phase margin
3. Derive M circle
4. Derive N circle
5. Write the procedure for Nichols chart
6. Consider a unity feed back system having open loop transfer function $G(S) = 75(1+0.2s)/s(s+5)$. sketch bode plot
7. Write the procedure for polar plot
8. For the following transfer function draw bode plot $G(S) = 20/S(1+3s)(1+4s)$
9. Write the procedure for bode plot
10. Plot the Bode diagram for the following transfer function and obtain the gain and phase over frequencies. $G(S) =10/S(1+0.04S)(1+0.1S)$.

UNIT IV

PART A

1) Define BIBO stability.
2) What is impulse response?
3) What is the requirement for BIBO stability?
4) How the roots of characteristics equation are related stability?
5) What is the necessary condition for stability?
6) What is routh stability criterion?
7) What is Nyquist stability criterion?
8) What is root locus?
9) Write the transfer function of Nyquist stability criterion?
10) What is magnitude criterion?
11) What is angle criterion?
12) What is centroid? How the centroid is calculated?
13) What is dominant pole?
14) For the system represented by the following characteristic equation say whether the necessary condition for stability is satisfied or not. (i)$S^4+3S^3+4S^2+5S+10=0$. (ii) $S^3-8S^2+7S+6=0$.
15) Distinguish between the concept of encircled and enclosed of Nyquist stability criterion?
16) Define gain margin and phase margin.

PART B

1) What are the necessary conditions for stability?
2) Using Routh criterion, determine the stability of the system represented by the characteristics equation, $s^4+8s^3+18s^2+16s+5 = 0$. Comment on the location of the roots of the roots of characteristics equation.
3) Construct Routh array and determine the stability of the system represented by the Characteristic equation $s^5+s^4+2s^3+2s^2+3s+5 = 0$. Comment on the location of the roots of characteristics equation.

4) Construct Routh array and determine the stability of the system whose characteristics equation, $s^6+2s^5+8s^4+12s^3+20s^2+16s+16 = 0$. Also determine the number of roots lying on the half of s-plane and on imaginary axis.

5) The open loop transfer function of a unity feedback system is given by
$G(s) = K/(s+2)(s+4)(s^2+6s+25)$.

6) Write the procedure for investigating the stability using Nyquist criterion.

7) 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.

8) Construct the Nyquist plot for a system whose open loop transfer function is given by $G(s)H(s)= K(1+s)^2/s^3$.Find the range of K for stability.

9) The open loop transfer function of a unity feedback system is given by $G(s) = K/s(1+sT_1)(1+sT_2)$.Determine an expression for gain K in terms T_1, T_2 and specified gain margin, K_g.

10) Determine the Gain crossover frequency, phase crossover frequency, Gain margin an phase margin of a system with open loop transfer function, $G(s)=1/s(1+2s)(1+s)$.

UNIT V

PART A

1. What is meant by Compensation?
2. Write the necessary frequency domain specifications for design of a control system.
3. List out the different types of compensator
4. Sketch an Electric lag-lead network of a lag-lead compensator.
5. Sketch an Electric lead network of a lead compensator.
6. Draw the bode plot of a lead compensator.

7. What is meant by lag compensator?
8. Write the transfer function of a typical lead-lag compensator.
9. What is meant by lag-lead compensator?
10. Sketch an electric lag network of a lag compensator.
11. Draw the bode plot of a lag compensator.
12. Why compensation is necessary in feedback control system?
13. Write the transfer function of a typical lead compensator.
14. Write the transfer function of a typical lag compensator.
15. Draw the bode plot of lag-lead compensator.
16. What are the characteristics of lead compensation?
17. List out the characteristics of lag-lead compensation?
18. List out the advantages in frequency domain design.
19. When maximum phase lag occurs in lag compensator?
20. Write down the expressions for maximum lag angle and the corresponding frequency.
21. Draw the pole zero plot for the lag compensator.
22. What is meant by series compensation?
23. List out the factors to be considered for choosing series compensation.
24. Draw the pole zero plot for the lead compensator.
25. Draw the pole zero plot for the lag-lead compensator.

PART B

1 Write the frequency response of lag compensator.

2 The controlled plant of a unity feedback system is $G(s) = K/s(s+5)$. It is specified that velocity error constant of the system be equal to 15, while the damping ratio is 0.6 and velocity error is less than 0.25 rad per unit ramp input. Design a suitable lag compensator?

2nd A1

3 A unity feedback system has an open loop transfer function, $G(s) = K/s(1+2s)$. Design a suitable lag compensator so that phase margin is 40° and the steady state error for ramp input is less than or equal to 0.2.

4 Write the frequency response of lead compensator.

5 The open loop transfer function of certain unity feedback control system is given by $G(s) = K/s\ (0.1s+1)\ (0.2s+1)$. It is designed to have the phase margin to be at least 30°. Design a suitable lead series compensator.

6 Write the procedure of lag-lead compensator on root locus and frequency domain method.

7 Write the realization of lag-lead compensator using electrical network.

8. Describe the different types of compensation schemes.

9. Explain the design procedure of a lag compensator.

10. Explain the design procedure of a lag-lead compensator.