U.S.N

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; June - 2017

Control System

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Prepare a list of characteristics essential for a good control system. 4

b. Differentiate closed loop system and open loop system. 6

c. Compute the transfer function for the circuit shown in Fig. 1.C.

(i) $\frac{V_2(s)}{V_1(s)}$ (ii) $\frac{V_1(s)}{I_1(s)}$

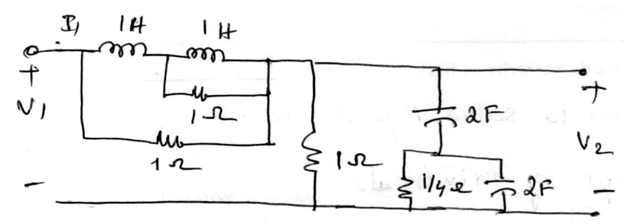

Figure 1.c

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2 a. Using force voltage analogy obtains a mechanical translational system from Fig. 2. a. 8

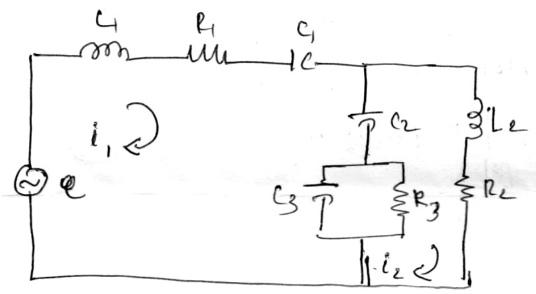


Figure 2.a

b. Write the differential equation for the mechanical system shown in Fig. 2.b and obtain F-V and F-I analogous circuits. 12

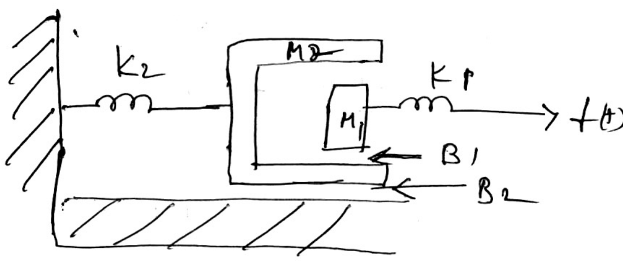


Figure 2.b

UNIT - II

3 a. Using block diagram reduction obtains the transfer function of Fig. 3.a. 10

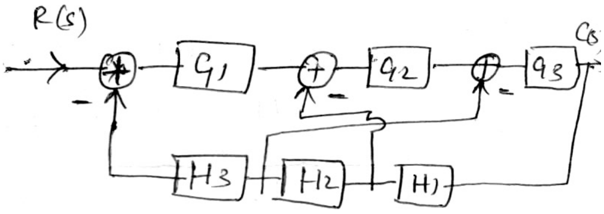


Figure 3.a

b. Obtain the transfer function using Masons gain formula for Fig. 3b. 10

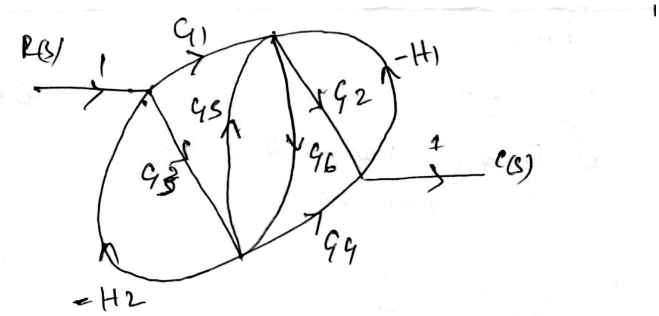


Figure 3-b

4 a. For a system $G(s)H(s)=\frac{K}{s^2(s+2)(s+3)}$ compute the value of K to limit steady state error to 10 when input to system is 1 + 10t + $40/20t^2$. 6

b. For a unity feedback control system with $G(s)=\frac{64}{s(s+9.6)}$. Determine the output response to a unit step input. (i) Response at t = 0.1sec (ii) setting time (iii) peak time. 6

c. Derive an expression for second order system for under damped case [consider unit step input]. 8

UNIT – III

5 a. Interpret the following in a system: 6

(i) Absolute stability (ii) Relative stability (iii) Marginal stability.

b. Use RH criterion to determine the stability of the system having characteristic equation.

$S^6+2S^5+5S^4+8S^3+8S^2+8S+4=0$. 8

c. The polynomial $P(S)=S^4+2S^3+3S^2+S+1$ has all its roots in LHS of S-plane use RH criterion to determine number of roots of P(S) lying between S = $-1/2$ and S = -1. 6

6 a. Explain the procedure to plot complete root locus of a given transistor function. 8

b. Sketch the root locus and hence determine, 12

(i) Damping ratio and corresponding value of k

(ii) Closed loop transfer function having G(S) = $\frac{K(S+3)}{S(S+2)}$.

UNIT - IV

7 a. Explain the procedure to solve Niquist criteria. 6

b. Describe the concept of Principle argument. 4

c. For a control system $G(S)H(S)=\dfrac{K}{S(S+2)(S+10)}$ Sketch the Nyquist plot and hence calculate the range of values of K for stability. 10

8 a. Explain the concept of encirclement in Nyquist criterion. 6

b. Sketch the Nyquist plot for a system with the open loop trans for function.

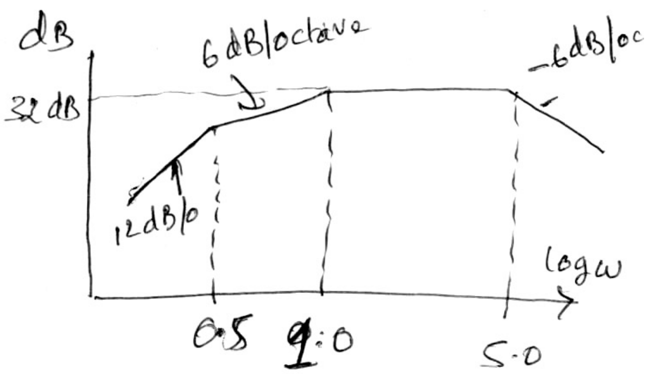
$G(S)H(S)=\dfrac{K(1+0.5S)(1+S)}{(1+10S)(S-1)}$, determine the range of values of K for which system is stable. 14

UNIT - V

9 a. For a control system having $G(S)H(S)=\dfrac{K(1+0.5S)}{S(1+2S)(1+0.05S+0.128S^2)}$

Draw Bode plot with k = 4 find GM and PM. 14

b. For the plot shown in Figure 9.b determine the transfer function. 6



10 a. Construct state model using phase variables if the system is described by equation.

$$\frac{d^3y(t)}{dt^3}+\frac{4d^2y(t)}{dt^2}+\frac{7dy(t)}{dt}+2y(t)=5\,u(t)$$ 8

b. List the properties of state transition matrix. 4

c. Obtain the solution of the homogenous state equation λ = A,

where $A=\begin{pmatrix}1 & -2\\ 1 & -4\end{pmatrix}$ and $\lambda_{(0)}=\begin{pmatrix}0.5\\ 1\end{pmatrix}$. 8

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