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; May/June - 2018

Control Systems

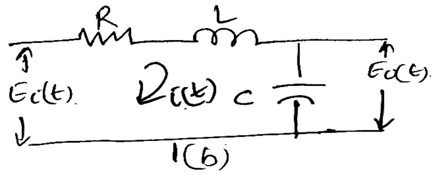
Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

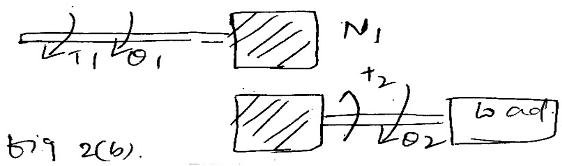
1 a. List the merits and demerits of open loop and closed loop control system. Give atleast one example. 10

b. Compute the transformer function for the circuit shown in Fig. 1(b) 10



2 a. List the advantages and disadvantages of transfer function. 6

b. Calculate the transfer functions $\frac{Q_1(S)}{T_1(S)}$ for the system shown in Fig.2(b) 8



c. Define the following : 6

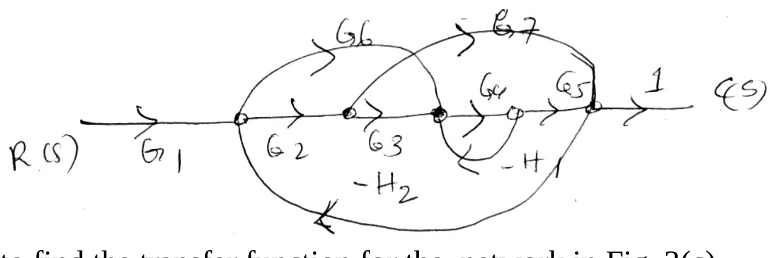
i) Control system ii) Command input iii) Reference input iv) Disturbance

UNIT - II

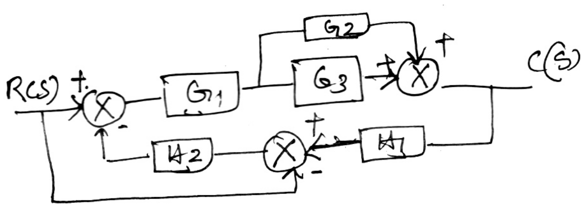
3 a. Explain the block diagram rules to perform the following : 4

i) Shifting a summing point ii) Shifting a take off point beyond the block

b. Obtain closed loop transfer function $\frac{C(S)}{R(S)}$ using Manson's gain formula for the signal flow graph shown in Fig. 3(b). 8



c. Use block diagram to find the transfer function for the network in Fig. 3(c) 8



4 a. Calculate the error coefficient and error for ramp input with magnitude 4 for unity feedback system 10

$$G(S) = \frac{40(S+2)}{S(S+1)(S+4)}$$

b. Write the output response to a unit step input for a unity feedback system with 10

$$G(S) = \frac{64}{S(S+9.6)}$$

Determine the response at t = 0.1 s, maximum value of response and setting time.

UNIT - III

5 a. Write a note on Routh Hurwitz criterion along with its limitations 6

b. Check the stability for the given characteristic equation using Routh's array $S^6+2S^5+8S^4+12S^3+20S^2+16S+16 = 0$. 8

c. State and prove the theorem on BIBO stability. 6

6 a. Explain the procedure to plot root locus of a given transfer function. 10

b. For the negative feedback system having,

$$G(S) = \frac{K(S+1)}{(S+2)(S+3)(S+4)}$$ 10

Sketch the root locus with necessary calculations. Show at least one test point plane on the complete plane on root locus where criterion is satisfied.

UNIT - IV

7 a. Explain the correlation between time domain and frequency domain approach. 8

b. Sketch the bode plot for unity feedback system $G(S) = \frac{80}{S(S+2)(S+2)}$. Determine; G.M, P.M, W_{gc} and W_{pc}. Comment on stability. 12

8 a. Explain the procedure to plot Nyquist plot. 10

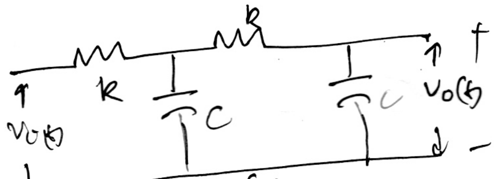
b. Find the range of R for closed loop stability using Nyquist stability, $G(S)\,H(S) = \frac{K(4S+1)}{S(S-1)}$, $K > 0$. 10

UNIT - V

9 a. Define: i) State ii) State variables iii) State vectors. 6

b. List the advantages of state variable analysis. 4

c. Obtain an approximate state model for a system represented by electric circuit shown in Fig. 9(c) 10



9(c)

10 a. Find the response of the system,

$$X' = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X + \begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix} U(t)$$

$$X(0) = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \quad y(t) = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} X$$ 10

$$U(t) = \begin{bmatrix} U_1(t) \\ U_2(t) \end{bmatrix} = \begin{bmatrix} U(t) \\ e^{-3t}U(t) \end{bmatrix}$$

Where $U(t)$ = Unit step input.

b. Find the transfer function of the system having state model,

$$X' = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} U, \; y = [1 \;\; 0]\, X$$ 10

$$A = \begin{bmatrix} 0 & +1 \\ 2 & -3 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \quad C = [1 \;\; 0] \quad D = 0.$$

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