Q.P. Code: 16EE216 **R16**

Reg. No: | | | | | | | | | | |

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

B.Tech III Year I Semester Regular Examinations November 2018

LINEAR CONTROL SYSTEMS

(ECE, EEE)

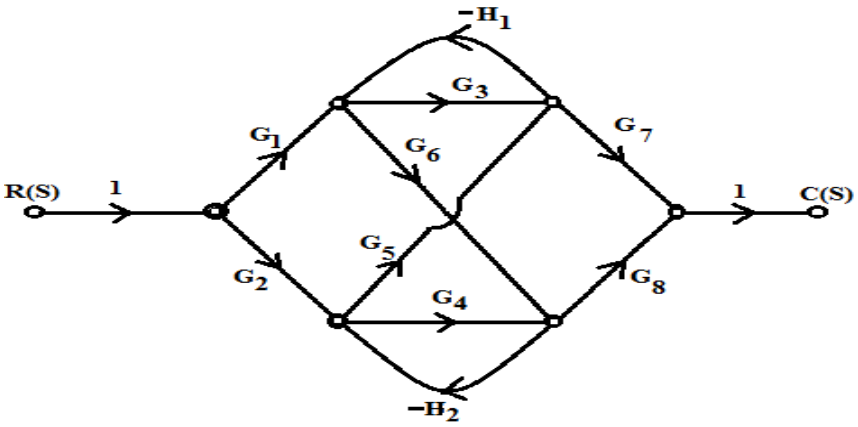
Time: 3 hours Max. Marks: 60

(Answer all Five Units **5 x 12 = 60** Marks)

UNIT-I

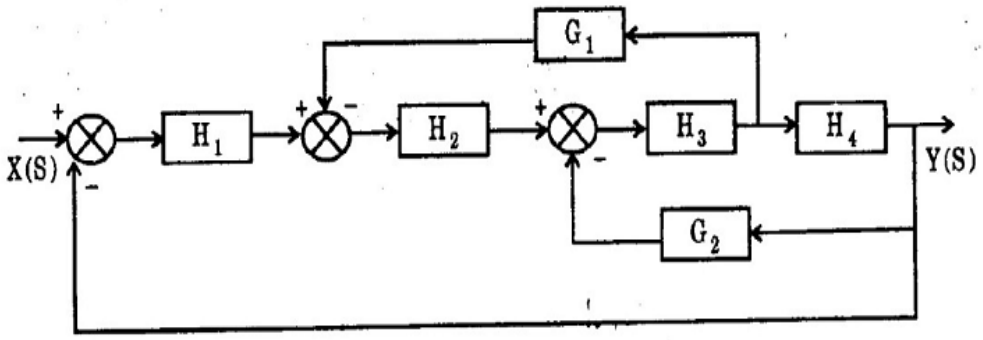
1 **a** Deduce the transfer function for field controlled DC servo motor with neat diagram. 6M

b Determine the transfer function for the signal flow graph given below. 6M

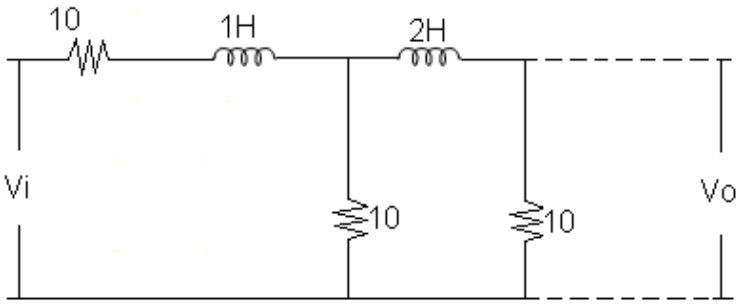


OR

2 **a** Using block diagram reduction technique, derive the transfer function of the system shown in the following figure. 7M



b For the electrical network shown in fig, derive the transfer function. 5M



UNIT-II

3 **a** A unity feedback control system has an open loop transfer function $G(S) = \frac{10}{S(S+2)}$ Find rise time, % peak overshoot, and peak time for a unit step input. 7M

b Explain the effect of PI, PD and PID controller's action on the performance of the system. 5M

OR

4 What is meant steady state error? Derive the static error components for Type 0, Type 1&Type 2 systems? 12M

UNIT-III

5 The characteristic equation of a feedback control system is $\mathbf{s^4+3s^3+12s^2+ (K-16) s+K=0}$. Sketch the root locus plot for 0<K< infinity. Determine the range of gain for which the system is stable. 12M

OR

6 Use the R-H criterion to determine the location of roots on the S- plane and find the stability for the systems represented by the characteristic equations

i) $S^4 + 8S^3 + 18S^2 + 16S + 5 = 0$ 6M

ii) $S^5 + 4S^4 + 8S^3 + 8S^2 + 7S + 4 = 0$ 6M

UNIT-IV

7 **a** Derive the expressions for resonant peak and resonant frequency. 6M

b Sketch the polar plot for the open loop transfer function of a unity feedback system is given by $G(S) = \frac{1}{S(S+1)(1+2S)}$**.** Determine Gain Margin & Phase Margin. 6M

OR

8 Sketch the bode plot for the following transfer function $G(S) = \frac{75(1+0.2S)}{S(S^2+16S+100)}$ and determine PM and GM. 12M

UNIT-V

9 **a** Diagonalizable the following system matrix

$$A = \begin{bmatrix} 0 & 6 & -5 \\ 1 & 0 & 2 \\ 3 & 2 & 4 \end{bmatrix}$$ 7M

b Determine the Solution for Homogeneous State equations. 5M

OR

10 For the state equation:

$\dot{X} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ with the unit step input and the initial conditions are $X(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$.

Find the following

(i) State transition matrix 6M

(ii) (ii) Solution of the state equation. 6M

*** END ***