EE-VI(R) 19/11/2014

CS-1. **Q.P. NO : 15013**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Questions **No. 1** is **compulsory.**
(2) Attempt any **Four** questions from remaining.
(3) Use **Graph Paper** and **Semi Log Paper** where **necessary.**
(4) Assume suitable **data** wherever **necessary.**

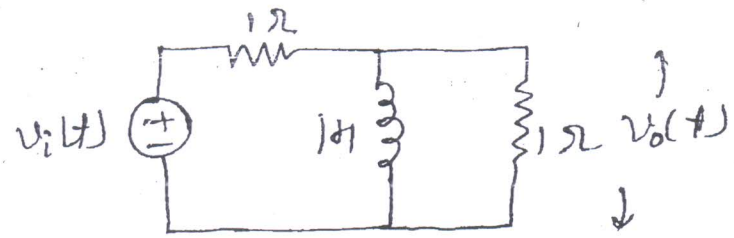
1. (a) Define the transfer fuction. Explain with example how transfer function is related to the characteristics of any system. **5**
   (b) Define state variables, state, state vectors and state space. **5**
   (c) Name and define four components of a block diagram for a linear, time invarient system. **5**
   (d) How can you tell from the root locus that the system is stable or unstable. **5**

2. (a) For a given transfer function find the location of poles and zeros. Plot them on S-plane and write an expresion for the general form of step response without solving for the inverse laplace program. **10**
   State the nature of the response.

$$T(s) = \frac{s+2}{s^2+9}$$

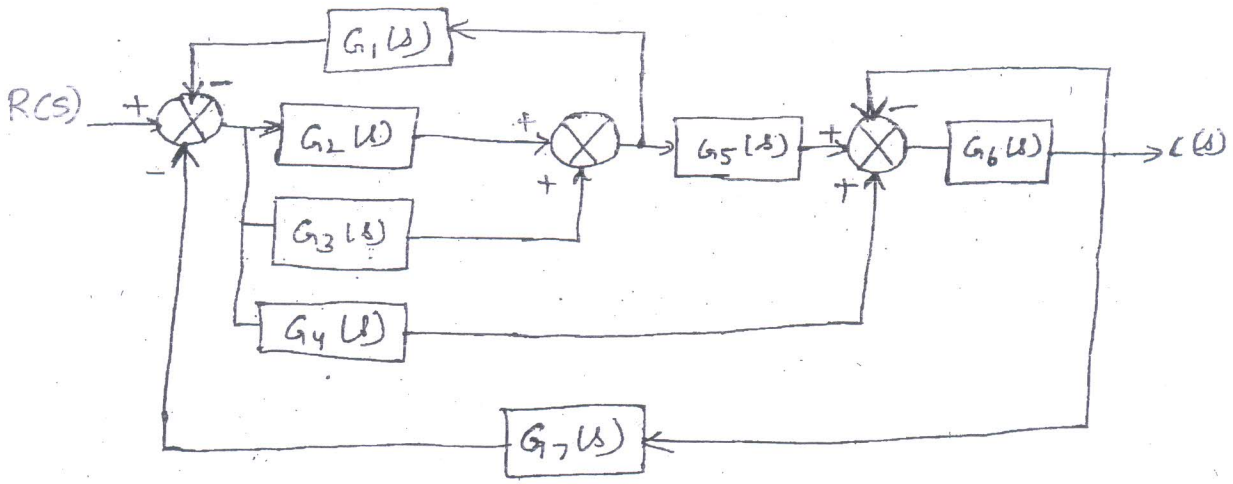
   (b) For the given second order system specification find the location of second order pairs of poles. **10**
   i) % OS = 12% Ts = 0.6 second
   ii) Ts = 7 Sec. Tp = 3 Sec.

3. (a) Find the transfer function G(s) = Vo(s)/Vi(s) for the network. **10**

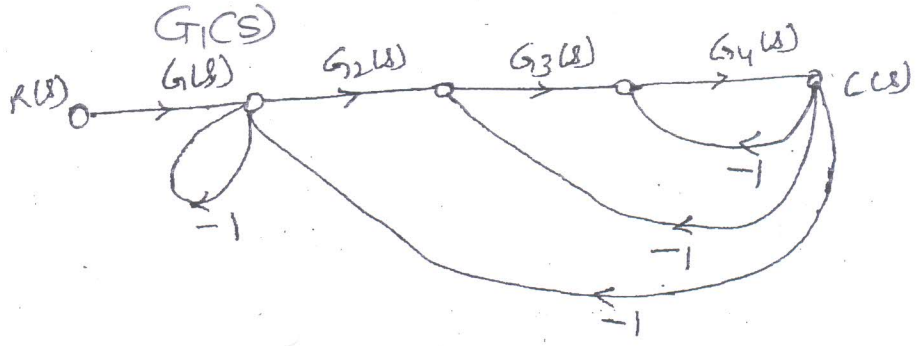


(b) Reduce the block diagram to a single transfer function. 10

$T(s) = C(s) / R(s)$



4. (a) Use Mason's gain formula and find the transfer function $T(s) = C(s) / R(s)$ for the system. 10



(b) For the unity feedback systems with the forward transfer function. 10

$$G(s) = \frac{K(s+20)}{s(s+2)(s+3)}$$

Find the range of K to make the system stable. Use Routh Hurwitz criteria.

5. (a) For the unity feedback system with 10

$$G(s) = \frac{450(s+8)(s+12)(s+15)}{s(s+38)(s^2+2s+28)}$$

Find the steady state error for the test input 25 u (t), 37 t u (t) and 47 t^2 u (t)

(b) For the unity feedback system, sketch the root locus 10

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

Find the dominant pole pair for the damping ratio 0.707

6. (a) Given the unity feedback system with forward transfer function. 10

$$G(s)=\frac{K}{s(s+3)(s+12)}$$

Find GM and PM for K = 40 through the bode phase and magnitude plot.

(b) Briefly state Nyquist stability criteria. 5

(c) A system with only four real and negative poles and no. zero what would be it's polar plot. 5

7. (a) Consider the following system in its state space for 10

$$\dot{x}=\begin{bmatrix}-2 & -1 & -3\\ 0 & -2 & 1\\ -7 & -8 & -9\end{bmatrix} x + \begin{bmatrix}2\\1\\2\end{bmatrix} u$$

$$y = [4 \quad 6 \quad 8]\, x$$

obtain its transfer function.

(b) Consider the plant 10

$$G(s)=\frac{1}{(s+7)(s+8)(s+9)}$$

Obtain state space model in phase variable form. Also draw the singal flow graph of the state space model.
