No. of Printed Pages : 4

BIEE-021

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

00757

June, 2014

BIEE-021 : CONTROL SYSTEM

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. Each question carry equal marks.*

1. (a) Evaluate $\frac{C_1}{R_1}$ and $\frac{C_2}{R_2}$ for a system whose block diagram representation is shown in Figure 1. *10*

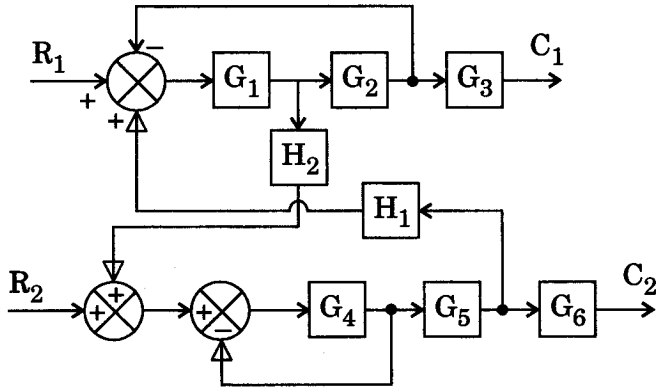

Figure 1

(b) Differentiate between open-loop and closed loop control system with suitable examples. *4*

2. (a) Solve $\frac{C_2}{R_1}$ in Figure 2 by using Mason's gain formula. *7*

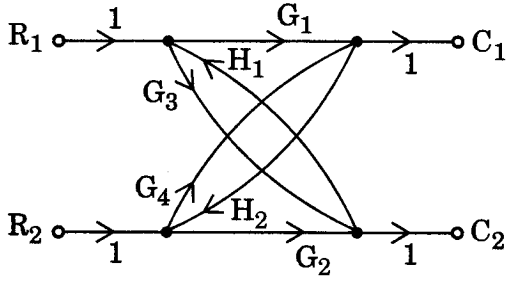

Figure 2

(b) Obtain the nodal equations for the system shown in Figure 3 and draw its electrical analog based on force – current analogy. *7*

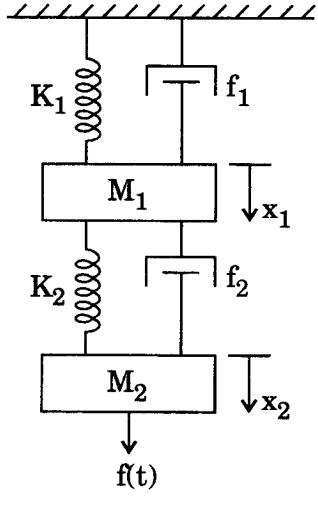

Figure 3

3. (a) The unit response of a system is given as $c(t) = \frac{5}{2} + 5t - \frac{5}{2}e^{-2t}$. Find the transfer function of the system. *7*

(b) For a unity feedback system whose open loop transfer function is

$$G(s) = \frac{50}{(1 + 0{\cdot}1s)(1 + 2s)}$$

find the position, velocity and acceleration error constants. *7*

4. Construct the Bode plot for a unity feedback control system having

$$G(s) = \frac{10(s + 10)}{s(s + 2)(s + 5)}$$

Find PM and GM. Also comment on the stability of system. *14*

5. The open-loop transfer function of closed loop system is

$$G(s)\,H(s) = \frac{4s + 1}{s^2(s + 1)(2s + 1)}$$

Determine stability using Nyquist's criteria. *14*

6. Consider a matrix A given below. Find the eigenvalues, eigenvector, modal matrix and diagonalise it. *14*

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}$$

7. Write short notes on the following : *2×7=14*

(a) PI, PD, PID controllers

(b) DC and AC servomotors

8. (a) Sketch the polar plot of $\frac{1}{s}$ and $\frac{1}{s^2}$ and comment on stability of the system. *6*

(b) Determine the range of values of k ($k > 0$) such that characteristics equation $s^3 + 3(k + 1)s^2 + (7k + 5)s + (4k + 7) = 0$ has roots more negative than $s = -1$. *8*