No. of Printed Pages : 4 **BIEE-021**

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

Term-End Examination

00046

June, 2016

BIEE-021 : CONTROL SYSTEMS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. All questions carry equal marks. Use of scientific calculator is allowed. Use of graph papers and semi-log sheets is permitted.*

1. Derive the transfer function of the system shown in Figure 1, k being the amplifier gain. *14*

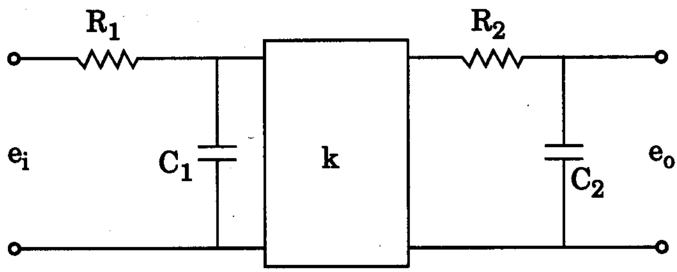

Figure 1

2. Determine the transfer functions C_1 / R_1, C_2 / R_2, C_1 / R_2 and C_2 / R_1 from the block diagram shown in Figure 2, using block diagram reduction technique. *14*

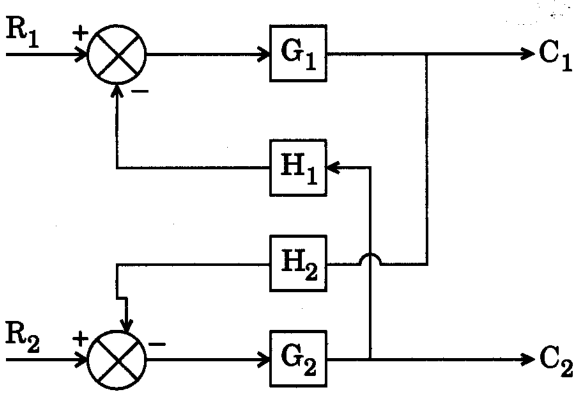

Figure 2

3. Write short notes on any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

   (a) Potentiometer

   (b) Synchros

   (c) AC Servomotor

   (d) Tachogenerators

   (e) Pneumatic Controller

4. A unity feedback system is characterized by the open-loop transfer function

$$G(s) = \frac{1}{s(0{\cdot}5s + 1)(0{\cdot}2s + 1)}.$$

Determine the steady-state errors for unit step, unit ramp and unit acceleration inputs. Also determine the damping ratio and natural frequency of the dominant roots. *14*

5. The open-loop transfer function of a unity feedback system is given by

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

Sketch the polar plot and determine the gain margin and phase margin. *14*

6. The open-loop transfer function of a unity feedback system is given by

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

Determine the value of k so that the system is stable with

(a) a phase margin > 45°, and

(b) gain crossover frequency as large as possible. *14*

7. Sketch the root-loci for the system shown in Figure 3. *14*

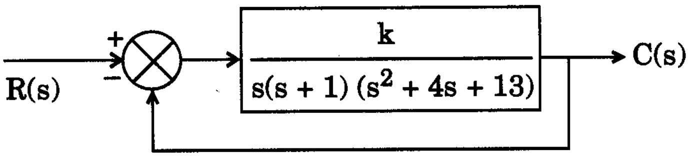

Figure 3

8. (a) Construct a state model for the following transfer function :

$$G(s) = \frac{5}{(s+1)^2\,(s+2)}$$ 7

(b) Derive the transfer function corresponding to the following state model : 7

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u \,; \quad y = [1 \quad 0]x.$$