No. of Printed Pages : 3

BIEE-021

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

Term-End Examination

00848

December, 2015

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 is permitted.*

1. (a) Discuss the characteristics of open-loop and closed-loop systems. Further, describe the block diagram of the speed control system of an automobile with a human driver. 7

(b) Explain the principle of servomechanism. 7

2. Write the differential equations for the mechanical system shown in Figure 1. Also obtain the electrical analogous circuit based on force – current analogy. 14

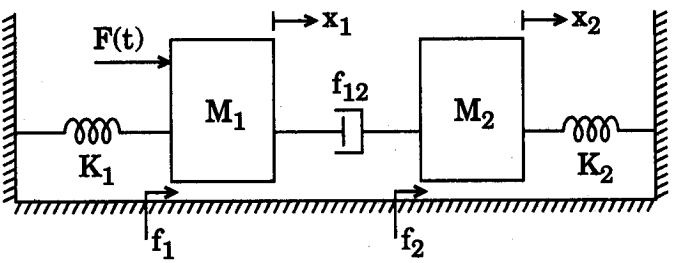

Figure 1

3. Use Mason's gain formula for determining the overall transfer function of the system shown in Figure 2. *14*

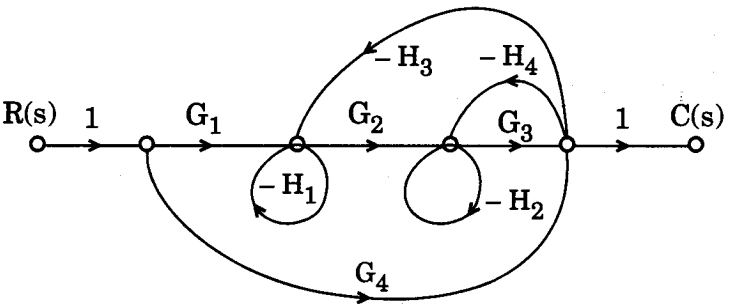

Figure 2

4. (a) Define synchros. Explain its principle of working. Also mention its application. *7*

   (b) Derive an expression for the transfer function of a field controlled d.c. servomotor. *7*

5. A unity feedback system is characterized by an open-loop transfer function

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

Determine the gain k so that the system will have a damping ratio of 0·5. For this value of k determine the settling time, peak overshoot and time to peak overshoot for a unit step input. *14*

6. (a) Discuss the different static error coefficients. How are these coefficients related to steady-state error ? *7*

   (b) Write and explain the defining equation of PI and PID modes of feedback control. Also derive their corresponding transfer functions. *7*

7. A unity negative feedback control system has an open-loop transfer function consisting of two poles, two zeros and a variable gain k. The zeros are located at – 2 and – 1; and the poles at 0·1 and + 1.

Using Routh stability criterion, determine the range of values of k for which the closed-loop system has 0, 1 and 2 poles in the right-half of s-plane. *14*

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

(a) Gain Margin and Phase Margin

(b) Concept of State Variable

(c) Diagonalisation

(d) Application of Nyquist

(e) Pneumatic Controller