

Please check that this question paper contains nine questions and two printed pages within first ten minutes.

[Total No. of Questions: 09]

[Total No. of Pages: 02]

Uni. Roll No.

Program: **B.Tech. (Electrical Engineering)**
Semester: **5th**
Name of Subject: **Control Systems**
Subject Code: **PCEE-110**
Paper ID: **16462**

11-01-2022(E)

Time Allowed: 02 Hours

Max. Marks: 60

NOTE:

- 1) Each question is of 10 marks.
- 2) Attempt any six questions out of nine.
- 3) Any missing data may be assumed appropriately.

- Q1.** (a) Distinguish between open and closed-loop systems. [10]
(b) For the system represented by the block diagram shown in Figure 1, Find $Y(s)/R(s)$

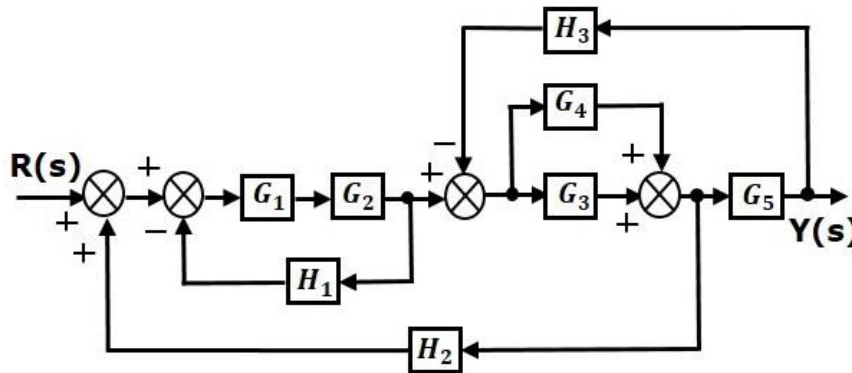


Figure 1.

- Q2.** Find the time domain specifications for the second order system given as [10]

$$C(s)/R(s) = 8/(s^2 + 4s + 8)$$

- Q3.** Draw the root-locus of the feedback system whose open-loop transfer function [10]
is given by $G(s)H(s) = K/s^2(s+1)$

- Q4.** (a) Explain the Routh Hurwitz Criteria for determining the stability of a system. [10]
(b) Determine the stability of given system using Routh-Hurwitz criterion

$$s^4 + 8s^3 + 18s^2 + 16s + 5 = 0$$

Q5. Draw the Bode magnitude and phase plot of the following open-loop transfer function and determine gain margin, phase margin and absolute stability? [10]
 $G(s)H(s) = 1 / s (s+2) (s+4)$

Q6. Using Nyquist criterion, determine the stability of a feedback system whose open-loop transfer function is given by [10]
 $G(s)H(s) = K/s(s+1)$

Q7. Describe the concepts of observability and controllability of a control system in detail? *Check whether the system represented by* [10]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \quad \text{is observable or not.}$$

Q8. (a) Derive the time response of second order under damped system due to unit step input. [10]
 b) Why derivative controller is not used in control systems? What is the effect of PI controller on the system performance?

Q9. The open-loop transfer function is given by [10]
 $G_p(s) = K/s(1+0.1s) (1+0.2s)$

Design a lead-lag compensator to meet $K_v = 100 \text{ sec}^{-1}$ and phase margin $\geq 30^\circ$.
