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

EVENING

2 8 DEC 2022

[Total No. of Questions: 09] [Total No. of Pages: 03]

Uni. Roll No. .....

Program: **B.Tech. (Batch 2018 onward)**
Semester: **5th**
Name of Subject: **Control Systems**
Subject Code: **PCEE-110**
Paper ID: **16462**
Scientific calculator is Allowed

Detail of allowed codes/charts/tables etc. Graph paper & semi-log paper

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

(a) Compare open loop and closed loop systems with suitable examples.

(b) Define Gain margin and phase margin.

(c) What is the difference between steady state and transient response?

(d) What are state variables? List the advantages of state space analysis.

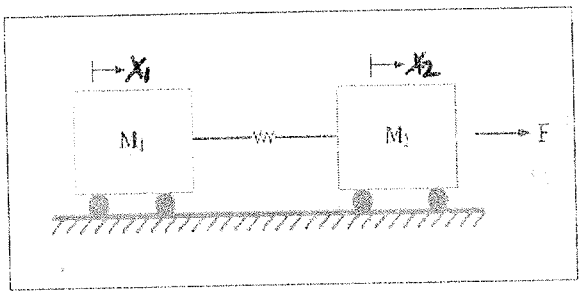
(e) Using final value theorem, find the steady state error for unit step input.

(f) Name the test signals used in time response analysis. Define ramp signal.

Part – B **[Marks: 04 each]**

Q2. Find the transfer function of the given mechanical translational system.

P.T.O.



EVENING

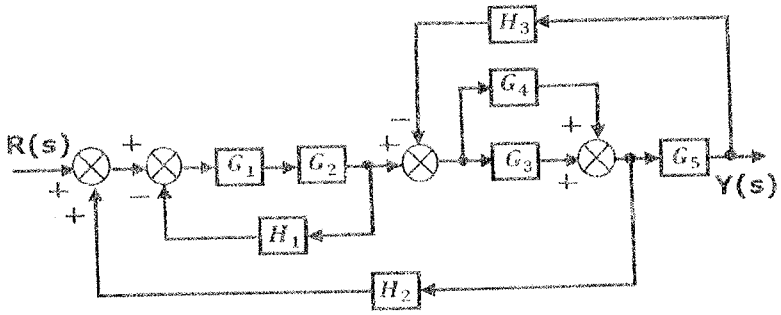
2 8 DEC 2022

Q3. Find the time domain specifications for the second order system given by

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

Q4. Explain in detail about PID Controllers used in control system.

Q5. For the system represented by the block diagram shown in below figure, find Y(s)/R(s)



Q6. Explain the Routh Hurwitz Criteria for stability. Determine the stability of given system using this criterion

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

Q7. State and explain Nyquist criterion.

Part – C **[Marks: 12 each]**

Q8. Draw the root-locus of the feedback system whose open-loop transfer function is given by $G(s)H(s) = K/s^2(s+1)$

OR

Draw the Bode magnitude and phase plot of the following open-loop transfer function and determine gain margin, phase margin and absolute stability?

$$G(s)H(s) = 1/s\,(s+2)\,(s+4)$$

P.T.O.

Q9. Describe the concepts of observability and controllability of a control system in detail?
Check whether the system represented by

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

OR

The open-loop transfer function is given by

$$G_p(s) = K/s(1+0.1s)\,(1+0.2s)$$

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

****