Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Even) Semester Examination May-June 2025

Roll no.....

Name of the Program and semester: B.Tech. ECE IV
Name of the Course: Control System
Course Code: TEC 401

Time: 3 hour Maximum Marks: 100

Note:
(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks) CO1

a. Explain control system components using block diagram of feedback control system.
b. Differentiate between open loop and closed loop system.
c. Draw signal flow graph for the following set of simultaneous equations and determine its transfer function using Mason's Gain Formula

$X_2 = 6\,X_1 + 5\,X_2$

$X_3 = 2\,X_1 + 3\,X_2 + 4\,X_3$

$X_4 = X_2 + 7\,X_3$

Q2. (2X10=20 Marks) CO2, CO3

a. Check the following system for its linearity and time variance
$Y(t) = 3\,x(t) + 6\,x(t-1)$
b. A second-order system has the transfer function $G(s) = 25/(s^2 + 6s + 25)$. Determine the rise time and peak time.
c. What are static error coefficients? Explain Kp, Kv, and Ka.

Q3. (2X10=20 Marks) CO3, CO4

a. Using Routh-Hurwitz criterion, determine the stability of a system with characteristic equation

$s^4 + 2s^3 + 3s^2 + 4s + 5 = 0$

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b. Sketch the (i) polar plot (ii) root locus plot of a system with G(s) = 10/(s+1)(s+2)
c. Write short notes on (i) Lead compensators (ii) static error coefficients

Q4. (2X10=20 Marks) CO5

a. Derive formulae for rise time and settling time in an under damped unit step response of a second order system

b. A unity feedback system has G(s) = 10/(s(s+2)). Calculate the steady state error for a unit ramp input.
c. Derive controller function and describe the working of PID controllers.

Q5. (2X10=20 Marks) CO5, CO6

a. Derive and explain the state-space model for a second order system
b. Define state variable representation and list its advantages.
c. Convert the following transfer function into state space model:
G(s) = $(2s + 3)/(s^2 + 4s + 5)$.