

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech.in Electronics and Instrumentation Engineering
Semester:	III
Course Code:	2EI101
Course Title:	Control Theory
Course Type:	Core
Year of Introduction:	2023-24

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, students will be able to -

1. apply the basic concept of mathematical modeling for the control system. (BL3)
2. analyse control system in time and state space domain. (BL4)
3. use graphical methods for the analysis of the control systems. (BL4)
4. evaluate the stability of linear control system. (BL5)

Teaching Hours: 30

Unit	Syllabus	Teaching hours
Unit-I	Introduction to Control System Introduction, examples of control systems, closed loop control versus open-loop control	01
Unit-II	Mathematical Modeling of Dynamic Systems Introduction, dynamical equations for mechanical and electrical systems, determination of transfer function, Analogues systems: Force (Torque)- voltage analogy and force(Torque) - current analogy, problems, Signal flow graph, definitions, construction of signal flow graph, Mason's gain formula, use of mason' s gain formula to determine the transfer function	08
Unit-III	State-space analysis State-space modeling of physical systems, Conversion of transfer function to the state model, Conversion of state model to the transfer function, Solutions of state equations	04
Unit-IV	Time response analysis Introduction, Time response of first order systems, Time response of a second order control system, Time response specifications. Derivation of specification, Problems on above topics. Steady state errors and error constants types of feedback control systems.	06
Unit-V	Stability Analysis Feedback and non-feedback systems, reduction of parameter variation by use of feedback, Disturbance reduction using feedback, Concept of	04

stability, absolute stability, absolute stability and relative stability, necessary conditions for stability. Hurwitz stability criterion, Routh stability criterion.

Unit-VI Graphical methods for analysis of control systems

07

Introduction to root locus plots, Stability analysis and determination of time domain parameters using root locus, Related examples, Introduction to Bode and Nyquist plots

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial:

Tutorial work will be based on above syllabus with minimum 10 tutorials to be incorporated.

Suggested Readings:

1. Katsuhiko Ogata, Modern Control Engineering, PHI Publication.
2. Nagrath & Gopal, Control System Engineering, New Age International Publication.
3. M.Gopal, Modern Control System Theory, New Age International Publication.
4. Norman S. Nise, Control System Engineering, Wiley Publication.

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. the academic year 2023 - 24 and onwards

