

COURSE CODE: 1152EE125	COURSE TITLE: INTRODUCTION TO NONLINEAR DYNAMICAL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE CATEGORY:

Program Elective

PREAMBLE :

The basic necessity of this course arises from the fact that most of the real world systems are highly nonlinear and handling these needs some preliminary background of these systems and its behaviour. This course introduces Nonlinear Systems in a basic level starting from one dimensional flows and ending in two dimensional flows.

PREREQUISITE COURSES:

- Control Systems

COURSE EDUCATIONAL OBJECTIVES:

The objectives of the course are to make the students,

- Impart knowledge about nonlinear systems in general
- Provide adequate knowledge in Bifurcation methods in 1 and 2 D flows
- Introduce the concepts of Chaos

COURSE OUTCOMES :

Upon the successful completion of the course, students will be able to:

CO Nos	Course Outcomes	Knowledge Level(Revised Bloom's Taxonomy)
CO1	Understand the importance of nonlinear Systems	K2
CO2	Explain various bifurcations methods for 1D systems	K2
CO3	Explain various bifurcations methods for 2D systems	K2
CO4	Describe the existence of limit cycles and its implications	K2
CO5	Explain about chaotic Systems	K2

CORRELATION OF COs AND Pos

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L		L					L			
CO2	L								L		L	
CO3	H	H				M	M			H	L	
CO4	H		M									
CO5	H	H		H					H			

COURSE CONTENT:		
UNIT I	INTRODUCTION AND ONE-DIMENSIONAL FLOW	9
Introduction to Dynamics – Importance of Nonlinear Systems-1D Systems- Fixed points and Stability- Linear stability Analysis- Existence and Uniqueness- Potentials		
UNIT II	BIFURCATIONS IN 1 D SYSTEMS AND FLOWS ON CIRCLE	9
Saddle Node – Transcritical – Pitch Fork –Uniform/Non uniform Oscillator-examples		
UNIT III	2 D FLOWS	9
Linear Systems: Introduction – Example- Classification; Phase Plane: Introduction- Phase portraits-Existence and uniqueness-Linearization-Conservative System- Reversible System- Index Theory		
UNIT IV	LIMIT CYCLES AND BIFURCATION IN 2D	9
Introduction- Existence of Limit Cycle- Poincare Bendixson Theorem-Lienard Systems- Relaxation and Weakly Nonlinear Oscillator; Bifurcations: Saddle. Trans-critical, Pitch fork- Hopf Bifurcation-examples- Poincare Maps		
UNIT V	INTRODUCTION TO CHAOS	9
Lorenz Equation- Properties of Lorenz Equation-Chaos on Strange attractor- Lorenz Map- One dimensional Maps – Fixed Points and Cobweb – logistic map- Liapunov and Exponent.		
TOTAL: 45 PERIODS		
TEXT BOOKS:		
<ol style="list-style-type: none"> 1. “Introduction to Applied Nonlinear Dynamical Systems and Chaos” , Stephen Wiggins, 2nd Edition , Springer 2010 2. “Nonlinear Dynamics and Chaos with applications to Physics, Biology, chemistry and Engineering”, Steven H Strogatz, Indian Edition by Levant Books- 2007 		