ABDULLAH GÜL UNIVERSITY
SCHOOL OF ENGINEERING
ELECTRICAL-ELECTRONICS ENGINEERING PROGRAM
COURSE DESCRIPTION AND SYLLABUS

Course Title	Code	Semester	T+L Hours	Credit	ECTS
NONLINEAR DYNAMICS AND CHAOS	ECE-577	FALL-SPRING	3	3	7.5

Prerequisite Courses	none

Type	Elective
Language	English
Coordinator	
Instructor	Assoc. Prof. Dr. Günyaz Ablay
Adjunct	none
Aim	To give an opportunity to students for 1. learning the fundamentals of nonlinear systems 2. learning the chaos science 3. learning chaos applications 4. learning software tools for analysis and design of nonlinear systems
Learning Outcomes	Students who successfully complete this course will be able to • Understand the concept of nonlinear systems, • Understand the concept of equilibrium points, • Analyze the nonlinear systems through linearization, • Understand the concept of limit cycles, bifurcation diagrams, • Analyze apply chaos via software tools.
Course Content	• Introduction to nonlinear systems • First, second and higher order nonlinear systems • Analysis of equilibrium points • Existence and uniqueness theorem • Limit cycles • Bifurcation diagrams • Chaos • Chaos control • Chaos synchronization • Chaos applications

WEEKLY TOPICS AND PRELIMINARY STUDY

Week	Topic	Preliminary Study
1	Introduction to nonlinear systems: nonlinear modeling, examples	The relevant lecture notes
2	First-order nonlinear systems: vector fields	The relevant lecture notes
3	First- order nonlinear systems: bifurcation diagrams	The relevant lecture notes
4	Second-order nonlinear systems	The relevant lecture notes
5	Linearization of Equilibrium points	The relevant lecture notes
6	Existence and uniqueness theorem	The relevant lecture notes
7	Limit cycles, bifurcation diagrams for 2nd order systems	The relevant lecture notes
8	Midterm	
9	Chaos	The relevant lecture notes
10	Chaos control	The relevant lecture notes
11	Chaos synchronization	The relevant lecture notes
12	Chaos-based random number generations	The relevant lecture notes
13	Chaos-based secure communication	The relevant lecture notes
14	Final Exam	

SOURCES

Lecture Notes	Lecture notes and slides
Other Sources	**Course Textbook:** Steven Strogatz, Nonlinear Dynamics and Chaos, Westview Press, 2014.. **Additional Materials:**

	1. Stephen Lynch, Dynamical Systems with Applications using MATLAB, Springer Science+Business Media, 2004.

COURSE MATERIALS SHARING	
Documents	Lecture notes, slides
Homework	Students will be given one homework each week
Exams	1 Midterm and 1 Final Exam

EVALUATION SYSTEM		
SEMESTER STUDY	**NUMBER**	**CONTRIBUTION**
Midterm	2	25
Homework	14	25
Quiz	5	25
SUB-TOTAL		75
Contribution of Semester Study		75
Contribution of Final Exam	1	25
TOTAL		100

Course Category	
Sciences and Mathematics	30%
Engineering	70%
Social Sciences	0%

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS

No	Program Qualifications	Contribution Level				
		1	2	3	4	5
a	The skills of using mathematics, science and engineering information in advanced research,					**X**
b	The skills of analyzing, designing and/or implementing an original system that will be able to solve an engineering problem,					**X**
c	The skills of using the required software, hardware and modern measurement equipment in their field of research,					**X**
d	The skills of planning independent research and implementing in detail,					**X**
e	The skills of following literature, listening to and making technical presentation, writing a paper in academic level,					**X**
f	The skills of innovative and interrogative thinking and finding original solutions					**X**

*Increasing from 1 to 5.

ECTS / WORK LOAD TABLE

Activities	Number	Duration (Hours)	Total Work Load
Course Length (includes exam weeks: 16x total course hours)	14	3	42
Out-of-class Study Time (Pre-study, practice)	14	2	28
Internet search, library work, literature search	14	2	28
Quiz / Presentation	5	2	10
Homework	8	7	54
Midterm	1	27	27
Final Exam	1	36	36
Total Work Load			225
Total Work Load / 30			225/30
Course ECTS Credit			6