



## ÇANKAYA UNIVERSITY

### Faculty of Arts and Sciences

### Course Definition Form

#### Part I. Basic Course Information

Department Name	MATHEMATICS	Dept. Numeric Code	2   7	
Course Code	M   A   T   H   4   0   2	Number of Weekly Lecture Hours	3	
		Number of Weekly Lab/Tutorial Hours	0	
		Number of Credit Hours	3	
Course Web Site	http:// math402.cankaya.edu.tr		ECTS Credit	0   5

<b>Course Name</b> <i>This information will appear in the printed catalogs and on the web online catalog.</i>	
English Name	Dynamical Systems and Chaos
Turkish Name	Dinamik Sistemler ve Kaos

<b>Course Description</b> <i>Provide a brief overview of what is covered during the semester. This information will appear in the printed catalogs and on the web online catalog. Maximum 60 words.</i>	
One dimensional maps. Fixed points and stability. Periodic points. Sensitive dependence on initial conditions. Chaos. Lyapunov exponents. Chaotic orbits. Fractals. Cantor set. Deterministic systems. Fractal dimensions.	

<b>Prerequisites</b> (if any) <i>Give course codes and check all that are applicable.</i>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/> Consent of the Instructor		<input type="checkbox"/> Senior Standing	
	<input type="checkbox"/> Give others, if any. <input style="width: 100%;" type="text"/>			
<b>Co-requisites</b> (if any)	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Course Type</b> <i>Check all that are applicable</i>	<input type="checkbox"/> Must course for dept. <input type="checkbox"/> Must course for other dept.(s) <input checked="" type="checkbox"/> Elective course for dept. <input checked="" type="checkbox"/> Elective course for other dept.(s)			

<b>Course Classification</b> <i>Give the appropriate percentage for each category.</i>				
Category	Mathematics & Natural Sciences	Engineering & Architectural Sciences		
Percentage	80	20		

**Part II. Detailed Course Information****Course Objectives***Maximum 100 words.*

To learn a qualitative way of looking at complex systems and their evolution.

**Learning Outcomes***Explain the learning outcomes of the course. Maximum 10 items.*

- 1) The students will learn fixed points, periodic points, sinks and sources
- 2) The students will learn Stability and Sensitive dependence on initial conditions
- 3) The student will learn that deterministic systems can be chaotic and therefore unpredictable

**Textbook(s)***List the textbook(s), if any, and other related main course material.*

Author(s)	Title	Publisher	Publication Year	ISBN
K.T. Alligood, T.D. Sauer, J.A. Yorke,	Chaos -An Introduction to Dynamical Systems	Springer Verlag,	1996	978-0387946771

**Reference Books***List, if any, other reference books to be used as supplementary material.*

Author(s)	Title	Publisher	Publication Year	ISBN
Hilborn, Robert C.	Chaos and nonlinear dynamics : an introduction for scientists and engineers.	Oxford University Press	2000	0-19-850723-2

**Teaching Policy***Explain how you will organize the course (lectures, laboratories, tutorials, studio work, seminars, etc.)*

3 hours of lecturing per week. Attendance is compulsory.

**Laboratory/Studio Work***Give the number of laboratory/studio hours required per week, if any, to do supervised laboratory/studio work and list the names of the laboratories/studios in which these sessions will be conducted.***Computer Usage***Briefly describe the computer usage and the hardware/software requirements for the course.*

<b>Course Outline</b> <i>List the weekly topics to be covered.</i>	
Week	Topic(s)
1	One Dimensional Maps
2	Stability, Periodic Points
3	Logistic Maps
4	Two Dimensional Maps
5	Linear Maps
6	Nonlinear Maps, Stable and Unstable Manifolds
7	Chaos
8	Basins of Attraction
9	Fractals
10	Basin Boundaries
11	Fractal Dimension
12	Chaos in Two Dimensional Maps
13	Lyapunov Dimension
14	Horseshoe Map

<b>Grading Policy</b> <i>List the assessment tools and their percentages that may give an idea about their relative importance to the end-of-semester grade.</i>								
Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage
Homework			Case Study			Attendance		
Quiz(es)			Lab Work			Field Study		
Midterm Exam	2	50	Classroom Participation			Project		
Term Paper			Oral Presentation			Final Exam	1	50

<b>ECTS Workload</b> <i>List all the activities considered under the ECTS.</i>			
Activity	Quantity	Duration (hours)	Total Workload (hours)
Attending Lectures ( <i>weekly basis</i> )	14	3	42
Attending Labs/Recitations ( <i>weekly basis</i> )			
Compilation and finalization of course/lecture notes ( <i>weekly basis</i> )	14	1	14
Collection and selection of relevant material ( <i>once</i> )	1	5	5
Self study of relevant material ( <i>weekly basis</i> )	14	1	14
Take-home assignments			
Preparation for quizzes			
Preparation for mid-term exams ( <i>including the duration of the exams</i> )	2	15	30
Preparation of term paper/case-study report ( <i>including oral presentation</i> )			
Preparation of term project/field study report ( <i>including oral presentation</i> )			
Preparation for final exam ( <i>including the duration of the exam</i> )	1	20	20
<b>TOTAL WORKLOAD / 25</b>			<b>125/25</b>
<b>ECTS Credit</b>			<b>5</b>

Total Workloads are calculated automatically by formulas. To update all the formulas in the document first press CTRL+A and then press F9.

<b>Program Qualifications vs. Learning Outcomes</b> Consider the program qualifications given below as determined in terms of learning outcomes and acquisition of capabilities for all the courses in the curriculum. Look at the learning outcomes of this course given above. Relate these two using the Likert Scale by marking with X in one of the five choices at the right.						
No	Program Qualifications	Contribution				
		0	1	2	3	4
1	Adequate knowledge in mathematics; ability to use applied and theoretical information in these areas to solve pure and applied mathematical problems.				X	
2	Ability to use modern computational tools to analyze an abstract or real life problem				X	
3	Adequate knowledge in theoretical and historical background in mathematics				X	
4	Ability to work individually and in teams efficiently, ability to collaborate effectively in teams to analyze complex systems from intra-disciplinary and multi-disciplinary areas				X	
5	Ability to communicate effectively in English about technical subjects, both orally and in writing				X	
6	Ability to use, develop and implement new experiments and algorithms to solve scientific, engineering and financial problems				X	
7	Ability to analyze a mathematical problem using both analytical and numerical methods; use and compare theoretical and simulational methods to gain deeper insight				X	
8	Ability to report the findings, conclusions and interpretations related to a project in the area of pure and applied mathematics, ability to write technical reports, to prepare and conduct effective presentations				X	
9	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to keep continuous self improvement				X	
10	Awareness of professional and ethical responsibility issues and their legal consequences					X

Scale for contribution to a qualification: **0**-none, **1**-little, **2**-moderate, **3**-considerable, **4**-highest