ÇANKAYA UNIVERSITY
Faculty of Arts and Sciences
Course Definition Form

Part I. Basic Course Information

Department Name	MATHEMATICS					**Dept. Numeric Code**	27
Course Code	MATH371	**Number of Weekly Lecture Hours**	3	**Number of Weekly Lab/Tutorial Hours**	0	**Number of Credit Hours**	3
Course Web Site	http:// math371.cankaya.edu.tr					**ECTS Credit**	05

Course Name *This information will appear in the printed catalogs and on the web online catalog.*	
English Name	Introduction to Fractional Differential Equations
Turkish Name	Kesirli Diferensiyel Denklemlere Giriş

Course Description
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.

Mittlag-Leffler Functions; Riemann-Liouville fractional integrals and derivatives; Caputo fractional derivatives; Grünwald-Letnikov fractional derivative; Riesz fractional integro-differentiation ordinary differential equations; fractional Laplace transform; Cauchy type problems.

Prerequisites (if any) *Give course codes and check all that are applicable.*	1st	2nd	3rd	4th
	☐ Consent of the Instructor	☐ Senior Standing	☐ Give others, if any.	
Co-requisites (if any)	1st	2nd	3rd	4th
Course Type *Check all that are applicable*	☐ Must course for dept.	☐ Must course for other dept.(s)	☒ Elective course for dept.	☒ Elective course for other dept.(s)

Course Classification
Give the appropriate percentage for each category.

Category	Mathematics & Natural Sciences	Engineering & Architectural Sciences			
Percentage	80	20			

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Part II. Detailed Course Information

Course Objectives
Maximum 100 words.

To teach fundamental methods and techniques of the fractional calculus. To apply the fractional calculus to several problems of engineering and physical interest.

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

1) The students will learn the concepts of fractional derivative and integrals named Riemann-Liouville, Caputo, Grünwald-Letnikov and Riesz.
2) The students will study the fractional Laplace transform and its applications.
3) The students will study the fractional calculus Cauchy type problems.

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

Author(s)	Title	Publisher	Publication Year	ISBN
A.A. Kilbas, H.M. Srivastava, J.J. Trujillo	Theory and applications of fractional differential equations	Elsevier	2006	978-0-444-51832-3

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

Author(s)	Title	Publisher	Publication Year	ISBN
I. Podlubny	Fractional differential equations	Academic Press	1999	0-12-558840-2
R. Magin	Fractional calculus in bioengineering	Begell House	2006	1-56700-215-3
D. Baleanu, K. Diethelm, E. Scalas, J. J. Trujillo	Fractional calculus: models and numerical methods	World Scientific	2012	981-4355-20-8

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

3 hours of lecturing per week. Attendance to the lectures 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.

MATHEMATICA,MAPLE, MATLAB

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Course Outline
List the weekly topics to be covered.

Week	Topic(s)
1	Generalized functions
2	Classical Mittag-Leffler functions
3	Generalized Mittag-Leffler functions
4	Functions of the Mittag-Leffler type
5	Riemann-Liouville fractional integrals and fractional derivatives
6	Caputo fractional derivatives
7	Grünwald-Letnikov fractional derivative
8	Riesz fractional integro-differantiation
9	Ordinary fractional differential equations
10	The fractional Laplace transform method
11	Equivalence of the Cauchy type problem and the Volterra integral equation
12	Existence and uniqueness of the global solution to the Cauchy type problem
13	The Weighted Cauchy type problem
14	Review

Grading Policy
List the assessment tools and their percentages that may give an idea about their relative importance to the end-of-semester grade.

Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage
Homework	5	5	Case Study			Attendance		
Quiz(es)	5	5	Lab Work			Field Study		
Midterm Exam	2	40	Classroom Participation			Project		
Term Paper			Oral Presentation			Final Exam	1	50

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ECTS Workload
List all the activities considered under the ECTS.

Activity	Quantity	Duration (hours)	Total Workload (hours)
Attending Lectures (*weekly basis*)	14	3	42
Attending Labs/Recitations (*weekly basis*)			
Compilation and finalization of course/lecture notes (*weekly basis*)	14	1	14
Collection and selection of relevant material (*once*)	1	5	5
Self study of relevant material (*weekly basis*)	14	1	14
Take-home assignments	5	2	10
Preparation for quizzes	5	1	5
Preparation for mid-term exams (*including the duration of the exams*)	2	7.5	15
Preparation of term paper/case-study report (*including oral presentation*)			
Preparation of term project/field study report (*including oral presentation*)			
Preparation for final exam (*including the duration of the exam*)	1	20	20
		TOTAL WORKLOAD / 25	125/25
		ECTS Credit	**5**

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

Program Qualifications vs. Learning Outcomes *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

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