COURSE PROFILE

Course Name	Code	Semester	Term	Theory +PS+Lab. (hour/week)	Local Credits	ECTS
Differential Equations	MATH 220	Spring	4	3+2+0	4	7

Prerequisites	Math 101

Course Language	English
Course Type	Required
Course Lecturer	Prof. Dr. Serdal Pamuk
Course Assistant	Filiz Uçgun
Course Objectives	This course aims to teach fundamental tools of differential equations used to solve problems from linear and nonlinear mathematics and physics, including mathematical modelling.
Course Learning Outcomes	The students who succeeded in this course should be able to: • provide an understanding the concept of ODEs , • select the appropriate method to solve differential equations with constant coefficients , • understand the behavior of the solutions of differential equations with discontinuous non-homogeneous parts, use Laplace transforms to solve that kind of equations , • use power series to solve ODEs, • find the solutions of systems of first order linear equations .
Course Content	Basic definitions, first order differential equations, second order linear differential equations with constant coefficients. Systems of first order linear differential equations with constant coefficients, Laplace transforms and its applications to linear differential systems.Linear differential equations with variable coefficients, series solutions of second-order linear differential equations.

COURSE CONTENT

Week	Subjects	Related Preparation
1	**Introduction.** **First order differential equations.** Linear equations; Method of integrating factors, separable equations, exact equations.	Chapter 1.1, 1.3 Chapter 2.1, 2.2, 2.6
2	Existence and uniqueness **Second Order Linear Equations:** Homogeneous equations with constant	Chapter 2.8 Chapter 3.1, 3.2

	coefficients. Fundamental solutions of linear homogeneous equations.	
3	Linear Independence, Wronskian. Complex roots, repeated roots; Reduction of order.	Chapter 3.3, 3.4, 3.5
4	**Nonhomogeneous Equations;** Method of undetermined Coefficients. Variation of parameters.	Chapter 3.6,. 3.7
5	**Higher order Linear equations:** General theory, Homogeneous Equations with constant coefficients.	Chapter 4.1, 4.2
6	**Higher order Linear equations** Method of undetermined coefficients. Variation of parameters.	Chapter 4.3, 4.4
7	**The Laplace Transform:** Definitions. Initial value problems. Step functions.	Chapter 6.1, 6.2, 6.3, 6.4, 6.5
8	Differential equations with discontinuous forcing functions. Impulse functions	Chapter 6.4, 6.5
9	The convolution integrals. **Systems of First Order Linear Equations**: Review of matrices.	Chapter 6.6 Chapter 7.1, 7.2
10	Linear independence, eigenvalues, eigenvectors. Basic Theory.Homogeneous linear systems with constant coefficients. Real eingenvalues.	Chapter 7.3, 7.4, 7.5
11	Complex eigenvalues. Fundamental matrices. Repeated eingenvalues. Nonhomogeneous Linear Systems.	Chapter 7.6, 7.7, 7.8, 7.9
12	**Series Solutions:** Power series. Series Solutions near an ordinary point. Part I	Chapter 5.1, 5.2
13	Series Solutions near an ordinary point. Part II Regular singular points.	Chapter 5.3
14	Euler equation. Series solutions near a regular singular point, Part I.	Chapter 5.4, 5.5

Course Textbooks	William E. BOYCE & Richard C. DIPRIMA, *Elementary Differential Equations and Boundary Value Problems,* 9th edition, 2009, John Wiley & Sons, Inc.
Recommended References	All "Elementary Differential Equation" books.

Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	1	10
Laboratory	-	-
Application	-	-
Special Course Internship (Work Placement)	-	-

Quizzes/Studio Critics	3	5
Homework Assignments	5	-
Presentation	-	-
Project	-	-
Seminar/Workshop	-	-
Midterms/Oral Exams	1	35
Final/Resit Exam	1	50
Total	11	100

PERCENTAGE OF SEMESTER WORK	10	50
PERCENTAGE OF FINAL WORK	1	50
Total	11	100

Course Category	Core Courses	X
	Major Area Courses	
	Supportive Courses	
	Media and Managment Skills Courses	
	Transferable Skill Courses	

COURSE'S CONTRIBUTION TO PROGRAM

#	**Program Qualifications / Outcomes**	*** Level of Contribution**				
		1	2	3	4	5
1	To have a grasp of basic mathematics, applied mathematics and theories and applications of statistics.					X
2	To be able to use theoretical and applied knowledge acquired in the advanced fields of mathematics and statistics,					X
3	To be able to define and analyze problems and to find solutions based on scientific methods,					X
4	To be able to apply mathematics and statistics in real life with interdisciplinary approach and to discover their potentials,				X	
5	To be able to acquire necessary information and to make modeling in any field that				X	

	mathematics is used and to improve herself/himself,					
6	To be able to criticize and renew her/his own models and solutions,					X
7	To be able to tell theoretical and technical information easily to both experts in detail and nonexperts in basic and comprehensible way,				X	
8	To be able to use international resources in English and in a second foreign language from the European Language Portfolio (at the level of B1) effectively and to keep knowledge up-to-date, to communicate comfortably with colleagues from Turkey and other countries, to follow periodic literature,				X	
9	To be familiar with computer programs used in the fields of mathematics and statistics and to be able to use at least one of them effectively at the European Computer Driving Licence Advanced Level,					
10	To be able to behave in accordance with social, scientific and ethical values in each step of the projects involved and to be able to introduce and apply projects in terms of civic engagement,					
11	To be able to evaluate all processes effectively and to have enough awareness about quality management by being conscious and having intellectual background in the universal sense,					
12	By having a way of abstract thinking, to be able to connect concrete events and to transfer solutions, to be able to design experiments, collect data, and analyze results by scientific methods and to interfere,				X	
13	To be able to continue lifelong learning by renewing the knowledge, the abilities and the compentencies which have been developed during the program, and being conscious about lifelong learning,					
14	To be able to adapt and transfer the knowledge gained in the areas of mathematics and statistics to the level of secondary school,				X	
15	To be able to conduct a research either as an individual or as a team member, and to be effective in each related step of the project, to take role in the decision process, to plan and manage the project by using time effectively.					

*1 Lowest, 2 Low, 3 Average, 4 High, 5 Highest

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	**Number**	**Duration (Hours)**	**Total Workload**
Course Hours (Including Exams)	14	3	42
Tutorials	14	2	28

Laboratory	-	-	-
Application	-	-	-
Special Course Internship (Work Placement)	-	-	-
Field Work	-	-	-
Study Hours Out of Class	14	2	28
Presentations / Seminar	-	-	-
Project	-	-	-
Preparatory reading	13	1	13
Homework Assignments	5	2	10
Quizzes	3	7	21
Midterm Exams	1	15	15
Final / Resit Exam	1	18	18
		Total Workload	**175**

COURSE CATEGORY

ISCED GENERAL AREA CODES	**GENERAL AREAS**	**ISCED BASİC AREA CODES**	**BASIC EDUCATIONAL AREAS**	
1	Education	14	Teacher Training and Educational Sciences	0
2	Humanities and Art	21	Art	0
2	Humanities and Art	22	Humanities	0
3	Social Sciences, Management and Law	31	Social and Behavioral Sciences	0
3	Social Sciences, Management and Law	32	Journalism and Informatics	0
3	Social Sciences, Management and Law	38	Law	0
4	Science	42	Life Sciences	0
4	Science	44	Natural Sciences	0
4	Science	46	Mathematics and Statistics	100

4	Science	48	Computer	0
5	Engineering, Manufacturing and Civil	52	Engineering	0
5	Engineering, Manufacturing and Civil	54	Manufacturing and Processing	0
5	Engineering, Manufacturing and Civil	58	Architecture and Structure	0
6	Agriculture	62	Agriculture, Forestry, Livestock, Fishery	0
6	Agriculture	64	Veterinary	0
7	Medicine and Welfare	72	Medical	0
7	Medicine and Welfare	76	Social Services	0
8	Service	81	Personal Services	0
8	Service	84	Transport Services	0
8	Service	85	Environment Protection	0
8	Service	86	Security Services	0