COURSE PROFILE

Course Name	Code	Semester	Term	Theory +PS+Lab. (hour/week)	Local Credits	ECTS
Multivariable Calculus and Differential Equations	MATH 203	Fall	3	4+1+0	4	7

Prerequisites	Math 102

Course Language	English
Course Type	Required
Course Lecturer	Asst. Prof. Handan Borluk
Course Assistant	Hazel Bayıntır
Course Objectives	This course aims • to provide basic theory and applications of multivariable calculus and its extentions to mathematical analysis, • to teach fundamental tools of differential equations used to solve problems from linear and nonlinear mathematics and physics.
Course Learning Outcomes	The students who succeeded in this course should be able to; • Demonstrate the abilities for solving mathematical problems that depend on more than one variables, • Solve various engineering problems which require knowledge of multivariable functions**,** • 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 , • find the solutions of systems of first order linear equations .
Course Content	• Functions of several variables. Partial derivatives, directional derivatives, Lagrange multipliers. Double integrals in Cartesian and polar coordinates, triple integrals in Cartesian, cylindrical and spherical coordinates, line integrals, Green's theorem, surface integrals, Stokes' theorem, divergence theorem. • 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.

COURSE CONTENT

Week	Subjects	Related Preparation
1	**Partial Derivatives:** Functions of several variables. Partial derivatives. The Chain Rule, implicit differentiation.	**Ref.I.: 14**- 1,3,4
2	Directional derivatives and gradient vectors. Tangent planes, linearization and differentials, total differential.	**Ref.I: 14-** 5,6
3	Extreme values and saddle points. Second derivative test. Lagrange multipliers. **Multiple integrals:** Double integral.	**Ref.I: 14**-7,8 **15**-1,2
4	**Multiple integrals:** Area by double integrals. Double integrals in polar forms.	**Ref.I.: 15**- 3,4,5
5	Triple integrals in rectangular coordinates, Triple integrals in cylindrical and spherical coordinates.	**Ref.I: 15**-5,7
6	Substitution in triple integrals. **Integration in Vector Fields**: Line integrals, Vector fields and Line integrals.	**Ref.I: 15**-8 **16**- 1,2
7	Path independence, potential functions, conservative fields, curl of a vector field. Green's theorem in the plane.	**Ref.I: 16-** 3
8	Surface and area. Surface integrals. Stokes theorem. Divergence Theorem.	**Ref.I: 16**- 5,6,7,8
9	**First Order Differential Equations:** Linear Equations, Method of integrating factors, separable equations. Exact equations and integrating factors. **Second Order Linear Equations:** Homogeneous equations with constant coefficients. Solutions of linear homogeneous equations; the Wronskian.	**Ref. II**: **2**-1,2,6 **3**-1,2
10	Complex roots of the characteristic equation. Repeated roots; reduction of order. **Nonhomogeneous Equations;** Method of undetermined coefficients.	**Ref. II: 3**-3,4,5
11	Variation of parameters. **Higher order Linear equations:** Homogeneous Equations with constant coefficients, Nonhomogeneous Equations. Method of undetermined coefficients. Variation of parameters	**Ref. II: 3**- 6 **4**-1,2,3,4
12	**The Laplace Transform:** Definitions. Initial value problems. Step functions. Discontinuous forcing functions. Differential equations with discontinuous forcing functions.	**Ref. II: 6**-1,2
13	Impulse functions. The convolution integrals. **Systems of First Order Linear Equations**: Linear independence, eigenvalues, eigenvectors. Linear Systems with constant coefficients.	**Ref. II: 6**-5,6 **7**-3,4,5
14	Complex eigenvalues, Fundamental matrices, Repeated eigenvalues. Non-homogeneous Linear Systems.	**Ref. II: 7**-6,7,8,9

Course Textbooks	**Ref. I:** (weeks 1-8) *Thomas' Calculus, 12th Edition (Early Transcendentals)*. Thomas, Weir, Hass, Addison- Wesley, 2010. **Ref. II:** (week 9-15), *Elementary Differential Equations and Boundary Value Problems,* 9th Edition, John Wiley & Sons. W.E. Boyce and R.C. Diprima, 2009.
Recommended References	Calculus with analytic geometry / C.H. Edwards, Jr., David E. Penney. Englewood Cliffs, N.J., Prentice Hall, c1994. 4th ed. Calculus with analytic geometry / Howard Anton; in collaboration with Albert Herr. New York, Wiley, c1995. 5th ed. All "Elementary Differential Equation" books.

Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	1	-
Laboratory	-	-
Application	-	-
Special Course Internship (Work Placement)	-	-
Quizzes/Studio Critics	-	-
Homework Assignments	5	-
Presentation	-	-
Project	-	-
Seminar/Workshop	-	-
Midterms/Oral Exams	2	60
Final/Resit Exam	1	40
Total	9	100

PERCENTAGE OF SEMESTER WORK	8	60
PERCENTAGE OF FINAL WORK	1	40
Total	9	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 mathematics is used and to improve herself/himself,				X	
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					X

	methods and to interfere,					
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	4	56
Tutorials	14	1	14
Laboratory	-	-	-
Application	-	-	-
Special Course Internship (Work Placement)	-	-	-
Field Work	-	-	-
Study Hours Out of Class	14	2	28
Presentations / Seminar	-	-	-
Project	-	-	-
Preparatory reading	13	2	26
Homework Assignments	5	2	10
Quizzes	-	-	-
Midterm Exams	2	13	26
Final / Resit Exam	1	15	15
		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