2024

YEDİTEPE UNIVERSITY

FACULTY OF ARTS AND SCIENCES

UNDERGRADUATE PROGRAM IN MATHEMATICS

INFORMATION PACKET

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FACULTY OF ARTS AND SCIENCES UNDERGRADUATE PROGRAM IN MATHEMATICS

INFORMATION PACKAGE (2024)

History: Founded in 1996.

Qualification Awarded: The Bachelor's Degree in Mathematics is awarded to the graduates who have successfully completed all courses in the curriculum.

Level of Qualification: First Cycle

Specific Admission Requirements: The general requirements explained in "General Admission Requirements" of Information on the Institution part are applied for admission of students.

Specific Arrangements for Recognition of Prior Learning (Formal, Non-Formal and In-formal):

The rules and regulations for recognition of formal prior learning are well defined. Transfer can be made among the institutions of which equivalency is recognized by Higher Education Council. Also successful vocational school graduates continue their education to obtain Bachelor's degrees if they are successful in the selection and the placement examination (DGS, i.e. vertical transfer examination) are admitted. The courses to be taken by these students are determined by the relevant department, on the basis of courses they have completed in the programs from which they have graduated. Recognition of prior non-formal and in-formal learning is at the beginning stage in Turkish Higher Education Institutions. Yeditepe University and hence of the Department is not an exception to this.

Qualification Requirements and Regulations:

Students must obtain a grade point average of at least 2.00 out of 4.00 and successfully pass all courses on the programme. (equivalent to a total 240 ECTS).

Profile of the Programme:

Our vision is to form a department, which is highly esteemed by its quality of education both at national and international levels, which renovates itself incessantly according to contemporary progress, and which provides a medium for scientific research at international standards.

Main Perspectives of Undergraduate Education

1. Providing courses on basic notions of mathematics such as limit, derivative, integral calculus, logic, linear algebra and discrete mathematics,

2. Providing fundamental courses on fundamental sub disciplines and research topics of mathematics such as analysis, algebra, differential equations and differential geometry,

3. Supporting students' formation of their pwn academic career and future plans by providing a wide range of selected courses portfolio on mathematics and related fields under the supervision of their advisors for choosing and forming their selective courses curriculum.

4. Supporting the development of students' knowledge and skills in non-professional areas, and consciousness of professional and social ethics,

5. Supporting the development of students' ability to become individuals who could make interdisciplinary work and communicate actively,

6.Supporting students`ability to access information and use information technologies,

7.Supporting students`ability to transform their academic and social identity acquired during their undergraduate education into a lifelong learning process.

Occupational Profiles of Graduates:

A graduate of the Mathematics program has job opportunities in the following areas:

- at departments of organizations for computing and planning which provides services in any field of activity
- at firms which specializing in topics such as programming, system analysis
- at banking and insurance sector
- at institutions of stock market, financial and capital market instruments
- at institutions of education
- at universities as an academician

Access to Further Studies:

The graduates holding Bachelor's Degrees are eligible to apply to Master's Degree programmes at national level and/or international level both in the same and in related disciplines.

Examination Regulations, Assessment and Grading:

Students are required to take a mid-term examination and/or complete other assigned projects/homework during the semester and, additionally, are required to take a final examination and/or complete a final project of course evaluation. The assessment for each course is described in detail in "Individual Course Description".

Course Grade	Grade Points
AA	4.0
BA	3.5
BB	3.0
CB	2.5
CC	2.0
DC	1.5
DD	1.0
FA	0.0 Unsuccessful (For unattended students)
FF	0.0 Unsuccessful

Other Grades:

I: Incomplete is given to a student who provides supporting evidence through genuine and valid documentation of illness or other reason which has prevented her/him form completing the necessary course work. In such a case, within 15 days form the day of submitting the grades to the Registrar's Office, the student required complete the missing work and obtain a grade. Otherwise, the I grade will automatically become an F

L: Leave

P: Pass is given to students who are successful in taking non-credit courses.

X: In Progress is used when the work of a student is a course extends past the time for reporting grades.

T: Transfer is given to courses accepted as equivalents in transfers form other universities.

W: Withdrawal is given if a student withdraws from a course after the add/drop period within the first 10 weeks after the semester starts, with the recommendation of her/his advisor and the permission of the instructor concerned.

NC: Non-Credit is given to the students who are successful in non-credit courses.

ND: Non-Degree is given to an applicant who wishes to take graduate courses but does not wish to be in a degree programme may request admission on a non-degree basis.

R: Repeat

RR: Repeat resigned

Graduation Requirements:

Graduation requirements are explained in the section "Qualification Requirements and Regulations".

Mode of Study: Full-Time

Address, Programme Director or Equivalent:

Head of Mathematics Department: Assoc. Prof. Dr. İlknur Kuşbeyzi Aybar,

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Tel : 0 216 578 0671, Fax: 0 216 578 0672

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İnönü Mah., Kayışdağı, 34755, ATAŞEHİR, İSTANBUL, TÜRKİYE

Facilities:

In the Mathematics Major Programme there are 2 professors, 1 associate professor and 8 assistant professors.

There is one computer per each person in each office and a common printer for the department to which all the computers are connected.

Our students can reach the sources they need through the computer by the database of the library of the university and the written articles by the library. Yeditepe University that was established in 1996 owns a library in the Rectorate building, that serves over an area of 6000 square meters and with 400 seats.

There are computer terminals at various places which are open to the students. In our department there is a seminar room and a computer lab where 6 machines are for the use of our students.

The "Graduate, Ph. D. and unified Ph. D." programmes in Mathematics provide students with the possibility of continuing their academic careers.

There are also "double major programmes" between Mathematics and one of the following Departments, provided that the GPA of the student is sufficient: Computer Eng., Electrical and Electronics Eng., Physics and Mathematics Education.

In the framework of the "Erasmus students exchange programme" we also have relationships with some European universities such as Leiden University (Germany), University of Loughborough (UK) open to our Mathematics major students.

Program Learning Outcomes:

PLO1. The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)

PLO2. Acquiring fundamental knowledge on fundamental research fields in mathematics,

PLO3. Ability form and interpret the relations between research topics in mathematics,

PLO4. Ability to define, formulate and solve mathematical problems,

PLO5. Consciousness of professional ethics and responsibility,

PLO6. Ability to communicate actively,

PLO7. Ability of self-development in fields of interest,

PLO8. Ability to learn, choose and use necessary information technologies,

PLO9. Lifelong education

Course Structure Diagram with Credits:

		FIRST SEMESTER	T	L	U	Y	E
MATH	101	Introduction to Set Theory and Logic	3	0	2	**4**	**7**
MATH	111	Analytical Geometry	3	0	2	**4**	**7**
MATH	155	Analysis I	3	0	2	**4**	**8**
PHYS	101	Physics I	3	2	0	**4**	**6**
TKL	201	Turkish I	2	0	0	**2**	**2**
						18	**30**

		SECOND SEMESTER	T	L	U	Y	E
MATH	102	Basic Algebraic Structures	3	0	2	**4**	**7**
MATH	158	Combinatorics	2	0	2	**3**	**7**
MATH	156	Analysis II	3	0	2	**4**	**8**
PHYS	102	Physics II	3	2	0	**4**	**6**
TKL	202	Turkish II	2	0	0	**2**	**2**
						17	**30**

		THIRD SEMESTER	T	L	U	Y	E
MATH	245	Ordinary Differential Equations	3	0	2	**4**	**7**
MATH	255	Calculus III	3	0	2	**4**	**7**
MATH	231	Linear Algebra I	3	0	2	**4**	**7**
MATH	201	Mathematical Software I	3	0	0	**3**	**6**
HUM	103	Humanities	2	0	0	**2**	**3**
						17	**30**

		FOURTH SEMESTER	T	L	U	Y	E
MATH	212	Differential Geometry	2	0	2	**3**	**6**
MATH	252	Real Analysis I	3	0	2	**4**	**7**
MATH	232	Linear Algebra II	3	0	2	**4**	**7**
MATH	202	Mathematical Software II	3	0	0	**3**	**6**
XXX	XXX	Free Elective I	3	0	0	**3**	**4**
						17	**30**

		FIFTH SEMESTER	T	L	U	Y	E
MATH	357	Complex Analysis	3	0	2	**4**	**7**
MATH	321	Introduction to Group Theory	2	0	2	**3**	**6**
MATH	325	Number Theory	3	0	0	**3**	**6**
DEPT	XXX	Departmental Elective I	3	0	0	**3**	**7**
XXX	XXX	Free Elective II	3	0	0	**3**	**4**
						16	**30**

		SIXTH SEMESTER	T	L	U	Y	E
MATH	362	Mathematical Probability	2	0	2	**3**	**6**
MATH	322	Abstract Algebra	2	0	2	**3**	**6**
MATH	343	Partial Differential Equations	2	0	2	**3**	**6**
DEPT	XXX	Departmental Elective II	3	0	0	**3**	**7**
XXX	XXX	Free Elective III	3	0	0	**3**	**5**
						15	**30**

		SEVENTH SEMESTER	T	L	U	Y	E
MATH	439	Metric and Topological Spaces	2	0	2	**3**	**7**
MATH	491	Senior Project and Seminar	3	0	0	**3**	**7**
HTR	301	History of Turkish Revolution I	2	0	0	**2**	**2**
DEPT	XXX	Departmental Elective III	3	0	0	**3**	**7**
DEPT	XXX	Departmental Elective IV	3	0	0	**3**	**7**
						14	**30**

		EIGHTH SEMESTER	T	L	U	Y	E
MATH	456	Functional Analysis	2	0	2	**3**	**9**
HTR	302	History of Turkish Revolution II	2	0	0	**2**	**2**
DEPT	XXX	Departmental Elective V	3	0	0	**3**	**7**
DEPT	XXX	Departmental Elective VI	3	0	0	**3**	**7**
XXX	XXX	Free Elective IV	3	0	0	**3**	**5**
						14	**30**

Course & Program Learning Outcomes:

	PLO1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9
MATH 101	1	3	5	5	5	3	5	1	5
MATH 102	5	5	5	5	2	1	3	1	3
MATH 111	1	2	5	4	3	3	4	1	3
MATH 155	5	5	5	5	3	0	5	0	3
MATH 156	5	5	5	5	3	0	5	0	3
MATH 158	5	1	1	4	4	1	5	1	4
MATH 201	2	5	5	5	3	3	4	3	3
MATH 202	2	5	5	5	3	3	4	3	3
MATH 212	2	5	5	5	3	3	4	3	3
MATH 231	5	5	5	4	5	3	5	5	5
MATH 232	5	5	5	4	5	3	5	5	5
MATH 245	3	4	3	2	1	1	5	1	3
MATH 252	5	5	5	5	3	3	4	3	3
MATH 255	5	5	5	5	3	3	5	0	0
MATH 321	3	5	5	5	5	2	5	3	5
MATH 322	3	5	5	5	5	2	5	3	5
MATH 325	3	5	5	5	5	3	5	2	5
MATH 343	1	5	4	4	4	1	4	1	3
MATH 357	3	4	5	5	5	4	4	4	5

MATH 362	5	5	3	5	2	3	3	3	4
MATH 439	5	5	5	5	3	3	5	1	3
MATH 456	5	5	5	5	3	3	5	1	3
MATH 491	5	5	5	5	5	5	4	5	5
PHYS 101	4	2	2	4	3	3	4	2	4
PHYS 102	4	2	2	4	3	3	4	2	4
HUM 103	0	0	0	0	3	3	4	0	4
TKL 201	0	0	0	0	3	5	4	0	4
TKL 202	0	0	0	0	3	5	4	0	4
HTR 301	0	0	0	0	3	3	4	0	4
HTR 302	0	0	0	0	3	3	4	0	4
MATH 311	1	4	4	4	4	1	4	1	3
MATH 344	1	4	4	4	4	1	4	1	3
MATH 346	5	4	3	2	4	4	3	3	4
MATH 348	5	2	2	5	4	4	4	2	5
MATH 353	5	5	5	5	3	3	4	3	3
MATH 355	5	5	5	5	3	3	4	3	3
MATH 365	5	2	3	5	3	1	5	4	4
MATH 411	3	5	5	5	3	3	4	3	5
MATH 413	3	5	5	5	5	3	5	2	5
MATH 416	3	5	5	5	5	3	5	2	5

MATH 422	3	5	5	5	5	3	5	2	5
MATH 423	3	5	5	5	5	2	5	3	5
MATH 424	4	5	5	5	3	3	4	3	3
MATH 425	1	5	5	4	4	4	5	1	5
MATH 426	4	5	5	5	3	3	4	3	3
MATH 427	5	5	5	5	4	3	5	5	3
MATH 440	5	5	5	5	3	3	5	3	3
MATH 441	1	5	5	4	4	4	5	1	5
MATH 453	1	5	5	4	4	4	5	1	5
MATH 454	4	3	5	5	3	3	5	3	3
MATH 462	5	5	5	4	4	4	5	1	5

0: Not supported

3: Moderately supported

5: Supported by an advanced level.

Course Categories:

Course Categories	ECTS
Support courses	
PHYS101 Physics I	6
PHYS102 Physics II	6
Free Elective I	4
Free Elective II	4
Free Elective III	5
Free Elective IV	5
Total	**30**
Core Courses	
MATH101 Introduction to Set Theory and Logic	7
MATH102 Basic Algebraic Structures	7
MATH111 Analytical Geometry	7
MATH155 Analysis I	8
MATH156 Analysis II	8
MATH158 Combinatorics	7
MATH231 Linear Algebra I	7
MATH232 Linear Algebra II	7
MATH255 Calculus III	7
Total	**65**
Expertise/ Field Courses	
MATH201 Mathematical Software I	6
MATH202 Mathematical Software II	6
MATH212 Differential Geometry	6
MATH245 Ordinary Differential Equations	7
MATH252 Real Analysis I	7
MATH321 Introduction to Group Theory	6
MATH322 Abstract Algebra	6
MATH325 Elementary Number Theory	6
MATH343 Partial Differential Equations	6
MATH357 Complex Analysis	7
MATH362 Mathematical Probability	6

MATH439 Metric and Topological Spaces	7
MATH456 Functional Analysis	9
MATH491 Senior Project and Seminar	7
MATHXXX Mathematics Elective I	7
MATHXXX Mathematics Elective II	7
MATHXXX Mathematics Elective III	7
MATHXXX Mathematics Elective IV	7
MATHXXX Mathematics Elective V	7
MATHXXX Mathematics Elective VI	7
Total	**134**
Humanities, Communication and Management Skills Courses	
HUM103 Humanities	3
TKL201 Turkish I	2
TKL202 Turkish II	2
HTR301 History of Turkish Revolution I	2
HTR302 History of Turkish Revolution II	2
Total	**11**
Total ECTS of all courses	**240**

Mathematics Department`s Teaching & Learning Methods:

Teaching Methods	Main Learning Activities	Teaching aids
1-Lecture	Listening and information processing	Standard classroom technologies, multimedia devices, projector, computer, overhead projector
2-Problem Solving	Set special skills	
3-Question-Answer	Listening and information processing, observing/analyzing cases, critical thinking, generating questions, team work	Standard classroom technologies, multimedia devices, projector, computer, overhead projector
4-Assignment	Research – life-long learning, writing, reading, IT	Online databases, library databases, e-mail
5-Quiz		
6-Oral Exam	Research – life-long learning, analyzing cases, generating questions, interpreting, presenting	

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
INTRODUCTION TO SET THEORY AND LOGIC	MATH 101	1	3 + 2	4	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To teach the usage of analytical tools for mathematical thinking.
Content	Propositional and predicate calculus. Introduction to logic. Methods of proof. Axioms of set theory. Cartesian product, relations and functions. Partial and total orderings. Finite, countable and uncountable sets.

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Thinks like a mathematician.		1,2,3,4	A
2) Applies laws of logic in reasoning.		1,2,3,4	A
3) Tests the validity of an argument by using laws of logic.		1,2,3,4	A
4) Identifies the properties of a given function, relation or an ordering.		1,2,3,4	A
5) Understands that there are different sizes of infinity.		1,2,3,4	A
6) Applies set theory axioms to deduce results about denumerable and uncountable sets.		1,2,3,4	A

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Basic connectives and truth tables	Textbook

2	Logical equivalence: The laws of logic	Textbook
3	Logical implication: The rules of inference	Textbook
4	The use of quantifiers	Textbook
5	Formal thinking: Methods of proof	Textbook
6	Sets, operations on sets	Textbook
7	Ordered pairs and Cartesian product	Textbook
8	Relations	Textbook
9	Ordering relations	Textbook
10	Equivalence relations	Textbook
11	Functions	Textbook
12	Equinumerous sets, Finite sets	Textbook
13	Countable sets	Textbook
14	Uncountable sets	Textbook

RECOMMENDED SOURCES	
Textbook	*Intro. to Mathematical Structures, Steven Galovich. HBJ*
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes	-	-
Assignments	-	-
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics			x		
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems					x
5	Consciousness of professional ethics and responsibilty					x
6	Ability to communicate actively			x		
7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	10	20
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	15	15
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
BASIC ALGEBRAIC STRUCTURES	MATH 102	2	3+2	4	7

Prerequisites	MATH 101

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To introduce basic algebraic structures and proof techniques
Content	Algebraic structures, integers, rings, fields, groups, homomorphisms and isomorphisms, natural numbers and their properties, rational numbers, real numbers and their properties, complex numbers.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Fasciliates abstract thinking	1,2	A
2) Learns proof techniques	1,2	A
3) Recognizes algebraic structures	1,2	A
4) Interprets relations between algebraic structures	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Review of algebraic structures	Textbook
2	Algebraic properties of integers	Textbook
3	Rings	Textbook
4	Fields	Textbook
5	Groups	Textbook
6	Homomorphisms and isomorphisms	Textbook
7	Natural numbers	Textbook

8	Arithmetic and ordering properties of natural numbers	Textbook
9	Integers	Textbook
10	Rational numbers	Textbook
11	Real numbers	Textbook
12	Algebraic and ordering properties of real numbers	Textbook
13	Complex Numbers	Textbook
14	Complex Numbers	Textbook

RECOMMENDED SOURCES	
Textbook	*Intro. to Mathematical Structures, Steven Galovich. HBJ.*
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x

3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems					x
5	Consciousness of professional ethics and responsibilty		x			
6	Ability to communicate actively	x				
7	Ability of self-development in fields of interest			x		
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education			x		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	10	20
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	15	15
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ANALYTICAL GEOMETRY	MATH 111	1	3 + 2	4	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To give the concepts of vectors and most fundamental analytic geometry (in two and three dimensions) together with some of their properties.
Content	Vectors, linear operations with vectors. Products of vectors. Definition of Euclidean space. Lines and planes. Circle and sphere. Parametrizations of curves and surfaces. Conics and quadrics, their symmetries and classifications. Translations, orthogonal transformations, similarities and inversions.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) calculate vectors and matrices	1,2,5	A,B,C
2) solve the problems about lines and planes	1,2,5	A,B,C
3) define conics and obtain canonic equations	1,2,5	A,B,C
4) find the tangent planes of quadratic planes	1,2,5	A,B,C
5) describe quadratic planes with canonic equations	1,2,5	A,B,C
6) reduce the general quadratic equations to canonic form	1,2,5	A,B,C

Teaching Methods:	1: Lecture, 2: Problem Solving 5: Quiz
Assessment Methods:	A: Written examination, B: Homework, C: Quiz

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	points, oriented segments, parallel translation, vectors, collinear and coplanar vectors,	Textbooks
2	linear operations with vectors, linear dependence, coordinates of vectors and points.	Textbooks
3	scalar(dot) product of vectors, projection, direction cosines, cosine	Textbooks

	theorem. Vector product, orientation of plane,	
4	Lagrange identity, area, collinear points, triple (mixed) product,	Textbooks
5	volume, double vector product. A definition of affine and Euclidean spaces.	Textbooks
6	curves and surfaces, parametric, explicit and implicit equations, geometric locus. Equations of straight lines and planes, normal vectors.	Textbooks
7	geometric problems with lines and planes. Menelaos and Ceva theorems. Intersections, angles, skew lines, distances, pencils.	Textbooks
8	review and midterm exam,	Textbooks
9	circles and spheres, parametric equations, polar, cylindrical and spherical coordinates,	Textbooks
10	intersection with a line, secant and tangent, normal, polar line and plane.	Textbooks
11	conics: canonical equation of ellipse and hyperbola, focuses and vertices, asymptotes. Directrix, eccentricity, parabola. Parametric equations.	Textbooks
12	quadrics: ellipsoid of revolution, hyperboloids, asymptotic cone, elliptic and hyperbolic paraboloids,	Textbooks
13	conics and quadrics: affine classification theorem of Gauss.	Textbooks
14	review and midterm exam	Textbooks

RECOMMENDED SOURCES	
Textbook	I. Vaisman, “Analytical Geometry” H. İ. Karakaş, “Analytic Geometry”
Additional Resources	V. Gutenmacher and N. B. Vasilyev, Lines and Curves, Birkhauser 2004, QA 459.G983 2004. C. B. Boyer, History of Analytic Geometry, Dover 1956, QA 551.B813 2004. There are chapters on several books named "calculus and analytical geometry".

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	X				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics		X			
3	Ability form and interpret the relations between research topics in mathematics					X
4	Ability to define, formulate and solve mathematical problems				X	
5	Consciousness of professional ethics and responsibilty			X		
6	Ability to communicate actively			X		
7	Ability of self-development in fields of interest				X	
8	Ability to learn, choose and use necessary information technologies	X				
9	Lifelong education			X		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	10	20
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	15	15
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ANALYSIS I	MATH 155	1	3 + 2	4	8

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To teach the students the concepts of limits, derivatives and integrals of functions of a single variable and have them maintain the ability to make calculations in these issues, which are the fundamental knowledge that is necessary for main research areas in mathematics.
Content	Introduction to calculus, sequences, series, convergence. Functions limits and derivatives. Differentiation rules, the chain rule, implicit differentiation, linear approximations. Applications of differentiation, minimum and maximum values, shapes of curves, optimization, applications to business and economics.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Learns the concept of limit, continuity	1,2	A
2) Learns the concept of convergence of sequences and series	1,2	A
3) Evaluates derivatives	1,2	A
4) Uses derivative to find extremum	1,2	A
5) Uses L'Hospital rule to evaluate limits	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	Introduction to Calculus	
2	Sequences, Series, Limit	
3	Functions, Composition of Functions, Inverse Functions	
4	Exponential Functions and Logarithms	
5	Trigonometric Functions	
6	The Limit of a function, Calculating limits using limit Laws	
7	Continuity, Limits involving infinity	
8	Tangents, Velocities, and Other Rates of Change, Derivatives, The Derivative as a Function	
9	What Does f' say about f? Derivatives of Polynomials and Exponential Functions,The Product and Quotient Rules	
10	Derivatives of Trigonometric Functions, The Chain Rule	
11	Implicit Differentiation, Derivatives of Logarithmic Functions ,Linear Approximations , Taylor Polynomial	
12	Maximum and Minimum Values	
13	Graphing with Calculus and Calculators	
14	Intermediate Forms and L' Hospital's Rule, Optimization Problems, Applications to Business and Economics	

RECOMMENDED SOURCES	
Textbook	Calculus, Concepts & Contexts by James Stewart, 7th edition.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Quizzes	0	0
Assignments	0	0

Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE	1	60
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					**X**	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					**X**	
3	Ability form and interpret the relations between research topics in mathematics					**X**	
4	Ability to define, formulate and solve mathmatical problems					**X**	
5	Consciousness of professional ethics and responsibilty			**X**			
6	Ability to communicate actively			**X**			
7	Ability of self-development in fields of interest					**X**	
8	Ability to learn, choose and use necessary information technologies	**X**					
9	Lifelong education			**X**			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms (Including self study)	1	20	20
Quizzes			
Assignments			
Final examination (Including self study)	1	25	25
Total Work Load			199
Total Work Load / 25 (h)			7,99
ECTS Credit of the Course			8

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ANALYSIS II	MATH 156	2	3 +2	4	8

Prerequisites	MATH 155

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To teach integration techniques and some applications of integrals such as calculating areas and volumes. To teach sequences and series and their convergence and divergence.
Content	General review. Integrals; Fundamental theorem of calculus, integration by parts, approximate integration, improper integrals. Applications of integration; Areas, volumes,arc lenght, average value of a function, other applications. Infinite sequences and series; sequences, series, convergence tests, representations of functions as power series Taylor and Maclaurin series.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Evaluates the integrals of functions of single variable.	1,2	A
2) Uses integrals to evaluate areas and volumes.	1,2	A
3) Learns the notion of convergence of a series.	1,2	A
4) Represents some functions with power series.	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Definite integral and indefinite integral	

2	Fundamental theorem of calculus, substitution, integration by parts	
3	Trigonometric substitutions, integrals of rational functions	
4	Areas of plane regions, improper integral	
5	Volume, arclength and surface area	
6	The algebraic and order properties of real numbers	
7	The completeness property. applications of the supremum property	
8	Sequences and their limits , limit theorems for sequences	
9	Monotone sequences, subsequences and the Bolzano-Weierstrass theorem .	
10	Cauchy sequences, the Cauchy criterion	
11	Infinite series, series with positive terms. comparison tests	
12	Tests for convergence	
13	Absolute and conditional convergence	
14	Power series, Taylor series and applications	

RECOMMENDED SOURCES	
Textbook	James Stewart, Calculus: Concepts and Contexts, 2nd Edition
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60

CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics						
4	Ability to define, formulate and solve mathmatical problems					x	
5	Consciousness of professional ethics and responsibilty			x			
6	Ability to communicate actively						
7	Ability of self-development in fields of interest			x			
8	Ability to learn, choose and use necessary information technologies						
9	Lifelong education			x			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms (Including self study)	1	20	20
Quizzes			
Assignments			
Final examination (Including self study)	1	25	25
Total Work Load			199
Total Work Load / 25 (h)			7,99
ECTS Credit of the Course			8

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
COMBINATORICS	MATH 158	2	2 + 2	3	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The aim of this course is to introduce the topics and techniques of discrete methods and combinatorial reasoning with wide variety of applications.
Content	Fundamental principle of counting. Introduction to discrete probability. Pigeonhole principle. The principle of inclusion and exclusion. Recurrence relations. Introduction to graph theory. Languages and finite state machines.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Understands and solves problems in counting using the basic principles of counting.	1,2	A
2) Uses the principle of inclusion and exclusion to solve related problems indirectly.	1,2	A
3) Solves first-order linear recurrence relations, second-order linear homogeneous recurrence relations with constant coefficients and some particular nonhomogeneous recurrence relations.	1,2	A
4) Models a given particular situation or a problem using graph theory.	1,2	A
5) Decides whether or not given graphs are isomorphic.	1,2	A
6) Understands the structure of languages and finite state machines.	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	The rules of sum and product. Permutations	1.1, 1.2

2	Combinations. The binomial theorem. Combinations with repetition	1.3, 1.4
3	The pigeonhole principle	5.5
4	Well ordering principle, Mathematical Induction	4.1, 4.2
5	Division Algorithm. The Euclidean Algorithm. The Fundamental Theorem of Arithmetic	4.3, 4.4, 4.5
6	The Principle of Inclusion and Exclusion	8.1, 8.2
7	Generating Functions	9.1, 9.2
8	Partition of integers,	9.3, 9.4
9	The first-order linear recurrence relation	10.1
10	The second-order linear homogeneous recurrence relation with constant coefficients	10.2
11	The nonhomogeneous recurrence relation	10.3
12	The method of generating functions	10.4
13	Graph theory: Graphs ,Subgraphs, Complements, Graph Isomorphisms	11.1
14	Languages: Finite state machine.	6.1, 6.2, 6.3

RECOMMENDED SOURCES		
Textbook	(I)	Discrete and Combinatorial Mathematics, 5th Ed. R. P. Grimaldi, Pearson. 2013.
Additional Resources	(II)	Discrete Mathematics and Its Applications, K. H. Rosen, Mc Graw Hill, 6th edition, 2007.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x
2	Acquiring fundamental knowledge on fundamental research fields in mathematics	x				
3	Ability form and interpret the relations between research topics in mathematics	x				
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively	x				
7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education				x	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms (Including self study)	1	15	15
Quizzes			
Assignments			
Final examination (Including self study)	1	20	20
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MATHEMATICAL SOFTWARES I	MATH 201	1	3 + 0	3	6

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programs)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To provide information about mathematical typesetting, symbolic computation and numerical computation software.
Content	Fundamentals of Latex, Maxima and Octave software

Learning Outcomes	Teaching Methods	Assessment Methods
1) To learn using Latex software	1	A,B
2) To learn using Maxima software	1	A,B
3) To learn using Octave software	1	A,B
4) To learn using symbolic computation software	1	A,B
5) To learn using numerical computation software	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	Basics; LATEX Input Files; Input File Structure; Command lines; The Layout of the Document; Document classes; Packages	The Not So Short Introduction to LATEX2e, Chapter 1
2	Typesetting Text ; The Structure of Text and Language; Line breaking and page breaking ; Justified Paragraphs ; Hyphenation; Readymade Strings; Special Characters and Symbols; International Language Support ; The Space between Words; Titles, Chapters, and Sections; Cross References; Footnotes; Emphasized Words; Environments; Floating Bodies; Protecting fragile commands.	The Not So Short Introduction to LATEX2e, Chapter 2
3	Typesetting Mathematical Formulae; Grouping in Math Mode; Building Blocks of a Mathematical Formula; Math Spacing; Vertically Aligned Material; Phantom: Math Font Size; Theorems, Laws; Bold symbols; List of Mathematical Symbols.	The Not So Short Introduction to LATEX2e, Chapter 3
4	Including EPS Graphics; Bibliography; Indexing; Fancy Headers; The Verbatim Package; Downloading and Installing LATEX Packages.	The Not So Short Introduction to LATEX2e, Chapter 4
5	Introduction, Available interfaces to Maxima, The Basics	The Maxima Book, Chapters 1,2,3,
6	Trig through Calculus; Advanced Mathematics - ODEs and Beyond; Matrix Operations and Vectors	The Maxima Book, Chapters 4,5,6
7	Introduction to Maxima’s Programming Language;	The Maxima Book, Chapter 7
8	Graphics and Forms of Output	The Maxima Book, Chapter 8
9	Additional Packages	The Maxima Book, Chapters 13, 14, 15, 17
10	Getting started,	Introduction to GNU Octave, Chapter 1
11	Matrices and Linear Systems	Introduction to GNU Octave, Chapter 2
12	Single variable calculus	Introduction to GNU Octave, Chapter 3
13	Eigenvalue problems	Introduction to GNU Octave, Chapter 5
14	Multivariable calculus and differential equations	Introduction to GNU Octave, Chapter 6

RECOMMENDED SOURCES	
Textbook	The Not So Short Introduction to LATEX2e, Or LATEX2" in 95 minutes; Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl; Version 3.20, 09 August, 2001 The Maxima Book; Paulo Ney de Souza, Richard J. Fateman, Joel Moses, Cliff Yapp, Introduction to GNU Octave, A brief tutorial for linear algebra and

	calculus students; Jason Lachniet, Wytheville Community College, Third Edition
Additional Resources	The Latex Companion, 2nd Edition, Frank Mittelbach and Michel Goossens

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	70
Quizzes		-
Assignments	3	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)		x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics					x	
4	Ability to define, formulate and solve mathematical problems					x	
5	Consciousness of professional ethics and responsibility			x			

6	Ability to communicate actively			x			
7	Ability of self-development in fields of interest				x		
8	Ability to learn, choose and use necessary information technologies			x			
9	Lifelong education			x			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Mid-terms (Including self-study)	2	12	24
Quizzes	-	-	-
Assignments	7	3	21
Final examination (Including self-study)	1	21	21
Total Work Load			150
Total Work Load / 25 (h)			6
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MATHEMATICAL SOFTWARES II	MATH 202	2	3 + 0	3	6

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	Symbolic and numerical computation by using Python language
Content	Fundamentals of Python language and its modules NumPy, SymPy and MatPlotlib

Learning Outcomes	Teaching Methods	Assessment Methods
1) To learn basics of Python language	1	A,B
2) To learn numerical computation by usingNumPy module	1	A,B
3) To learn symbolic computation by using SymPy module	1	A,B
4) To learn plotting graphs of functions by using MatPlotLib module	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Python Basics	[T1] Chapter 1
2	Variables and Basic Data Structures	[T1] Chapter 2
3	Functions	[T1] Chapter 3
4	Branching Statements; Iteration	[T1] Chapter 4-5
5	Class and Object; Round-Off Errors	[T1] Sections 7.2, 9.3
6	Visualization and Plotting; MIDTERM EXAM 1	[T1] Chapter 12

7	Linear Algebra and Systems of Linear Equations	[T1] Chapter 14
8	Eigenvalues and Eigenvectors	[T1] Chapter 15
9	Creating and manipulating expressions by using SymPy	[T2] pp.17-28
10	Calculus with SymPy	[T2] pp.31-34
11	Solving equations by SymPy; MIDTERM EXAM 2	[T2] pp.35-37
12	Taylor Series; Root Finding	[T1] Chapter 18-19
13	Numerical Differentiation; Numerical Integration	[T1] Chapter 20-21
14	Ordinary Differential Equations (ODEs) Initial-Value Problems	[T1] Chapter 22

RECOMMENDED SOURCES	
Textbook	[T1] Kong, Qingkai, et al. *Python Programming and Numerical Methods: A Guide for Engineers and Scientists*. Academic Press, 2021. [T2] Lamy, Ronan. *Instant SymPy Starter: Learn to Use SymPy's Symbolic Engine to Simplify Python Calculations*. Packt Publishing, 2013.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	70
Quizzes		-
Assignments	3	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)		x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics					x	
4	Ability to define, formulate and solve mathmatical problems					x	
5	Consciousness of professional ethics and responsibilty			x			
6	Ability to communicate actively			x			
7	Ability of self-development in fields of interest				x		
8	Ability to learn, choose and use necessary information technologies			x			
9	Lifelong education			x			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Mid-terms (Including self study)	2	12	24
Quizzes	-	-	-
Assignments	7	3	21
Final examination (Including self study)	1	21	21
Total Work Load			150
Total Work Load / 25 (h)			6
ECTS Credit of the Course			6

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
DIFFERENTIAL GEOMETRY	MATH 212	2	2 + 2	3	6

Prerequisites	MATH 255

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To provide information about the local and global structures of curves and surfaces in three dimensions.
Content	Curves in plane and 3-space, the local theory of curves, Serret-Frenet formulas. Closed curves, isoperimetric inequality and four-vertex theorem. Surfaces, first and second fundamental forms. Geometry of Gauss map. Structure equations. Theorema Egregium. Formulation with differential forms. Gauss-Bonnet theorem. Intrinsic and extrinsic geometry of surfaces.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Learns the local behaviour of curves	1	A
2) Learns the local behaviour of surfaces	1	A
3) Learns how to distinguish local and global behaviours of curves	1	A
4) Learns how to distinguish local and global behaviours of surfaces	1	A
5) Learns how to obtain global information about curves	1	A
6) Learns how to obtain global information about surfaces	1	A

Teaching Methods:	1: Lecture, 2: Problem Solving

Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Local Curve Theory in 2D	From textbook 2.1-2.3
2	Local Curve Theory in 3D	2.4-2.6
3	Global Theory of Plane Curves	3.1-3.3
4	Global Theory of Plane Curves	3.4-3.6
5	MIDTERM and discussion of solutions	
6	Local Surface Theory (First and Second Fundamental Forms)	4.1-4.3, 4.7
7	Local Surface Theory (Parallelism and Curvatures)	4.4-4.6, 4.8,
8	Local Surface Theory (Fundamental Theorem of Surfaces)	4.10
9	Local Surface Theory (Theorema Egregium)	4.9
10	MIDTERM and discussion of solutions	
11	Global Theory of Space Curves	5.1-5.3
12	Global Theory of Surfaces (Curvature, Orientability)	6.1-6.3
13	Global Theory of Surfaces (Gauss-Bonnet Formula)	6.4-6.6
14	Global Theory of Surfaces (Index of a Vector Field)	6.7

RECOMMENDED SOURCES	
Textbook	R.S. Millman, G.D. Parker, Elements of Differential Geometry, Pearson, 1977
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE
Mid-terms	2	100
Quizzes	-	-
Assignments	-	-
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)		x			
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems					x
5	Consciousness of professional ethics and responsibilty			x		
6	Ability to communicate actively			x		
7	Ability of self-development in fields of interest				x	
8	Ability to learn, choose and use necessary information technologies			x		
9	Lifelong education			x		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)

Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms (Including self study)	2	10	20
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	18	18
Total Work Load			150
Total Work Load / 25 (h)			6
ECTS Credit of the Course			6

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
LINEAR ALGEBRA I	MATH 231	1	3 + 2	4	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	-
Instructors	
Assistants	
Goals	To provide tools for dealing with problems in many fields from a variety of disciplines and to serve as a bridge from the typical intuitive treatment of calculus to more rigorous courses such as abstract algebra and analysis.
Content	Matrices and systems of linear equations. Vector spaces; subspaces, sums and direct sums of subspaces. Linear dependence, bases, dimension, quotient spaces. Linear transformations, kernel, range, isomorphism. Spaces of linear transformations. Representations of linear transformations by matrices. Determinants. Inverse of a matrix. Eigenvalues and eigenvectors. Diagonalization of a matrix.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Solves the systems of linear equations using matrices.	1,2	A
2) Determines spanning sets for a given vector space.	1,2	A
3) Applies Gram-Schmidt Process to an independent set of vectors to obtain an orthogonal set.	1,2	A
4) Determines if a given matrix is nonsingular.	1,2	A
5) Uses elementary matrices to compute the inverse of a matrix.	1,2	A
6) Uses determinant and adjoint to compute the inverse of a matrix.	1,2	A
7) Diagonalizes a matrix	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT

Week	Topics	Study Materials
1	Vectors and linear equations. The idea of elimination	Textbook
2	Elimination using matrices	Textbook
3	Rules for matrix operations, inverse matrices	Textbook
4	LU-decomposition, transposes and permutations	Textbook
5	Spaces of vectors,	Textbook
6	Nullspace of A, The complete solution to Ax=b	Textbook
7	Independence, basis and dimension,	Textbook
8	Dimensions of the four subspaces	Textbook
9	Orthogonality of the four subspaces	Textbook
10	Projections, orthonormal bases and Gram-Schmidt orthonormalization process	Textbook
11	The properties of determinants, permutations and cofactors,	Textbook
12	Cramer's rule, inverses and volumes	Textbook
13	Introduction to eigenvalues,	Textbook
14	Diagonalizing a matrix	Textbook

RECOMMENDED SOURCES	
Textbook	Gilbert Strang - Introduction to Linear Algebra Fifth Edition-Wellesley-Cambridge Press (2016)
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty					x
6	Ability to communicate actively			x		
7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies					x
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	1	15	15
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	20	20
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
LINEAR ALGEBRA II	MATH 232	2	3 + 2	4	7

Prerequisites	MATH 231 or MATH 221

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	Mustafa Polat
Assistants	
Goals	To provide tools for dealing with problems in many fields from a variety of disciplines and to serve as a bridge from the typical intuitive treatment of calculus to more rigorous courses such as abstract algebra and analysis.
Content	Characteristic and minimal polynomials of an operator, eigenvalues, diagonalizability, canonical forms, Jordan and rational forms of matrices. Inner product spaces, norm and orthogonality, projections. Linear operators on inner product spaces, adjoint of an operator, normal, self adjoint, unitary and positive operators. Bilinear and quadratic forms.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Determines if a given set is independent and/or spanning set.	1,2,3,4	A
2) Constructs an orthonormal basis for a given vector space.	1,2,3,4	A
3) Determines if a given linear transformation is injective, surjective or invertible.	1,2,3,4	A
4) Represents a linear transformation by matrices and obtains information about transformation by using these representations.	1,2,3,4	A
5) Determines if a matrix is diagonalizable and if it is, diagonalizes the matrix.	1,2,3,4	A
6) Computes the Jordan canonical form of a matrix.	1,2,3,4	A

Teaching Methods:	1: Lecture, 2: Problem solving 3: question – answer 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Wee	**Topics**	**Study**

k		Materials
1	Vector spaces, subspaces	Textbook
2	Bases, dimension and coordinates.	Textbook
3	Linear transformations, the algebra of linear transformations	Textbook
4	Isomorphism, the representation of linear transformations by matrices	Textbook
5	Linear functionals, the double dual, the transpose of a linear transformation	Textbook
6	Determinant functions, permutations and uniqueness of determinants,	Textbook
7	Additional properties of determinants	Textbook
8	Elementary canonical forms, characteristic values, annihilating polynomials, invariant subspaces,	Textbook
9	Direct sum decompositions, invariant direct sums,	Textbook
10	Primary decomposition theorem	Textbook
11	Cyclic subspaces and annihilators,	Textbook
12	Cyclic decompositions and the rational form	Textbook
13	The Jordan form	Textbook
14	Computation of invariant factors	Textbook

RECOMMENDED SOURCES	
Textbook	Kenneth M Hoffman, Ray Kunze - Linear Algebra Second Edition -Prentice Hall (1971)
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Quizzes	-	-
Assignments	-	-
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty					x
6	Ability to communicate actively			x		
7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies					x
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	1	15	15
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	20	20
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ORDINARY DIFFERENTIAL EQUATIONS	MATH 245	1	3 + 2	4	7

Prerequisites	MATH 156

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	Determining the type of a given first or higher order differential equation, examining the existence and uniqueness solution and being able to select the appropriate analytical technique for finding the solution if it can be obtained. Understanding the fundamental theorems of differential equations, understanding Laplace transform and application to differential equations, Finding an infinite series solution to a given differential equation
Content	First order equations and various applications. Higher order linear differential equations. Power series solutions: ordinary and regular singular points. The Laplace transform: solution of initial value problems. Systems of linear differential equations: solutions by operator method, by Laplace transform.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Can classify the first and higher order ordinary differential equations.	1,2,3,4	A
2) Can determine the appropriate solution method for a given differential equation.	1,2,3,4	A
3) Can investigate the existence and uniqueness of solutions for initial value problems.	1,2,3,4	A
4) Can use Laplace transforms.	1,2,3,4	A
5) Can determine an infinite series solution for a given differential equation.	1,2,3,4	A

Teaching Methods:	1: Lecture, 2: Problem Solving, 3: Question-Answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction, Solution of Differential Equations, Classification of DEs, Initial and Boundary conditions. Separable equations.	Course book, Chapter 1 , 2.2

2	Homogeneous, Linear 1st Order Differential Equations, Bernoulli, Ricatti equations	2.2,2.1,2.4
3	Clairaut Differential Equations Exact Differential Equations and Integrating Factors	2.6
4	Existence and Uniqueness Theorem for 1st order ODEs, discontinuous coefficient, forcing function	2.4,2.8
5	Higher Order Linear ODEs Homogeneous Eqs with constant coefficients Existence and Uniqueness for general higher order equations	3.1,3.2,4.1
6	**Midterm I** Fundamental Set of Solutions of linear Homogeneous DE s, Linear Independence, Wronskian, Complex roots of the characteristic equation, Reduction of Order,	- 3.2,3.3,3.4
7	Repeated roots of characteristic equation for constant coefficient homogenous equation Cauchy-Euler Equation	3.5,5.5,3.6
8	Linear Non-Homogeneous DE s (Method of Undetermined Coefficients),Variation of Parameters	4.3,3.7
9	Definition of Laplace Transform, Solution of Initial Value Problems, Step Functions	6.1,6.2,6.3
10	**Midterm II**, Differential Equations with discontinuous forcing functions,	- 6.4
11	Impulse Function, The Convolution Integral, Review of Power Series, Ordinary Points, Singular Points	6.5,6.6,5.1
12	Series Solutions near an Ordinary Point, Regular Singular Points, Series Solutions near a Regular Singular Point,	5.2, 5.3,5.4
13	Bessel, Legendre, Hermite, Chebyshev Equation	5.5,5.6
14	System of differential equations	7.1, ch 6

RECOMMENDED SOURCES	
Textbook	Elementary Differential Equations and Boundary Value Problems, W. E. Boyce and R. C. DiPrima, John Wiley and Sons, 2009
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes	-	
Assignments	-	
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60

Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)			X			
2	Acquiring fundamental knowledge on fundamental research fields in mathematics				X		
3	Ability form and interpret the relations between research topics in mathematics			X			
4	Ability to define, formulate and solve mathematical problems		X				
5	Consciousness of professional ethics and responsibilty	X					
6	Ability to communicate actively	X					
7	Ability of self-development in fields of interest					X	
8	Ability to learn, choose and use necessary information technologies	X					
9	Lifelong education			X			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	15	30
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	20	20
Total Work Load			190
Total Work Load / 25 (h)			7.60
ECTS Credit of the Course			8

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
REAL ANALYSIS I	MATH 252	1	3 +2	4	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programs)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	This course constitutes the pillar of many topics in mathematics such as complex analysis, differential equations, differential and integral calculus, and differential geometry. It is impossible to assimilate these areas of mathematics without having this basic knowledge of analysis. The aim of the course is to equip students with this basic knowledge.
Content	Limits of functions, continuous functions. Inverse function theorem, sequences of functions, uniform convergence. Cauchy criterion for uniform convergence. The derivative, the mean value theorem, L'Hospital rules, Taylor's theorem. Riemann sum, Riemann integrability. Boundedness theorem. Riemann Integrable Functions, Cauchy Criterion. Squeeze Theorem, Classes of Riemann Integrable Functions. Additivity Theorem, The Fundamental Theorem of Calculus. Substitution Theorem, Lebesgue's Integrability Criterion. Integration by Parts, Taylor's Theorem with the Remainder

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Grasp the structure of the real numbers as a complete ordered field	1	A,B
2) Learn how to handle the convergence of sequences, series	1	A,B
3) Master the concept of the limit of functions and the concept of continuity;	1	A,B
4) Acquire the knowledge of differentiability of functions	1	A,B
5) Learn integration and classes of Riemann integrable functions	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Limits of Functions, Limit Theorems, Cauchy Convergence criterion	Textbook
2	Continuous Functions, Combinations of Continuous Functions, Continuous Functions on Intervals	Textbook
3	Uniform Continuity. Monotone functions. Inverse Function Theorem	Textbook
4	Continuous and Monotone Functions, Sequences of Functions, Pointwise and Uniform Convergence	Textbook
5	Cauchy Criterion for Uniform Convergence	Textbook
6	The Derivative, The Mean Value Theorem, L'Hospital Rules, Taylor's Theorem	Textbook
7	Partitions and Tagged Partitions, Riemann sum, Riemann integrability	Textbook
8	Some Properties of the Integral, Boundedness Theorem	Textbook
9	Riemann Integrable Functions, Cauchy Criterion,	Textbook
10	Squeeze Theorem, Classes of Riemann Integrable Functions	Textbook
11	Additivity Theorem, The Fundamental Theorem of Calculus,	Textbook
12	Substitution Theorem, Lebesgue’s Integrability Criterion,	Textbook
13	Composition Theorem, The Product Theorem,	Textbook
14	Integration by Parts, Taylor’s Theorem with the Remainder	Textbook

RECOMMENDED SOURCES	
Textbook	Robert G. Bartle,Donald R. Sherbert**, Introduction to Real Anlaysis**, Fourth Edition, John Wiley & Sons, Inc.(2011),ISBN-13: 978-0471433316ISBN-10: 9780471433316. https://sciencemathematicseducation.files.wordpress.com/2014/01/0471433314realanalysis4.pdf

Additional Resources	Stephen Abbott, Understanding Analysis, Springer, 2. Edition (2015)

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	70
Quizzes		-
Assignments	3	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM								
No	Program Learning Outcomes	Contribution						
		1	2	3	4	5		
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x		
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x		
3	Ability form and interpret the relations between research topics in mathematics					x		
4	Ability to define, formulate and solve mathematical problems					x		
5	Consciousness of professional ethics and responsibility			x				
6	Ability to communicate actively			x				

7	Ability of self-development in fields of interest				x		
8	Ability to learn, choose and use necessary information technologies			x			
9	Lifelong education			x			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms (Including self-study)	2	10	20
Quizzes	-	-	-
Assignments	3	5	15
Final examination (Including self-study)	1	15	15
Total Work Load			176
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CALCULUS III	MATH 255	1	3 + 2	4	7

Prerequisites	MATH 156 OR MATH132

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The aim of this course is to provide students with an understanding of differentiation and integration of multivariable functions and their calculations.
Content	Functions of several variables; limits and continuity, partial derivatives, linear approximations, chain rule, directional derivatives, maximum and minimum values, Lagrange multipliers. Vector functions; space curves, derivatives and integrals, arc length, motion in space, parametric surfaces. Multiple integrals and applications. Vector calculus; vector fields, line integrals, Green’s theorem, curl and divergence, surface integrals, Stokes’ theorem, the divergence theorem.

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Calculates the partial derivatives of multivariable functions.	1,2,4,7	1,2	A
2) Calculates local and global extreme values.	1,2,4,7	1,2	A
3) Evaluates the arclength of space curves.	1,2,7	1,2	A
4) Evaluates double and triple integrals.	1,2,4,7	1,2	A
5) Changes variables in double and triple integrals.	1,2,4,7	1,2	A
6) Evaluates line integrals and surface integrals.	1,2,4,7	1,2	A
7) Expresses the concepts of circulation, work and flux using line and surface integrals.	1,2,3,4,7	1,2	A
8) Uses Green's, Stokes' and the divergence theorems.	1,2,3,4,7	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving

Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Functions of Several Variables, Limits, Continuity,	Textbook
2	Partial Derivatives and Higher Order Derivatives	Textbook
3	Chain Rule, Gradient, Directional Derivatives,Extreme Values, Lagrange Multipliers	Textbook
4	Vector-Valued Functions : Arc Length, Vector Fields, Divergence and Curl	Textbook
5	Double and Triple Integrals : The Double Integral Over a Rectangle, The Double Integral Over More General Regions	Textbook
6	Changing the Order of Integration, The Triple Integral	Textbook
7	The Change of Variables Formula and Applications of Integration: The Geometry of Maps from R^2 to R^2, The Change of Variables Theorem	Textbook
8	Applications of Double and Triple Integrals, Improper Integrals	Textbook
9	Integrals: The Path Integral, Line Integrals	Textbook
10	Parametrized Surfaces, Area of a Surface	Textbook
11	Integrals of Scalar Functions Over Surfaces, Surface Integrals of Vector Functions	Textbook
12	The Integral Theorems of Vector Analysis: Green's Theorem	Textbook
13	Stokes' Theorem, Conservative Fields,	Textbook
14	Gauss' Theorem	Textbook

RECOMMENDED SOURCES	
Textbook	*"Vector Calculus"*, 6th Edition, by J. Marsden and A. Tromba
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes		
Assignments		
Total		**100**

CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Core Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					**X**	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					**X**	
3	Ability form and interpret the relations between research topics in mathematics					**X**	
4	Ability to define, formulate and solve mathematical problems					**X**	
5	Consciousness of professional ethics and responsibility			**X**			
6	Ability to communicate actively			**X**			
7	Ability of self-development in fields of interest					**X**	
8	Ability to learn, choose and use necessary information technologies						
9	Lifelong education						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	10	20
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	15	15
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
INTRODUCTION TO GROUP THEORY	MATH 321	1	2+2	3	6

Prerequisites	MATH 102

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To teach as much about groups as one can in a first course to constitute a firm foundation for more specialized work and to provide valuable experience for any further axiomatic study of mathematics.
Content	Binary operations, groups, subgroups, cyclic groups and generators. Permutation groups. Orbits, cycles and alternating groups. Cosets and Lagrange theorem. Direct products. Finitely generated Abelian groups. Isomorphism theorems. Cayley's theorem. Factor groups, simple groups, series of groups, group action. Sylow theorems and applications. Free groups. Group representations.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Classifies finite abelian groups	1,2	A
2) Finds the Sylow subgroups of a group	1,2	A
3) Compute factor groups	1,2	A
4) Finds group homomorphisms	1,2	A
5) Determines if groups are isomorphic or not	1,2	A
6) Determines if a group is simple	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Groups, subgroups, cyclic groups	Textbook
2	Permutation groups, orbits, cycles, alternating groups	Textbook
3	Cosets and the theorem of Lagrange	Textbook
4	Direct product and finitely generarted abelian groups	Textbook
5	Homomorphisms, factor groups	Textbook
6	Simple groups	Textbook
7	Group action on a set	Textbook
8	Isomorphism theorems	Textbook
9	Series of groups	Textbook
10	Sylow theorems	Textbook
11	Applications of the Sylow theory	Textbook
12	Free abelian groups	Textbook
13	Free groups	Textbook
14	Groups presentations	Textbook

RECOMMENDED SOURCES	
Textbook	A First Course in Abstract Algebra, J. Fraleigh.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes		

Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)			x		
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems					x
5	Consciousness of professional ethics and responsibilty					x
6	Ability to communicate actively		x			
7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies			x		
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms (Including self study)	1	15	15

Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	20	20
Total Work Load			147
Total Work Load / 25 (h)			5.88
ECTS Credit of the Course			6

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ABSTRACT ALGEBRA	MATH 322	2	2+2	3	6

Prerequisites	MATH 231 and MATH 321

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To teach as much about rings and fields as one can in a first course to constitute a firm foundation for more specialized work and to provide valuable experience for any further axiomatic study of mathematics.
Content	Rings. Integral domains. Fermat's and Euler's theorems. Quotient field of an integral domain. Rings of polynomials. Factorization of polynomials over a field. Noncommutative rings. Ring homomorphisms and factor rings. Prime and maximal ideals. Unique factorization domains. Field extensions. Algebraic extensions. Geometric constructions. Finite fields.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Applies Fermat’s and Euler’s theorems	1,2	A
2) Find maximal and prime ideals in a ring	1,2	A
3) Constructs the field of quotients of an integral domain	1,2	A
4) Factorizes polynomials over rings	1,2	A
5) Finds ring homomorphisms	1,2	A
6) Determines algebraic and transcendental elements over a field	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Rings and fields	Textbook
2	Integral domains	Textbook
3	Fermat’s and Euler’s theorems	Textbook
4	The field of quotients of an integral domain	Textbook
5	Rings of polynomials	Textbook
6	Factorization of polynomials over a field	Textbook
7	Noncommutative examples	Textbook
8	Ordered rings and fields	Textbook
9	Homomorphisms and factor rings	Textbook
10	Prime and maximal ideals	Textbook
11	Introduction to Extension fields	Textbook
12	Algebraic extensions	Textbook
13	Geometric constructions	Textbook
14	Finite fields	Textbook

RECOMMENDED SOURCES	
Textbook	A First Course in Abstract Algebra, J. Fraleigh.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100

Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)			x			
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics					x	
4	Ability to define, formulate and solve mathematical problems					x	
5	Consciousness of professional ethics and responsibilty					x	
6	Ability to communicate actively		x				
7	Ability of self-development in fields of interest					x	
8	Ability to learn, choose and use necessary information technologies			x			
9	Lifelong education					x	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	4	56

Mid-terms (Including self study)	2	15	30
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	16	16
Total Work Load			158
Total Work Load / 25 (h)			6.32
ECTS Credit of the Course			6

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ELEMENTARY NUMBER THEORY	MATH 325	1	2+2	3	6

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	To introduce the fundamental topics in elementary number theory.
Content	Integers, divisibility, prime numbers, congruences,Chinese remainder theorem, arithmetic functions, quadratic reciprocity law, quadratic fields, Pell's equation, further topics including equations over finite fields, zeta functions and Weil conjectures.

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knows the basic properties of divisibility, prime numbers and the fundamental theorem of arithmetic.	2,4	1	A,B
2) Using Euclidean algorithm, computes the greatest common divisior of integers and the least common multiple of integers.	2,4,7	1	A,B
3) Solves congruence equations including systems of congruence equations by applying Chinese remainder theorem.	1,2,4,7,9	1	A,B
4) Knows the basic properties of Euler's Phi-function, and arithmetic functions, applies Mobius inversion formula.	1,2,3,4,7,9	1	A,B
5) Applies Gauss' quadratic reciprocity law.	1,2,3,4,7,9	1	A,B
6) Knows the elementary theory of equations over finite fields and the statements of Weil conjectures.	1,2,3,4,7,9	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Divisibility, the greatest common divisor and the least common multiple, primes, unique factorization and the fundamental theorem of arithmetic.	
2	Congruences, Fermat's Little Theorem, Euler's Formula.	
3	Euler's Phi Function and the Chinese Remainder Theorem.	
4	Counting Primes. Euler's Phi Function and Sums of Divisors.	
5	Arithmetical Functions, Mobius inversion formula.	
6	The structure of the unit group of $\mathbf{Z}_n$.	
7	Gauss' Quadratic Reciprocity.	
8	Arithmetic of quadratic number fields	
9	Pell's equation	
10	Quadratic Gauss sums	
11	Finite fields.	
12	Gauss and Jacobi sums	
13	Equations over finite fields.	
14	The zeta function and Weil conjectures.	

RECOMMENDED SOURCES	
Textbook	A Classical Introduction to Modern Number Theory, K. Ireland, M. Rosen, Graduate Texts in Math., Springer-Verlag.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms		
Quizzes		
Assignments	7	100
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/ Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)			x			
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics					x	
4	Ability to define, formulate and solve mathematical problems					x	
5	Consciousness of professional ethics and responsibilty					x	
6	Ability to communicate actively			x			
7	Ability of self-development in fields of interest					x	
8	Ability to learn, choose and use necessary information technologies		x				
9	Lifelong education					x	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)

Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Mid-terms (Including self study)			
Quizzes			
Assignments	7	5	35
Final examination (Including self study)	1	14	14
Total Work Load			148
Total Work Load / 25 (h)			5,92
ECTS Credit of the Course			6

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
PARTIAL DIFFERENTIAL EQUATIONS	MATH 343	2	2+2	3	6

Prerequisites	MATH 245

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To give the students the formation of Partial Differential Equations, classifications and their solutions at the beginning level.
Content	First order equations; linear, quasilinear and nonlinear equations. Classification of second order linear partial differential equations, canonical forms, Cauchy problem. The Cauchy problem for the wave equation. Dirichlet and Neumann problems for the Laplace equation, maximum principle. Heat equation on the strip.

Learning Outcomes	**TeachingMethods**	**Assessment Methods**
1) Understands the derivation of PDE and modelling	1, 2	A, B
2) Knows the nonlinear equations, their properties and the solution techniques	1, 2	A, B
3) Has a general information on higher order equations and on Cauchy problem	1, 2	A, B
4) Knows the properties of wave equation and the solution techniques of initial value problems	1, 2	A, B
5) Knows the properties of Laplace equation and the solution techniques of boundary value problems	1, 2	A, B
6) Knows the properties of heat equation and the solution techniques of initial value problems	1, 2	A, B

Teaching	1: Lecture, 2: Problem Solving

Methods:	
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction, First-order DE,	Relevant topics in the text book
2	Introduction, First-order DE,	Relevant topics in the text book
3	First-order nonlinear DE, Compatible systems Charpit's method	Relevant topics in the text book
4	First-order nonlinear DE, Compatible systems Charpit's method	Relevant topics in the text book
5	Linear second-order equations; constant coefficient and factorable operators, particular solutions.	Relevant topics in the text book
6	Linear second-order equations; constant coefficient and factorable operators, particular solutions.	Relevant topics in the text book
7	Normal forms; hyperbolic, parabolic, elliptic cases; Cauchy problem.	Relevant topics in the text book
8	Normal forms; hyperbolic, parabolic, elliptic cases; Cauchy problem.	Relevant topics in the text book
9	Elliptic equations	Relevant topics in the text book
10	Elliptic equations	Relevant topics in the text book
11	Hyperbolic equations	Relevant topics in the text book
12	Hyperbolic equations	Relevant topics in the text book
13	Parabolic equations	Relevant topics in the text book
14	Parabolic equations	Relevant topics in the text book

RECOMMENDED SOURCES	
Textbook	1. An introduction to PDE and BVP, by Rene Dennemeyer, McGraw

	Hill. 2. Elements of PDE, by Ian Sneddon, McGraw Hill.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes	0	0
Assignments	0	0
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics				x	
4	Ability to define, formulate and solve mathematical problems				x	

5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively	x				
7	Ability of self-development in fields of interest				x	
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education			x		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms (Including self study)	2	9	18
Quizzes	0		00
Assignments	-	-	-
Final examination (Including self study)	1	20	20
Total Work Load			150
Total Work Load / 25 (h)			6
ECTS Credit of the Course			6

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
COMPLEX CALCULUS	MATH 357	1	3 + 2	4	7

Prerequisites	MATH 132

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	Getting know about complex numbers, complex variabled functions, complex sequences and series, being able to do calculations with them. Information about contour integral and residue and getting know how to evaluate some integral with such techniques.
Content	Algebra of complex numbers. Sequences and series with complex terms. Power series and convergence radius. Some elementary functions and mappings. Riemann surfaces. Regular functions and Cauchy - Riemann equations. Harmonic functions. Contour integrals and Cauchy theorem. Cauchy's integral formula and some of its direct rusults. Residue concept. Taylor and Laurent expansions.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Can do calculations with functions of complex variables and sequences of complex numbers.	1,2,3	A,B
2) Can use Cauchy Riemann equations	1,2,3	A,B
3) Knows the concepts of analytic functions and harmonic functions	1,2,3	A,B
4) Knows how to evaluate contour integrals and knows Cauchy Integral Teorem.	1,2,3	A,B
5) Can evaluate integrals using residues.	1,2,3	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving ,3: Question-Answer
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction, Definitions and importance of the subject, Complex numbers and complex plane. Algebraic operations	Course Book 1.1, 1.2,1.3

2	Complex Exponential, powers, roots	1.4,1.5,1.6
3	Functions, Limit and continuity, analyticity	2.1,2.2,2.3
4	Derivative, Cauchy Riemann equations, harmonic functions	2.4,2.5
5	Elementary Functions and Inverses	3.1,3.2,3.3
6	Sequences, Series.	5.1,5.2,5.3
7	Introduction to complex Integration, contours	4.1,4.2
8	Cauchy theorem, Cauchy`s formula and its consequences	4.3,4.4,4.5
9	Midterm	
10	Integral Theorems, Laurent Series	4.5,5.5
11	Singularities, Residue Theorem	5.6,5.7,6.1
12	Residue theorem	6.1
13	Trigonometric Integrals	6.2
14	Improper Integrals	6.3,6.4

RECOMMENDED SOURCES	
Textbook	Fundamentals of Complex Analysis with Applications to Engineering, Science, and Mathematics (3rd Edition), E. Saff, A. Snider, Pearson Education, 2003.
Additional Resources	Complex variables and applications, R.V. Churchill and J.W. Brown, McGraw-Hill, 1996 Complex analysis, J. Back and D.J. Newman, Springer-Verlag, 1991

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					X
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					X
3	Ability form and interpret the relations between research topics in mathematics			X		
4	Ability to define, formulate and solve mathematical problems				X	
5	Consciousness of professional ethics and responsibilty			X		
6	Ability to communicate actively		X			
7	Ability of self-development in fields of interest			X		
8	Ability to learn, choose and use necessary information technologies	X				
9	Lifelong education		X			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms (Including self study)	1	10	10
Quizzes			
Assignments			
Final examination (Including self study)	1	11	11
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MATHEMATICAL PROBABILITY	MATH 362	5	2+2	3	6

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To prepare students for a career in actuarial science, graduate studies in financial engineering/mathematics and high school teachers to teach probability and statistics in high schools.
Content	Counting. Elements of probability theory. Random variables. Conditional probability. Bayes' rule. Probability distributions and densities. Uniform, Bernoulli, Binomial, Geometric, Hypergeometric, Poisson and Gaussian (normal) distributions. Uniform density. Expectations and moments.

Learning Outcomes	Teaching Methods	Assessment Methods
1) Apply the counting principles	1,2	A,B
2) Compute probabilities	1,2	A,B
3) Know and apply Bayes' rule	1,2	A,B
4) Know discrete probability functions	1,2	A,B
5) Know continuous probability functions	1,2	A,B
6) Know and apply normal distribution	1,2	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Random Experiments, Sample Spaces, Events Counting Sample Points, Probability of an Event	
2	Counting Principles, Permutations and Combinations	

3	Conditional Probability and the Independence of Events. The Law of Total Probability and Bayes' Rule	
4	Definiton of Discete Random variable. The Probability Distribution of a Discrete Random Variable. Expected value and Variance of a Random Variable	
5	The Binomial, Geometric, Negative Binomial and Hypergeometric and Poisson Probability Distributions	
6	The Poisson Probability Distribution. Moments and Moment-Generating Functions for discrete distributions.	
7	Definition of Continuous Random Variable. The Probability Distribution of a Continuous Random Variable. Expected Values for a Continuous random Variable.	
8	The Uniform, Normal and Exponential Probability Functions.	
9	The Gamma, Weibull and Beta Probability Distributions. Moments and Moment-Generating Functions for continuous distributions.	
10	Sampling Distributions Related to the Normal Distribution. The Central Limit Theorem. The Normal Approximations to the Binomial.	
11	Bivariate and Multivariate Probability Distributions. Marginal and Conditional Probability Distributions	
12	Independent Random Variables. The Covariance of Two Random Variables. The Expected Value and Variance of Linear Functions of Random Variables	
13	Finding the Probability Distribution of a Function of Random Variables. Multivariate Transformations	
14	Tchebysheff's Inequality. Weak Law of Large Numbers. Order Statistics.	

RECOMMENDED SOURCES	
Textbook	Mathematical Statistics with Applicatins. Wackerly, Mendenhall, Scheaffer. Brooks/Cole
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL		40

GRADE		
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics			x			
4	Ability to define, formulate and solve mathmatical problems					x	
5	Consciousness of professional ethics and responsibilty		x				
6	Ability to communicate actively			x			
7	Ability of self-development in fields of interest			x			
8	Ability to learn, choose and use necessary information technologies			x			
9	Lifelong education				x		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Mid-terms (Including self study)	2	14	28
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	24	24
Total Work Load			150
Total Work Load / 25 (h)			6
ECTS Credit of the Course			6

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
METRIC AND TOPOLOGICAL SPACES	MATH 439	1	2+2	3	7

Prerequisites	MATH 252

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	To develop the necessary background for modern analysis courses to follow
Content	Basic concepts about topological spaces and metric spaces. Complete metric spaces, Baire's theorem, Contracting mapping theorem and its applications. Compact spaces, Arzela-Ascoli Theorem Seperability, second countability, Urysohn's lemma and the Tietze extension theorem, Connected spaces, Weierstrass approximation theorem

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Learns basic concepts of topological spaces with emphasis on metric spaces		1,2	A
2) Learns Cauchy sequences and completeness		2,2	A
3) Learns the concept of compact space		1,2	A
4) Learns Baier's category		1,2	A
5) Learns Ascoli-Arzela theorem, Weierstrass approximation		1,2	A
6) Acquires the skill of applying these concepts		1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving

Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Basic concepts about metric spaces and examples	
2	Open, closed sets, topology and convergence	
3	Cauchy sequences and complete metric spaces, Baire's theorem	
4	Continuity and uniformly continuity, spaces of continuous functions, Euclidean space	
5	Contracting mapping theorem and its applications	
6	The definition of topological spaces and some examples , elementary concepts, Open bases and open subbases	
7	Compact spaces, Products of spaces,Tychonoff's theorem and locally compact spaces	
8	Compactness for metric spaces	
9	Arzela-Ascoli Theorem	
10	Seperability, second countability	
11	Hausdorff spaces, Completely regular spaces and normal spaces	
12	Urysohn's lemma and the Tietze extension theorem	
13	Connected spaces, The components of a space, Totally disconnected spaces, Locally connected spaces	
14	The Weierstrass approximation theorem ,The Stone-Weierstrass theorems	

RECOMMENDED SOURCES	
Textbook	1. S. Kumaresan, Topology of Metric Spaces 2. George F. Simmons, Topology and Modern Analysis 3. W A Sutherland, Introduction to Metric and Topological Spaces 4. E T Copson, Metric Spaces
Additional Resources	

MATERIAL SHARING

Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes	-	0
Assignments	-	0
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					**X**
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					**X**
3	Ability form and interpret the relations between research topics in mathematics					**X**
4	Ability to define, formulate and solve mathematical problems					**X**
5	Consciousness of professional ethics and responsibilty			**X**		
6	Ability to communicate actively			**X**		
7	Ability of self-development in fields of interest					**X**
8	Ability to learn, choose and use necessary information technologies	**X**				

9	Lifelong education			**X**		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	15	30
Quizzes	-		
Assignments	-		
Final examination (Including self study)	1	19	175
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
FUNCTIONAL ANALYSIS	MATH 456	2	2+2	3	9

Prerequisites	MATH 439

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	Functional analysis, is a subject that has many applications. We can count the theory of differential equations and applications in physics among them.
Content	Topological dual. Compact, closed and adjoint operators. Inner product spaces. Orthonormal sets and Fourier series. Linear operators on Hilbert spaces. Resolvent and spectrum of an operator. Spectra of continuous and compact linear operators. Spectral analysis on Hilbert spaces. Derivations of operators.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Learns inner product and Hilbert Spaces	1,2	A
2) Computes the Fourier Coefficients with respect to an orthonormal basis	1,2	A
3) Learns dual spaces and to utilize of Hahn-Banach theorem	1,2	A
4) Learns Riesz Representation Theorem	1,2	A
5) Learns the spectrum of linear operators	1,2	A
6) Learns compact operators and how to apply them	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Inner Product Spaces, Hilbert Spaces ,Orthogonality	
2	Orthonormal Bases in Infinite Dimensions ,Fourier Series	
3	Continuous Linear Transformations	
4	Hahn–Banach Theorem	
5	Dual Spaces	
6	The Second Dual, Reflexive Spaces and Dual Operators	
7	Projections and Complementary Subspaces	
8	Linear Operators on Hilbert Spaces, Riesz Theorem	
9	The Adjoint of an Operator	
10	Normal, Self-adjoint and Unitary Operators	
11	The Spectrum of an Operator	
12	Positive Operators and Projections	
13	Compact Operators	
14	Spectral Theory of Compact Operators	

RECOMMENDED SOURCES	
Textbook	Linear Functional Analysis, Bryan Rynne, M.A. Youngson
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100

Quizzes	0	0
Assignments	0	0
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					**X**
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					**X**
3	Ability form and interpret the relations between research topics in mathematics					**X**
4	Ability to define, formulate and solve mathematical problems					**X**
5	Consciousness of professional ethics and responsibilty			**X**		
6	Ability to communicate actively			**X**		
7	Ability of self-development in fields of interest					**X**
8	Ability to learn, choose and use necessary information technologies	**X**				
9	Lifelong education			**X**		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	7	98

Mid-terms (Including self study)	2	23	46
Quizzes	-		
Assignments	-		
Final examination (Including self study)	1	25	25
Total Work Load			225
Total Work Load / 25 (h)			9
ECTS Credit of the Course			9

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
SENIOR PROJECT AND SEMINAR	MATH 491	8	3 + 0	3	7

Prerequisites	Consent of the instructor

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	Student`s learning how to do research in a basic area, investigate a problem. Writing in suitable format, submitting and presenting the study.
Content	Presentation of project in a seminar and project reports written to publication standards.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Learns how to do literature search.	1, 2	D
2) Can investigate a problem in an area.	1, 2	D
3) Can learn new concepts.	1,2	D
4) Can interpret what he/she has learned.	2	D
5) Can prepare report.	2	D
6) Can present the study.	1,2	D

Teaching Methods:	1: Lecture, 7: Face to face
Assessment Methods:	D: Presentation

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Meeting of the student and the instructor, talking about topics and determining options.	
2	Deciding on a subject. General introduction to the subject.	
3	Read, research and study.	
4	Read, research and study.	

5	Read, research and study.	
6	Read, research and study.	
7	Study.	
8	Study.	
9	Discussion about the work and plan for the future.	
10	Study.	
11	Discussion about the results.	
12	Preparation of the report.	
13	Writing the report.	
14	Finish the report and preparation of the presentation.	

RECOMMENDED SOURCES	
Textbook	
Additional Resources	Advised resources by instructor

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms		
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5

1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					X
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					X
3	Ability form and interpret the relations between research topics in mathematics					X
4	Ability to define, formulate and solve mathematical problems					X
5	Consciousness of professional ethics and responsibilty					X
6	Ability to communicate actively					X
7	Ability of self-development in fields of interest				X	
8	Ability to learn, choose and use necessary information technologies					X
9	Lifelong education					X

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)			
Quizzes	7	4	28
Assignments	1	35	35
Final examination (Including self study)			175
Total Work Load			7
Total Work Load / 25 (h)			7
ECTS Credit of the Course	14	3	42

urse Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CALCULUS ON MANIFOLDS	MATH 311	1-2	3+0	3	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	-
Instructors	
Assistants	
Goals	To teach the theory of exterior differential forms and integration on smooth manifolds.
Content	Functions on Euclidean spaces. Differentiation. Inverse and implicit function theorems. Integration. Partitions of unity. Sard's theorem. Multilinear functions, tensors, fields and differential forms. Poincare lemma. Chains and integration over chains. Stokes' theorem. Differentiable manifolds. Fields and forms on manifolds. Orientation and volume. Applications.

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knows the properties of exterior algebra of a finite dimensional real vector space.	2,3	1,4	A,B
2) Knows Stokes’ theorem for a manifold with boundary.	2,3	1,4	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Point-set topology in R^n	Textbook
2	Point-set topology in R^n (continued)	Textbook
3	Differentiation	Textbook
4	Differentiation (continued)	Textbook
5	Integration	Textbook
6	Integration (continued)	Textbook
7	Integration (continued)	Textbook

8	Integration on chains	Textbook
9	Integration on chains (continued)	Textbook
10	Integration on chains (continued)	Textbook
11	Integration on chains (continued)	Textbook
12	Integration on manifolds	Textbook
13	Integration on manifolds (continued)	Textbook
14	Integration on manifolds (continued)	Textbook

RECOMMENDED SOURCES	
Textbook	Calculus on Manifolds, by M. Spivak.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes	-	-
Assignments	0	0
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics				x	

3	Ability form and interpret the relations between research topics in mathematics				x	
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively	x				
7	Ability of self-development in fields of interest				x	
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education			x		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	15	30
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	28	28
Total Work Load			170
Total Work Load / 25 (h)			6,8
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
FOURIER ANALYSIS	MATH 344	1-2	3	3	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	-
Instructors	
Assistants	
Goals	To teach the basic principles of elementary Fourier analysis.
Content	Functional sequences and series. Convergence. Cauchy-Schwarz inequality. Fourier series and its convergence. Orthogonal polynomials. Fourier series with respect to an orthogonal system. Bessel's inequality. Generalizations with weight. Completeness of orthogonal systems. Parseval's identity. Fourier integrals. Fourier transformations. Applications to boundary value problems,

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knows how to compute Fourier series of a function.	2,3	1,4	A
2) Knows the basic terminology and results of inner product spaces, Hilbert spaces, L^2 spaces.	2,3	1,4	A
3) Knows how to compute Fourier transform of a function.	2,3	1,4	A
4) Knows some applications of Fourier series and Fourier transform.	2,3,4	1,4	A

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Fourier Series	Textbook
2	Fourier Series (continued)	Textbook
3	Fourier Series (continued)	Textbook

4	Orthogonal Sets of Functions	Textbook
5	Orthogonal Sets of Functions (continued)	Textbook
6	Orthogonal Sets of Functions (continued)	Textbook
7	Orthogonal Polynomials	Textbook
8	Orthogonal Polynomials (continued)	Textbook
9	Orthogonal Polynomials (continued)	Textbook
10	The Fourier Transform	Textbook
11	The Fourier Transform (continued)	Textbook
12	The Fourier Transform (continued)	Textbook
13	Some Boundary Value Problems	Textbook
14	Some Boundary Value Problems (continued)	Textbook

RECOMMENDED SOURCES	
Textbook	Fourier Analysis and Its Applications, by G. B. Folland
Additional Resources	Fourier Series and Boundary Value Problems, by J. W. Brown and R. V. Churchill.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes	-	-
Assignments	-	-
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM		
No	Program Learning Outcomes	Contribution

		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics				x	
3	Ability form and interpret the relations between research topics in mathematics				x	
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively	x				
7	Ability of self-development in fields of interest				x	
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education			x		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	14	28
Quizzes	-	-	-
Assignments	7	3	21
Final examination (Including self study)	1	14	14
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
QUALITATIVE THEORY OF ORDINARY DIFFERENTIAL EQUATIONS	MATH 346	2	3 + 0	3	7

Prerequisites	MATH 241 or MATH 245

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	Main goals are to provide the properties of the systems of linear and nonlinear equations, the development of their general solutions, the linearization of nonlinear systems, adjoint equations, Green's functions and Sturm-Liouville equations.
Content	Self-adjoint second order equations, general theorems. Green's function. Spectral theory. Sturm-Liouville systems, Liouville normal forms. Orthogonal functions and their completeness. Stability of first order systems of equations. Autonomous systems, matrix exponential functions and general solutions of systems of equations with constant coefficients Autonomous,gradient and Hamiltonian systems, Lyapunov functions.. Linearization. Periodic solutions, Poincare-Bendixon theorem.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Knows the stability of systems of equations	1, 2	A, B
2) Knows matrix exponential functions	1, 2	A, B
3) Knows the general solutions of systems of equations with constant coefficents	1, 2	A, B
4) Has some information on Hamilton systems and Lyapunov functions	1, 2	A, B
5) Uses Poincare-Bendixon theorem	1, 2	A, B
6) Knows Green's functions and orthogonal functions	1, 2	A, B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	Main results, linear phase diagram	1.1, 1.2, 1.3
2	Bifurcation, linear systems	1.4, 2.1
3	Linear systems, vectorial equations	2.1, 2.2
4	Matrix exponential systems, continuous systems	2.3, 3.1
5	Autonomous systems, plane phase diagrams	3.1, 3.2
6	Plane phase diagrams for linear systems	3.3
7	Plane phase diagrams for linear systems, stability of nonlinear systems	3.3, 3.4
8	Stability of nonlinear systems	3.4
9	Midterm Linearizations of nonlinear systems	3.5
10	Linearizations of nonlinear systems	3.5
11	Self-adjoint second order equations	5.1, 5.2
12	Sturm-Liouville problems	5.4
13	Green’s functions	5.9
14	Green’s functions	5.9

RECOMMENDED SOURCES	
Textbook	Theory of Differential Equations Kelley-Peterson, Pearson
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x
2	Acquiring fundamental knowledge on fundamental research fields in mathematics				x	
3	Ability form and interpret the relations between research topics in mathematics			x		
4	Ability to define, formulate and solve mathematical problems		x			
5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively				x	
7	Ability of self-development in fields of interest			x		
8	Ability to learn, choose and use necessary information technologies			x		
9	Lifelong education				x	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms (Including self study)	2	14	28
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	20	20
Total Work Load			174
Total Work Load / 25 (h)			6,99
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MATHEMATICAL MODELLING	MATH348	1-2	3 + 0	3	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Mathematics Elective
Course Coordinator	
Instructors	
Assistants	
Goals	Determining suitable mathematical models for problemles in some areas. advancing closest solutions to the models and evoluating results
Content	Modeling of systems with one independent, one dependent variable and with several variables, Modelling of systems with difference equations, Applications to some examples; population, finance, epidemic problems. . Analytical and numerical solutions of the model equations. Linear, Nonlinear, Periodic Models, Continuous modelling with differential equations, Applications to some problems.

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Determines variables and parameters of problem.	1,4	1,2,4	A
2) Analyzes the problem which is modelled.	2,3,4	1,2,4	A
3) Associates the solution of the model with the solution of the problem.	2,3,4	1,2,4	A
4) Writes a discrete model equation of a problem.	1,4	1,2,4	A
5) Writes a continous model equation of a problem.	1,4	1,2,4	A
6) Interests in modelling of some industrial, financial, social, health problems.	2,3,4,6,7,9	1,2,4	A

Teaching Methods:	1: Lecture, 2: Problem Solving 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Variables, parameters, setting up modelling materials.	
2	Setting up model with difference equations	

3	Examples in finance, population problems	
4	Fixed points and stability	
5	Systems of difference equations	
6	Examples in epidemic problems and some industrial problems	
7	Linear, nonlinear, periodic models	
8	Midterm, Markov chain	
9	Markov Chain, Continous modelling, differential equations	
10	Continous modelling, basic models of paticle dynamics	
11	Midterm, dimensionless equations	
12	Perturbation techniques for nonlinear models	
13	Examples in various areas.	
14	Examples in various areas	

RECOMMENDED SOURCES	
Textbook	
Additional Resources	Principles of Mathematical Modelling, C. Dym. Mathematical Modelling, J. N. Kapur

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	70
Quizzes		
Assignments	3	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Expertise/ Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					X
2	Acquiring fundamental knowledge on fundamental research fields in mathematics		X			
3	Ability form and interpret the relations between research topics in mathematics		X			
4	Ability to define, formulate and solve mathematical problems					X
5	Consciousness of professional ethics and responsibilty				X	
6	Ability to communicate actively				X	
7	Ability of self-development in fields of interest				X	
8	Ability to learn, choose and use necessary information technologies		X			
9	Lifelong education					X

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	14	28
Quizzes	-	-	-
Assignments	3	7	21
Final examination (Including self study)	1	14	14
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
REAL ANAYSIS II	MATH 353	1	3 + 0	3	6

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programs)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	This course is the continuation of Real Analysis I and together with Real Analysis I they constitutes the pillar of many topics in mathematics such as complex analysis, differential equations, differential and integral calculus, and differential geometry. It is impossible to assimilate these areas of mathematics without having this basic knowledge of analysis. The aim of the course is to equip students with this basic knowledge.
Content	Riemann Integral. Riemann Integrable Functions. The Fundamental Theorem of Calculus. The Darboux Integral. Sequences of functions. Pointwise and Uniform Convergence. Interchange of Limits. The Exponential and Logarithmic Functions. The Trigonometric Functions

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) A sound understanding of Riemann integral	1	A,B
2) Learn the class of Riemann integrable functions	1	A,B
3) Master the fundamental theorem of calculus	1	A,B
4) Aquire the knowledge of Darboux integral and its equivalence to Riemann integral of functions	1	A,B
5) Learn sequences of functions.	1	A,B
6) Apply these ideas to obtain rigorous definitions most important analytic functions	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Partitions and Tagged Partitions, Riemann sum, Riemann integrablity	Bartle, Sherbert Chapter 7-1
2	Some Properties of the Integral, Boundedness Theorem	Bartle, Sherbert Chapter 7-1
3	Riemann Integrable Functions, Cauchy Criterion, Squeeze Theorem	Bartle, Sherbert Chapter 7-2
4	Classes of Riemann Integrable Functions	Bartle, Sherbert Chapter 7-2
5	Additivity Theorem	Bartle, Sherbert Chapter 7-2
6	The Fundamental Theorem of Calculus, Substitution Theorem	Bartle, Sherbert Chapter 7-3
7	Lebesgue's Integrability Criterion, Composition Theorem,	Bartle, Sherbert Chapter 7-3
8	The Product Theorem, Integration by Parts, Taylor's Theorem with the Remainder	Bartle, Sherbert Chapter 7-3
9	The Darboux Integral, Upper and Lower Sums, Upper and Lower Integrals ,	Bartle, Sherbert Chapter 7-4
10	Darboux integrable functions Darboux Integrability Criterion, Continuous and Monotone Functions	Bartle, Sherbert Chapter 7-4
11	Equivalence of Riemann and Darboux integrals, Sequences of Functions, Pointwise and Uniform Convergence	Bartle, Sherbert Chapter 7-4, Chapter 8
12	Cauchy Criterion for Uniform Convergence	Bartle, Sherbert Chapter 8
13	The Exponential and Logarithmic Functions	Bartle, Sherbert Chapter 8
14	The Trigonometric Functions	Bartle, Sherbert Chapter 8

RECOMMENDED SOURCES	
Textbook	Robert G. Bartle,Donald R. Sherbert**, Introduction to Real Anlaysis**, Fourth Edition, John Wiley & Sons, Inc.(2011),ISBN-13: 978-0471433316ISBN-10: 9780471433316. https://sciencemathematicseducation.files.wordpress.com/2014/01/04714

	33314realanalysis4.pdf
Additional Resources	Stephen Abbott, Understanding Analysis, Springer, 2. Edition (2015)

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	70
Quizzes		-
Assignments	3	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics					x	
4	Ability to define, formulate and solve mathematical problems					x	
5	Consciousness of professional ethics and responsibility			x			

6	Ability to communicate actively			x			
7	Ability of self-development in fields of interest				x		
8	Ability to learn, choose and use necessary information technologies			x			
9	Lifelong education			x			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms (Including self-study)	1	15	15
Quizzes	-	-	0
Assignments	3	1	3
Final examination (Including self-study)	1	20	20
Total Work Load			178
Total Work Load / 25 (h)			7,12
ECTS Credit of the Course			7

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CONVEX ANALYSIS AND OPTIMIZATION	MATH 355	1	3 + 0	3	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programs)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	This course is intended to introduce basic concepts of convex analysis and optimization theory. First the convex subsets and its geometric properties are defined. Then convex functions and functions of several variables are studied. Finally the convex optimization theory is discussed.
Content	Affine subspaces, convex subsets, polyhedra, convex functions, differentiable functions of several variables, convex optimization theory

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) A sound understanding of convex subsets.	1	A,B
2) Learn the class of convex functions.	1	A,B
3) Learn differentiable functions of several variables.	1	A,B
4) Acquire the knowledge of convex optimization theory.	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Fourier-Motzkin Elimination	Ch.1
2	Affine Subspaces	Ch.2
3	Convex Subsets	Ch.3
4	Polyhedra	Ch.4
5	Computations with polyhedra	Ch.5
6	Closed convex subsets and separating planes	Ch.6
7	Convex Functions	7.1, 7.2, 7.3, 7.4
8	Convex Functions	7.5, 7.6, 7.7, 7.8
9	Differentiable functions of several variables	8.1, 8.2
10	Differentiable functions of several variables	8.3, 8.4, 8.5
11	Convex functions of several variables	Ch.9
12	Convex optimization	10.1, 10.2, 10.3, 10.4
13	Convex optimization	10.5, 10.6, 10.7
14	Review	

RECOMMENDED SOURCES	
Textbook	Undergraduate Convexity: From Fourier and Motzkin to Kuhn and Tucker, Niels Lauritzen, World Scientific Publishing, Illustrated Edition.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE
Mid-terms	1	25
Quizzes		-
Assignments	1	24
Total		**49**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		51
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		49
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics					x	
4	Ability to define, formulate and solve mathematical problems					x	
5	Consciousness of professional ethics and responsibility			x			
6	Ability to communicate actively			x			
7	Ability of self-development in fields of interest				x		
8	Ability to learn, choose and use necessary information technologies			x			
9	Lifelong education			x			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	6	84

Mid-terms (Including self-study)	1	15	15
Quizzes	-	-	0
Assignments	3	1	3
Final examination (Including self-study)	1	20	20
Total Work Load			178
Total Work Load / 25 (h)			7,12
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
NUMERICAL ANALYSIS	MATH 365	1-2	3 +0	3	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	Getting know and examine different numerical methods for various type of caluculations.
Content	Introduction and background. Iterative solution of non-linear equations, bisection method, fixed point iteration, Newton's and the secant method. Polynomial, divided differences and finite differences interpolations. Systems of linear equations, Gaussian elimination, LU decomposition, iterative methods. Numerical differentiation and integration.

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) can determine roots of higher order equations numerically.		1,2,3,4	A
2) have a basic knowledge of numerical interpolation and approximation of functions		1,2,3,4	A
3) have a basic knowledge of numerical integration and differentiation.		1,2,3,4	A
4) is familiar with numerical solution of ordinary differential equations [		1,2,3,4	A
5) can do error analysis		1,2,3,4	A

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Basic definitions, Taylor polynomials,	Course book:Chapter 1,3

2	Rootfinding, bisection method	4.1
3	Newton`s method, fixed point iteration	4.2, 4.4
4	Polynomial interpolation, Divided differences, Error in polynomial interpolation	5.1,5.2,5.3
5	Approximation problems, error	Chapter 6
6	Numerical integration, the trapezoidal and Simpson rules,	7.1
7	error formulas. Gaussian numerical integration method.	7.2,7.3
8	Numerical differentiation, Differentiation by interpolation,	7.4
9	MIDTERM	
10	An introduction to numerical solutions to differential equations	9.1
11	Euler's method, convergence.	9.2, 9.3
12	Taylor and Runge-Kutta methods	9.4
13	Cont.	9.4
14	review	

RECOMMENDED SOURCES	
Textbook	K. E. Atkinson, W. Han, Elementary Numerical Analysis, 3Ed. John Wiley, 2004.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	60
Quizzes	-	
Assignments	4	40
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					X
2	Acquiring fundamental knowledge on fundamental research fields in mathematics			X		
3	Ability form and interpret the relations between research topics in mathematics		X			
4	Ability to define, formulate and solve mathematical problems					X
5	Consciousness of professional ethics and responsibilty			X		
6	Ability to communicate actively	X				
7	Ability of self-development in fields of interest					X
8	Ability to learn, choose and use necessary information technologies				X	
9	Lifelong education				X	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	1	14	14
Quizzes			
Assignments	4	7	28
Final examination (Including self study)	1	21	21
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
GEOMETRIES	MATH 411	1-2	3 + 0	3	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	To provide information about the fundamental concepts of geometries defined by invariants of transformations on two dimensional spaces of constant curvature.
Content	Plane Euclidean geometry, Affine transformations in the Euclidean plane, Finite groups of isometries of Euclidean plane, Geometry on sphere, The projective plane, The hyperbolic plane.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Learns the geometry on plane	1	A
2) Learns the geometry on sphere	1	A
3) Learns the geometry on hyperbolic plane	1	A
4) Learns the transformations on plane	1	A
5) Learns the transformations on sphere	1	A
6) Learns the transformations on hyperbolic plane	1	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Plane Euclidean Geometry	From textbook Chapter 1
2	Plane Euclidean Geometry	Chapter 1
3	Plane Euclidean Geometry	Chapter 1
4	Affine transformations in Euclidean Plane	Chapter 2

5	Affine transformations in Euclidean Plane	Chapter 2
6	Finite Group of Isometries of Euclidean Plane	Chapter 3
7	MIDTERM and discussion of solutions)	
8	Geometry on Sphere	Chapter 4
9	Geometry on Sphere	Chapter 4
10	Geometry on Sphere	Chapter 4
11	The Projective plane	Chapter 5
12	Distance geometry on Projective Plane	Chapter 6
13	The Hyperbolic Plane	Chapter 7
14	The Hyperbolic Plane	Chapter 7

RECOMMENDED SOURCES	
Textbook	P. J. Ryan, Euclidean and Non-Euclidean Geometry An analytic Approach, Cambridge, 1997
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/ Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5

1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)			x		
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems					x
5	Consciousness of professional ethics and responsibilty			x		
6	Ability to communicate actively			x		
7	Ability of self-development in fields of interest				x	
8	Ability to learn, choose and use necessary information technologies			x		
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	1	24	24
Final examination (Including self study)	1	36	36
Total Work Load			172
Total Work Load / 25 (h)			6.88
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CLASSICAL LIE GROUPS AND LIE ALGEBRAS	MATH 413	1-2	3 + 0	3	7

Prerequisites	Math 212 and Math 321

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	To introduce the basics of the theory of Lie groups and Lie algebras within the framework of matrix groups.
Content	General linear groups, Matrix groups, example : orthogonal groups, Tangent space and the dimension of matrix groups, smooth homomorphisms, Exponential and the logarithm of a matrix, Center, Maximal tori, Clifford algebras, Normalizers, Weyl groups, Reflections and roots.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Applies linear algebraic methods	1	A,B
2) Knows the basic properties and examples of matrix groups	1	A,B
3) Determines the tangent space to a matrix group	1	A,B
4) Computes the exponential and the logarithm of matrices	1	A,B
5) Knows the definition and basic properties of a maximal torus in a matrix groups	1	A,B
6) Knows the definition and very basic properties of general Lie groups and Lie algebras	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	General linear groups	Textbook
2	Orthogonal groups	Textbook
3	Homomorphisms	Textbook

4	Exponential of a matrix, logarithm of a matrix	Textbook
5	Lie algebras	Textbook
6	Manifolds	Textbook
7	Maximal tori	Textbook
8	Covering by maximal tori	Textbook
9	Conjugacy of maximal tori	Textbook
10	Simply connected groups	Textbook
11	Spin(k)	Textbook
12	Normalizers, Weyl groups	Textbook
13	Lie groups	Textbook
14	Reflections, roots	Textbook

RECOMMENDED SOURCES	
Textbook	Matrix Groups, M. Curtis, 2nd. Ed., Springer-Verlag, 1984.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms		
Quizzes		
Assignments	7	100
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/ Field Courses

COURSE'S CONTRIBUTION TO PROGRAM		
No	Program Learning Outcomes	Contribution

		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)			x		
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems					x
5	Consciousness of professional ethics and responsibilty					x
6	Ability to communicate actively			x		
7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies		x			
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms (Including self study)			
Quizzes			
Assignements	7	8	56
Final examination (Including self study)	1	20	20
Total Work Load			174
Total Work Load / 25 (h)			6.96
ECTS Credit of the Course			7.00

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
READINGS IN GEOMETRY	MATH 416	1-2	3	3	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	-
Instructors	
Assistants	
Goals	To teach selected topics in geometry preferably involving parts of advanced books or research articles
Content	selected topics in geometry

Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

12		
13		
14		

RECOMMENDED SOURCES	
Textbook	
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms		
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE	1	100
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively				x	

7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	8	112
Mid-terms (Including self study)			
Quizzes			
Assignments			
Final examination (Including self study)	1	21	21
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
GALOIS THEORY	MATH 422	1-2	3 + 0	3	7

Prerequisites	Consent of the instructor

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	To introduce the basic facts about field extensions, Galois theory and its applications.
Content	Algebraic extensions, Algebraic Closure, Splitting Fields, Normal Extensions, Separable Extensions, Finite Fields, Fundamental Theorem of Galois Theory, Cyclic Extensions, Solvability by Radicals, Solvability of Algebraic Equations, Construction with Ruler and Compass.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Applies irreducibility criterions to decide if a given polynomial is irreducible or not. Computes the minimal polynomial of a given element algebraic over a base field.	1	A,B
2) Computes the splitting field of a given polynomial	1	A,B
3) Decides if a given polynomial is separable or not.	1	A,B
4) Decides if a given extension is Galois or not. Compute the Galois group of a given Galois extension.	1	A,B
5) Applies Fundamental Theorem of Galois Theory in concrete examples	1	A,B
6) Analyses particular polynomials – computes their Galois groups and assesses their solvability by radicals.	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Rings and homomorphisms Ideals and quotient rings	Textbook
2	Polynomial rings Vector spaces	Textbook
3	Algebraic extensions	Textbook

4	Algebraic extensions continued	Textbook
5	Algebraic Closure	Textbook
6	Splitting Fields, Normal Extensions	Textbook
7	Separable Extensions	Textbook
8	Finite Fields	Textbook
9	Fundamental Theorem of Galois Theory	Textbook
10	Fundamental Theorem of Galois Theory continued	Textbook
11	Cyclic Extensions	Textbook
12	Solvability by Radicals	Textbook
13	Solvability of Algebraic Equations	Textbook
14	Construction with Ruler and Compass	Textbook

RECOMMENDED SOURCES	
Textbook	Galois Theory, M. P. Murthy, K.G. Ramanathan, C.S. Seshadri, U. Shukla, R. Sridharan, Tata Inst. of Fund. Research, Bombay, 1965
Additional Resources	Algebra, Serge Lang, 3rd. ed., Addison-Wesley, 1994

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms		
Quizzes		
Assignments	7	100
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/ Field Courses

COURSE'S CONTRIBUTION TO PROGRAM		
No	Program Learning Outcomes	Contribution

		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)			x		
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems					x
5	Consciousness of professional ethics and responsibilty					x
6	Ability to communicate actively			x		
7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies		x			
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms (Including self study)			
Quizzes			
Assignements	7	8	56
Final examination (Including self study)	1	20	20
Total Work Load			174
Total Work Load / 25 (h)			6.96
ECTS Credit of the Course			7.00

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
INTRODUCTION TO REPRESENTATION THEORY	MATH 423	1	3+0	3	7

Prerequisites	MATH 321 AND MATH 322

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	To introduce basic facts about representation theory of groups and to find a representation of a group as a group of matrices in order to have a concrete description of this group.
Content	Generalities and basic definitions. Sums, quotients, tensor products, characters and decompositions of representations. Group algebra. Generalities on algebras and modules, semi-simple modules. Invertible and nilpotent elements. Idempotents. The Jacobson radical. Semi-simple and local algebras. Projective modules. Primitive decompositions and points. Blocks of an algebra. Duality. Symmetric algebras.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Visualizes groups as matrices	1,2	A
2) Uses group algebra to construct the regular representation of a group	1,2	A
3) Uses FG-modules to obtain information about representations of a group G over a field F	1,2	A
4) Computes the character table of a group	1,2	A
5) Applies tensor products to find all the irreducible characters of a direct product of groups	1,2	A
6) Uses blocks of an algebra to get information about its modules	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Generalities and basic definitions	Textbook

2	Sums, quotients, tensor products, characters	Textbook
3	Decompositions of representations	Textbook
4	Group algebra	Textbook
5	Generalities on algebras and modules, semi-simple modules	Textbook
6	Invertible and nilpotent elements	Textbook
7	Idempotents	Textbook
8	The Jacobson radical	Textbook
9	Semi-simple and local algebras	Textbook
10	Projective modules	Textbook
11	Primitive decompositions and points	Textbook
12	Blocks of an algebra	Textbook
13	Duality	Textbook
14	Symmetric algebras	Textbook

RECOMMENDED SOURCES	
Textbook	Representations and characters of groups. Gordon James, Martin Liebeck.
Additional Resources	Representations of finite groups and associative algebras. C.W. Curtis, I. Reiner.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/ Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)			x		
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems					X
5	Consciousness of professional ethics and responsibilty					x
6	Ability to communicate actively		x			
7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies			x		
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms (Including self study)	2	15	30
Quizzes	-	-	-
Assignments	-	-	-
Final examination (Including self study)	1	20	20
Total Work Load			176
Total Work Load / 25 (h)			7.04
ECTS Credit of the Course			7

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CATEGORY THEORY IN COMPUTATION	MATH 424	1	3 + 0	3	7

Prerequisites	MATH321 Abstract Algebra, MATH101 Set Theory and Logic

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programs)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	This course aims to equip students with knowledge of fundamentals of category theory and applications in computing sciences.
Content	Some preliminaries for categories, Sets, functions. Definitions of categories, functors, natural transformations. Functional programming languages as categories. Category of sets. Categories of sets with extra structure. Yoneda Lemma. Universal properties. Initial and Terminal objects. Adjoint functors. Monads/Lawvere theories. Finitary algebraic theories. Universal Algebra and Programming Languages.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Learn categories, functors and natural transformations.	1	A,B
2) Learn Yoneda lemma and its consequences.	1	A,B
3) Learn universal algebra through monads and Lawvere theories	1	A,B
4) Understand the link between universal algebra and programming	1	A,B
5) Master categorical constructions.	1	A,B
	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Preliminaries	
2	Categories, functors and natural transformations	
3	Mathematical structures and functional programming languages as categories	
4	Categories of sets	
5	Categories of sets with extra structures	
6	Representable functors and Yoneda lemma.	
7	Universal properties: Initial and terminal objects	
8	Categorical products, coproducts	
9	Categorical limits and colimits	
10	Adjoint functors	
11	Lawvere theories/Monads: Definitions and Examples	
12	Universal algebra via Lawvere theories/Monads	
13	Lawvere theories/Monads in Computer Science	
14	Universal algebra and programming	

RECOMMENDED SOURCES	
Textbook	Barr, Michael, and Charles Wells. *Category theory for computing science*. Vol. 49. New York: Prentice Hall, 1990. http://www.tac.mta.ca/tac/reprints/articles/22/tr22.pdf
Additional Resources	Mac Lane, Saunders. *Categories for the working mathematician*. Vol. 5. Springer Science & Business Media, 2013. Leinster, Tom. *Basic category theory*. Vol. 143. Cambridge University Press, 2014. Milewski, Bartosz. *Category theory for programmers*. Blurb, 2018.

MATERIAL SHARING	
Documents	

Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	60
Quizzes		-
Assignments	3	40
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM								
No	Program Learning Outcomes	Contribution						
		1	2	3	4	5		
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)				x			
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x		
3	Ability form and interpret the relations between research topics in mathematics					x		
4	Ability to define, formulate and solve mathematical problems					x		
5	Consciousness of professional ethics and responsibility			x				
6	Ability to communicate actively			x				
7	Ability of self-development in fields of interest				x			
8	Ability to learn, choose and use necessary information technologies			x				
9	Lifelong education			x				

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	5	70
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Mid-terms (Including self-study)	2	10	20
Quizzes	-	-	0
Assignments	3	8	24
Final examination (Including self-study)	1	19	19
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
READINGS IN ALGEBRA	MATH 425	1-2	3+0	3	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	-
Instructors	
Assistants	
Goals	To teach selected topics in algebra preferably involving parts of advanced books or research articles
Content	selected topics in algebra

Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

12		
13		
14		

RECOMMENDED SOURCES	
Textbook	
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms		
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE	1	100
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively				x	

7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	8	112
Mid-terms (Including self study)			
Quizzes			
Assignments			
Final examination (Including self study)	1	21	21
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Ideals and Varieties	MATH 426	1	3 + 0	3	6

Prerequisites	MATH322 Abstract Algebra

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programs)
Course Type	Elective
Course Coordinator	Mehmet Akif Erdal
Instructors	
Assistants	
Goals	The aim of this course is to introduce students to the preliminary concepts for classical algebraic geometry and understand the links between geometry and algebra.
Content	Polynomial rings, ideals and varieties. Monomial orderings. Monomial ideals and Dickson's lemma. The Hilbert Basis Theorem and Gröbner Bases. Properties of Groebner bases. Buchberger's algorithm. Applications of Groebner bases. Elimination and Extension theorems. Resultants and the extension theorem.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Learn ideals of polynomial rings and varieties.	1	A,B
2) Learn monomial ordering and monomial ideals.	1	A,B
3) Learn Hilbert Basis Theorem and Gröbner Bases	1	A,B
4) Understand Buchberger's algorithm.	1	A,B
5) Understand the link between basic geometric shapes and polynomial ideals.	1	A,B
	1	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Polynomials and Affine Space	
2	Affine Varieties	
3	Parametrizations of Affine Varieties	
4	Ideals	
5	Polynomials of One Variable	
6	Orderings on the Monomials in k[x1,..., xn].	
7	A Division Algorithm in k[x1,..., xn]	
8	Monomial Ideals and Dickson's Lemma	
9	he Hilbert Basis Theorem and Gröbner Bases	
10	Properties of Gröbner Bases, Buchberger's Algorithm	
11	First Applications of Gröbner Bases	
12	Refinements of the Buchberger Criterion	
13	Improvements on Buchberger's Algorithm	
14	Elimination Theory, The Elimination and Extension Theorems	

RECOMMENDED SOURCES	
Textbook	**Cox, Little and O'Shea - Ideals, Varieties and Algorithms**
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	60
Quizzes		-
Assignments	3	40
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM								
No	Program Learning Outcomes	Contribution						
		1	2	3	4	5		
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)				x			
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x		
3	Ability form and interpret the relations between research topics in mathematics					x		
4	Ability to define, formulate and solve mathematical problems					x		
5	Consciousness of professional ethics and responsibility			x				
6	Ability to communicate actively			x				
7	Ability of self-development in fields of interest				x			
8	Ability to learn, choose and use necessary information technologies			x				
9	Lifelong education			x				

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)

Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self-study)	2	17.5	35
Quizzes	-	-	0
Assignments	3	7	21
Final examination (Including self-study)	1	20	20
Total Work Load			188
Total Work Load / 25 (h)			7.52
ECTS Credit of the Course			7.52

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
COMPUTATIONAL ALGEBRA	MATH 427	7-8	3 + 0	3	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	The aim of this course is to provide students with a knowledge and understanding of basic results of computational algebra and basic algorithmic approaches to algebra and their implementations.
Content	The Elimination and Extension Theorems, The Geometry of Elimination, Implicitization, Singular Points and Envelopes, Gröbner Bases and the Extension Theorem, Hilbert's Nullstellensatz, Radical Ideals and the Ideal-Variety Correspondence, Sums, Products and Intersections of Ideals, Zariski Closure and Quotients of Ideals, Irreducible Varieties, Decomposition of a Variety, Polynomial Mappings, Quotients of Polynomial Rings, Algorithmic Computations in k[x1, . . . , xn]/I, The Coordinate Ring of an Affine Variety, Primary Decomposition of Ideals, The Variety of a Monomial Ideal

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Knows about algebraic geometry and commutative algebra.	1,2	A,B
2) Knows about Gröbner basis theory and understands the relevant algorithms and their analysis.	1,2	A,B
3) Knows how to use computational algorithms in commutative algebra and Gröbner basis theory to solve various problems.	1,2	A,B
4) Participates in research and scientific discussions and is able to learn new topics in computational algebra.	1,2	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT

Week	Topics	Study Materials
1	The Elimination and Extension Theorems, The Geometry of Elimination	Textbook 3.1, 3.2
2	Implicitization	Textbook 3.3
3	Singular Points and Envelopes	Textbook 3.4
4	Gröbner Bases and the Extension Theorem	Textbook 3.5
5	Hilbert's Nullstellensatz	Textbook 4.1
6	Radical Ideals and the Ideal-Variety Correspondence	Textbook 4.2
7	Sums, Products and Intersections of Ideals	Textbook 4.3
8	Zariski Closure and Quotients of Ideals	Textbook 4.4
9	Irreducible Varieties, Decomposition of a Variety	Textbook 4.5
10	Decomposition of a Variety into Irreducibles	Textbook 4.6
11	Primary Decomposition of Ideals	Textbook 4.8
12	Polynomial Mappings, Quotients of Polynomial Rings	Textbook 5.1, 5.2
13	Algorithmic Computations in k[x1, . . . , xn]/I	Textbook 5.3
14	The Coordinate Ring of an Affine Variety	Textbook 5.4

RECOMMENDED SOURCES

Textbook	D. A. Cox, J. Little, D. O'Shea, Ideals, Varieties, and Algorithms, Springer, Fourth Edition, 2015.
Additional Resources	G.-M. Greuel, G. Pfister, A Singular introduction to commutative algebra, Springer, 2002. D. Shafer, V. Romanovski, The center and cyclicity problems: a computational algebra approach, Birkhäuser Basel, 2009. V.G. Romanovski, M. Presern, An approach to solving systems of polynomials via modular arithmetics with applications, Journal of Computational and Applied Mathematics, 236, 196–208, 2011.

MATERIAL SHARING

Documents	

Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	70
Quizzes	0	0
Assignments	5	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE	1	50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics					x	
4	Ability to define, formulate and solve mathematical problems					x	
5	Consciousness of professional ethics and responsibility				x		
6	Ability to communicate actively			x			
7	Ability of self-development in fields of interest					x	
8	Ability to learn, choose and use necessary information technologies					x	
9	Lifelong education			x			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	1	10	10
Quizzes			
Assignments	5	5	25
Final examination (Including self study)	1	20	20
Total Work Load			167
Total Work Load / 25 (h)			6.68
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
INTRODUCTION TO GRAPH THEORY	MATH 440	1-2	3 + 0	3	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	Çizgeler, bilimdeki, işletmedeki ve endüstrideki pek çok problemde model olarak kullanılır. Bu dersin amacı, öğrencilere grafikler, yönlendirilmiş grafikler ve ağaçlar gibi çizgelerin temel bilgileriyle birlikte, çizgelerin gerçek hayat uygulamalarını ve çok bilinen bazı algoritmalarını tanıtmaktır.
Content	Fundamental concepts of graphs and digraphs. Trees and distance. Matching and factorization. Connectivity, networks. Graph coloring. Planar.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Manipulate the basic concepts associated with graphs such as paths, cycles, vertex degrees, and counting. Directed graphs. Use these definitions in proofs, and calculate specific values.		1,2
2) The concept of tree, spanning trees, optimization.		1,2
3) Cuts and connectivity. Network Flow problems and algorithms		1,2
4) Matching and Covers. Algorithms and Applications		1,2
5) Vertex Colorings		1,2
6) Characterization of Planar Graphs. Parameters of Planarity.		1,2

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	What Is a Graph? Paths, Cycles, and Trails. Vertex Degrees	
2	Counting. Directed Graphs	

3	Basic Properties of Trees. Spanning Trees and Enumeration	
4	Optimization and Trees	
5	Matching and Covers. Algorithms and Applications.	
6	Matching in General Graphs.	
7	Cuts and Connectivity. K-connected Graphs.	
8	Network Flow Problems	
9	Vertex Colorings and Upper Bounds	
10	Structure of k-chromatic Graphs. Enumerative Aspects.	
11	Embeddings and Euler's Formula. Characterization of Planar Graphs.	
12	Parameters of Planarity.	
13	Line Graphs and Edge-Coloring. Hamiltonian Cycles.	
14	Planarity, Coloring, and Cycles.	

RECOMMENDED SOURCES	
Textbook	1. Douglas B. West - Introduction to Graph Theory (Pearson) 2. Wilson RJ - Introduction to Graph Theory (Longmans)
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					**X**
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					**X**
3	Ability form and interpret the relations between research topics in mathematics					**X**
4	Ability to define, formulate and solve mathematical problems					**X**
5	Consciousness of professional ethics and responsibilty			**X**		
6	Ability to communicate actively			**X**		
7	Ability of self-development in fields of interest					**X**
8	Ability to learn, choose and use necessary information technologies			**X**		
9	Lifelong education			**X**		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms (Including self study)	2	10	20
Quizzes	-		
Assignments	-		
Final examination (Including self study)	1	20	20
Total Work Load			166
Total Work Load / 25 (h)			6.64
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
READINGS IN DIFFERENTIAL EQUATIONS	MATH 441	1-2	3+0	3	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	-
Instructors	
Assistants	
Goals	To teach selected topics in differential equations preferably involving parts of advanced books or research articles
Content	selected topics in differential equations

Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

12		
13		
14		

RECOMMENDED SOURCES	
Textbook	
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms		
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE	1	100
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively				x	

7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	8	112
Mid-terms (Including self study)			
Quizzes			
Assignments			
Final examination (Including self study)	1	21	21
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
READINGS IN ANALYSIS	MATH 453	1-2	3	3	7

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	-
Instructors	
Assistants	
Goals	To teach selected topics in analysis preferably involving parts of advanced books or research articles
Content	selected topics in analysis

Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

12		
13		
14		

RECOMMENDED SOURCES	
Textbook	
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms		
Quizzes		
Assignments		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE	1	100
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)	x				
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x
3	Ability form and interpret the relations between research topics in mathematics					x
4	Ability to define, formulate and solve mathematical problems				x	
5	Consciousness of professional ethics and responsibilty				x	
6	Ability to communicate actively				x	

7	Ability of self-development in fields of interest					x
8	Ability to learn, choose and use necessary information technologies	x				
9	Lifelong education					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	8	112
Mid-terms (Including self study)			
Quizzes			
Assignments			
Final examination (Including self study)	1	21	21
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CALCULUS OF VARIATIONS	MATH 454	1-2	3+0	3	7

Prerequisites	MATH 343

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	To understand the problems of Pyhsics and engineering better and find their solutions
Content	Euler-Lagrange equations and generalizations.Hamiltonian functions. Invariant integrals. Noether theorem. Second variation and Jacobi fields. Constraint variational problems. Isoperimetric problems. Non-holonomic systems.

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knows variations and their properties	3,4,5,7,8,9	1,2	A
2) Derives Euler equation	3,4,5,7,8,9	1,2	A
3) Can perform generalizations	3,4,5,7,8,9	1,2	A
4) Investigates moving boundary value problems	3,4,5,7,8,9	1,2	A
5) Knows the direct method and Ritz method	3,4,5,7,8,9	1,2	A
6) Can investigate the multiple independent variables case	3,4,5,7,8,9	1,2	A

Teaching Methods:	1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Minima and maxima of differentiable functions	
2	Variations and its properties	

3	Euler equation	
4	Some generalizations	
5	Parametric representations of variation problems	
6	Variation problems with moving boundaries	
7	Variation problems with moving boundaries (continued)	
8	Sufficiency for an extremum	
9	Problems with constrained extrema	
10	Problems with constrained extrema (continued)	
11	Direct methods	
12	Ritz’s method	
13	Generalizations to more than one independent variables	
14	Generalizations to more than one independent variables	

RECOMMENDED SOURCES	
Textbook	L. E. Elsgolc; Calculus of Variations
Additional Resources	F. B. Hildebrand; Methods of Applied Mathematics

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	100
Quizzes	-	
Assignments	-	
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)				**X**	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics			**X**		
3	Ability form and interpret the relations between research topics in mathematics					**X**
4	Ability to define, formulate and solve mathematical problems					**X**
5	Consciousness of professional ethics and responsibilty			**X**		
6	Ability to communicate actively			**X**		
7	Ability of self-development in fields of interest					**X**
8	Ability to learn, choose and use necessary information technologies			**X**		
9	Lifelong education			**X**		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	15	30
Quizzes	0	0	0
Assignments	0	0	0
Final examination (Including self study)	1	30	30
Total Work Load			172
Total Work Load / 25 (h)			6.88
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MATHEMATICAL STATISTICS	462	1-2	3+0	3	7

Prerequisites	

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	To prepare students for a career in actuarial science, graduate studies in financial engineering/mathematics and high school teachers to teach probability and statistics in high schools.
Content	Introduction and background. Populations and samples. Measures of the center of a set of observations. Measurement of variability. Sampling, sampling distributions. Estimations. Hypothesis testing. Statistical decision theory. Contigency Tables. Regression and correlation analysis.

Learning Outcomes	Teaching Methods	Assessment Methods
1) Compute measures od central tendency	1,2	A,B
2) Compute measures of variability	1,2	A,B
3) Estimate parameters of a distribution	1,2	A,B
4) Perform hypothesis testing	1,2	A,B
5) Apply contigency tables	1,2	A,B
6) Use regression equations	1,2	A,B

Teaching Methods:	1: Lecture, 2: Problem Solving
Assessment Methods:	A: Written examination, B: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Descriptive Statistics. Histograms, measures of Central Tendency and Dispersion.	
2	Estimating Parameters: the method of Maximum Likelihood and the Method of Moments.	

3	Properties of Estimators: Unbiased, Minimum Variance Estimators	
4	The Rao- Cramer Inequality. Efficiency, Sufficiency, Consistency.	
5	Hypothesis testing concerning the Mean of the Normal Distribution. Null and Alternative Hypothesis. Type I and II Errors.	
6	Critical Point, Test Statistic, One Tail and Two Tail Tests when σ is Known.	
7	P-value. Small sample T-test. Power of Test.	
8	Relation between Type I error, Type II error and sample size. Test concerning the parameter p of the Binomial distribution.	
9	Confidence intervals concerning μ and p. Determining the sample size.	
10	Paired t-test, tests concerning the means of two populations. Test concerning a single variance. Test concerning two variances.	
11	Hypothesis testing concerning non-normal data. The likelihood ratio test.	
12	The Multinomial Distribution Goodness-of-Fit Tests: All Parameters Known.	
13	Contingency Tables. Regression Analysis	
14	Regressions Analysis. The Method of Least Squares. The Linear Model. Covariance and Correlation.	

RECOMMENDED SOURCES	
Textbook	Mathematical Statistics with Applicatins. Wackerly, Mendenhall, Scheaffer. Brooks/Cole
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	70
Quizzes		
Assignments	3	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					x	
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					x	
3	Ability form and interpret the relations between research topics in mathematics			x			
4	Ability to define, formulate and solve mathmatical problems					x	
5	Consciousness of professional ethics and responsibilty		x				
6	Ability to communicate actively			x			
7	Ability of self-development in fields of interest			x			
8	Ability to learn, choose and use necessary information technologies			x			
9	Lifelong education				x		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Mid-terms (Including self study)	2	14	28
Quizzes	-	-	-
Assignments	3	5	15
Final examination (Including self study)	1	20	20
Total Work Load			175
Total Work Load / 25 (h)			7
ECTS Credit of the Course			7

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
PHYSICS I	PHYS 101	1	3 +1+2	3	6

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The aim of this course is to teach concepts of mechanics.
Content	Measurement and Unit, Vectors, Motion in one and two dimensions, Newton’s Laws of Motion, Work, Power, Energy, Momentum and Collisions, Rotational Motion, Torque and Angular Momentum, Universal Gravitational Law.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Relates units and their conversion	1,2,3	A,B,I
2) Calculates the operations with vectors	1,2,3	A,B,I
3) Analysis the translational motion	1,2,3	A,B,I
4) Writes down the equations of motion for the systems with and without friction	1,2,3	A,B,I
5) Applies the work-energy rpinciple	1,2,3	A,B,I
6) Applies the momentum and center of mass information to various cases	1,2,3	A,B,I
7) Analaysis the cases about rotation and angular momentum.	1,2,3	A,B,I
8) Knows the universal gravitational law	1,2,3	A,B,I

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion,
Assessment Methods:	A: Testing, B: Final, I:Lab

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Measurement	Units

2	Motion in one dimension	Kinematic equations
3	Motion in two dimensions and vectors	Operations with vectors
4	Dynamics: Newton’s Laws of Motion	Laws of dynamics
5	Dynamics: Newton’s Laws of Motion	Newton’s Laws
6	Further Applications of Newton’s Laws of Motion	Newton’s Laws
7	Work, Power, Energy – Midterm I	Revision
8	Conservation of Energy	What is energy?
9	Linear Momentum and Collisions	Linear Momentum and vectors
10	Linear Momentum and Collisions	Linear Momentum and vectors
11	Rotational Motion	Circular motion
12	Rotational Motion – Midterm II	Rotational kinematics
13	Conservation of Angular Momentum	Angular momentum
14	Universal Gravitational Law	What is the gravitational field?

RECOMMENDED SOURCES	
Textbook	Douglas C. GIANCOLI, Physics for Scientists & Engineers , 4th Edition, Pearson
Additional Resources	Halliday, Resnick, Walker: Fundamentals of Physics, 6th Edition-Serway, Jewett, Physics for Scientists and Engineers with Modern Physics, 8th Edition

MATERIAL SHARING	
Documents	Mechanics Lab Experiments Handouts
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	50
Lab	12	20
Final	1	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Support courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					
3	Ability form and interpret the relations between research topics in mathematics					
4	Ability to define, formulate and solve mathematical problems					
5	Consciousness of professional ethics and responsibilty					
6	Ability to communicate actively					
7	Ability of self-development in fields of interest					
8	Ability to learn, choose and use necessary information technologies					
9	Lifelong education					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms	2	2	4
Lab	12	2	24
Final examination	1	3	3
Total Work Load			143
Total Work Load / 25 (h)			5.72
ECTS Credit of the Course			6

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
PHYSICS II	PHYS 102	2	3 +(1+2)	4	6

Prerequisites	PHYS101, MATH151

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The aim of this course is to teach basic concepts of electricity and magnetism and in particular, to have students learn for themselves how physics as a discipline can be used to obtain a deep understanding of how the world works.
Content	Electric Charge, Electric Fields, Gauss' Law, Electric Potential, Capacitance, Current and Resistance, Circuits, Magnetic Fields, Magnetic Field Due to Currents, Induction and Inductance, Magnetism of Matter, Maxwell's Equations, Electromagnetic Oscillations and Alternating Current, LC oscillator, RLC Phase diagrams

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Expresses the basic (theoretical and experimental) concepts of electricity and magnetism.	1,2,5,14,15	A,B,I
2) Identifies, formulates and solves physical problems regarding the electricity and magnetism.	1,2,5,14,15	A,B,I
3) Relates the physics of electricty and magnetism and other branches of physics,and learns how physics as a discipline can be used to obtain a deep understanding of how the world works.	1,2,5,14,15	A,B,I
4) Gets prepared for the advanced physics lectures regarding electricity and magnetism and learns a range of methods for applying these understandings and problems toward solving a broad range of physical problems .	1,2,5,14,15	A,B,I

Teaching Methods:	1: Lecture, 2: Question-Answer, 5: Problem Solving, 14: Laboratory ; 15:Homework
Assessment Methods:	A: Testing, B: Final, I:Laboratory

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	ELECTRIC CHARGE, ELECTRIC FIELDS	electric charge
2	GAUSS'S LAW	Electric field

3	ELECTRIC POTENTIAL	Potantial
4	CAPACITANCE	Capacitors
5	Midterm Exam	
6	CURRENT AND RESISTANCE	Current, circuit elements
7	CIRCUITS	Electric circuits
8	MAGNETIC FIELDS	Magnetic field
9	MAGNETIC FIELD DUE TO CURRENTS	Sources of magnetic fields
10	Midterm Exam	
11	INDUCTION AND INDUCTANCE	Faraday's Law of Induction
12	MAGNETISM OF MATTER	Magnetism
13	MAXWELL'S EQUATIONS	Maxwell
14	ELECTROMAGNETIC OSCILLATIONS, LC OSCILLATOR, RLC	Electromagnetic oscillations in the electric circuits

RECOMMENDED SOURCES	
Textbook	"PHYSICS FOR SCIENTISTS AND ENGINEERS" GIANCOLI, 4TH EDITION, PRENTICE HALL
Additional Resources	FUNDAMENTALS OF PHYSICS" HALLIDAY RESNICK , "PHYSICS", SERWAY.

MATERIAL SHARING	
Documents	"FIRST YEAR PHYSICS LABORATORY EXPERIMENTS" YEDİTEPE UNIVERSITY-DEPARTMENT OF PHYSICS (2002-2013)
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	71
Laboratory	12	29
Assignment	10	0
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Support courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					
3	Ability form and interpret the relations between research topics in mathematics					
4	Ability to define, formulate and solve mathematical problems					
5	Consciousness of professional ethics and responsibilty					
6	Ability to communicate actively					
7	Ability of self-development in fields of interest					
8	Ability to learn, choose and use necessary information technologies					
9	Lifelong education					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms	2	2	4
Lab	12	2	24
Final examination	1	3	3
Total Work Load			
Total Work Load / 25 (h)			143
ECTS Credit of the Course			5.72
ECTS Credit of the Course			6

HUM 103 - COURSE INFORMATON					
Course Title	***Code***	***Semester***	***L+P Hour***	***Credits***	***ECTS***
HUMANITIES	HUM 103		2+0	2	3

GENERAL INFORMATION	
This course is mandatory for ALL undergraduate students of Yeditepe University. Each student takes this course in line with the academic program of his/her Faculty.	
Prerequisites	None
Coordination Office	GSF Building 708, Monday 9-18
Attendance (Lectures)	Students are required to attend to at least %80 of the classes.
Language of Instruction	Turkish
Course Level	Undergraduate
Course Type	Compulsory
Course Coordinator	Dr. Ferzan Durul ferzan.durul@yeditepe.edu.tr
Goals	This course aims to provide: a comprehensive review of the history of civilization; an understanding of the role of multiple disciplines (philosophy, arts, literature, science) as they progressed within various civilizations around the globe throughout history; how these humanities disciplines contributed to the formation of the value system of our contemporary civilization; to develop the ability to analyze contemporary social movements. Particular emphasis is given to the fields of science, philosophy, arts and literature.
Content	The start of civilization on earth, the Neolithic age; Turkish, Indian and Chinese civilizations and their interactions; the developments in the Mediterranean cultural basin; the elements of civilization in the middle ages; the examination of eastern and Eurasian civilizations with a particular focus on the formation in arts, social sciences, technology, science; The renaissance, the enlightenment, the American and the French revolution; modernization phases in the Turkish civilization; the new world order; the study of civilizations in the 21st century.

COURSE LEARNING OUTCOMES		
Students who take this course will	**Teaching Methods**	**Assessment Methods**
gain an understanding of the evolution of science and the scientific approach throughout history, and the appreciation of scientific thinking as the most important dimension of the value systems of contemporary human civilization.	1,2,3	A,B
be able to interpret and appreciate the diversity of the cultures and the dynamics of nations throughout history in their geographical and historical context.	1,2,3	A,B
be able to understand the formation and evolution of the concepts of equality, ethics and justice, and the importance of their application in today's global environment.	1,2,3	A,B

be able to understand the formation, evolution and the passing among nations and subsequent generations of the arts, esthetics and literature throughout history.		
gain an appreciation of the development of the methods of inquiry and the importance of critical thinking in today’s global environment.	1,2,3	A,B
understand the eastern roots of civilizations (as opposed to only western), gain a multi-centered civilization appreciaton, and realize the value of conceptual frames such as the Turkish World and the Eastern World.	1,2,3	A,B

Teaching Methods:	1: Lecture, 2: Q-A, 3: Debate
Assessment Methods:	A: Exam , B: Paper

COURSE CONTENT

Week	Topics	Study Materials
1	What is "Human"?	İnsanın Tarih Yolculuğu, Bölüm 1 İnsan Nedir? Sorusu Düşünce Dünyasında Yerini Alıyor (Syf: 21-42)
2	Culture and Cvilization	İnsanın Tarih Yolculuğu, Bölüm 2 İnsanın Kültürel Özne’ye Dönüşüm Hikayesi (Syf: 43-60)
3	Cultural Phases I: Paleolithic-Mesolithic Period	İnsanın Tarih Yolculuğu, Bölüm 3 Kültürel Evreler: Avcılıktan Yerleşik hayata Geçiş (Syf: 61-83)
4	Cultural Phases II: NeolithicPeriod	İnsanın Tarih Yolculuğu, Bölüm 3 Kültürel Evreler: Avcılıktan Yerleşik hayata Geçiş (Syf: 61-83)
5	Early Age Civilizations I: Mesopotamia	sanın Tarih Yolculuğu, Bölüm 4 Bereketli Hilal’in Uygarlıkları: Mezopotamya ve Mısır (Syf: 85-114)

6	Early Age Civilizations II: Indian, Chinese, Turkish	sanın Tarih Yolculuğu, Bölüm 4 Bereketli Hilal'in Uygarlıkları: Mezopotamya ve Mısır (Syf: 85-114)
7	Mediterranean Cultural Basin I: Signs of Greek, Turkish and Roman	İnsanın Tarih Yolculuğu, Bölüm 6 Eski Yunan Medeniyeti (Syf: 145-166) Bölüm 7, Roma Tarihi (167-193)
8	Mid-term exam	
9	Mediterranean Cultural Basin I: Signs of Greek, Turkish and Roman	İnsanın Tarih Yolculuğu, Bölüm 6 Eski Yunan Medeniyeti (Syf: 145-166) Bölüm 7, Roma Tarihi (167-193)
10	Middle Ages and feudality	İnsanın Tarih Yolculuğu, Bölüm 9 Orta Çağda Avrupa ve Feodalizm (Syf: 219-242)
11	Eastern Cultural World: The First Civilizations of the Muslim Turkish States	İnsanın Tarih Yolculuğu, Bölüm 10 İlk Müslüman Türk Devletleri (Syf: 243-268)
12	Renaissance Reform	İnsanın Tarih Yolculuğu, Bölüm 11 Rönesans Nedir? (Syf: 269-286) Bölüm 12 Reform: Dinsel Yorumların Çoğullaşması (Syf: 287-302)
13	Age of Revolutions; English Revolution; American Revolution; The Enlightenment; French Revolution; Modernization in Turkish Civilization	İnsanın Tarih yolculuğu Bölüm 13 Aydınlanma (Syf: 303-323)

		Bölüm 14 Sanayi Devrimi (Syf: 329-347)
14	Evaluation and review	

COURSE MATERIALS	
Text Books	İnsanın Tarih Yolculuğu, Yeditepe Üniversitesi Yayınevi, 2020, ISBN: 978-975-307-109-3

ASSESSMENT		
	NUMBER	**PERCENTAGE**
Midterm	1	40
Final	1	60
Total		**100**

ECTS ALLOCATION			
Activity	**Quantity**	**Duration (Hours)**	**Total Workload (Hours)**
Duration (Total of exam and class hours)	14	2	28
Out of class study time	14	3	42
Mid-term exam	1	1	1
Final	1	1	1
Readind	1	3	3
Total Work Load			75
Total Work Load / 25 (h)			3

ECTS Credits 3

CONTRIBUTION TO PROGRAM OUTCOMES

No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Understands the basic concepts and analysis methods required to be successful in academic studies in the field of philosophy.		x				

2	Gain the critical view, analytical approach, problem solving, versatile view, interpretation and inference skills required for a successful philosophy career.			x			
3	Communicates effectively, is successful especially in a written and oral presentation, can do teamwork and interdisciplinary work, has an entrepreneurial spirit, a sense of responsibility has developed, produces original ideas in the field of philosophy, adheres to ethical principles.				x		
4	With a lifelong learning approach, they reach the competence to continue their professional and personal development by using all kinds of information sources.				x		
5	Gains awareness of professional and social ethics.					x	
6	Gains the ability to choose and develop contemporary tools required for applications in the field of philosophy and to use information technologies effectively.	x					
7	Gains the basic information about the history of philosophy.		x				
8	Have enough knowledge of the classical language and at least one modern language to follow the texts of the history of philosophy in their original	x					
9	Identifies, recognizes, grasps, and discusses the problems in the field of philosophy within their place in the history of philosophy.					x	
10	Develops competence in reading, understanding, and analyzing texts from different languages in the field of philosophy.	x					

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Turkish Language 1	TKL 201	1	2+0	2	2

Prerequisites	

Language of Instruction	Turkish 
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	-
Goals	The course aims at helping students improve their skill in written and oral narration, by teaching them features and rules of the language.
Content	A general information about language in general and world languages, the historical evolution of Turkish and its relationship with other languages, phonetical and morphological characteristics of Modern Turkish, applying/practicing rules of orthography and punctuation

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1-Aims at helping students use punctuation marks and orthography correctly	1, 3,4	A
2-Aims at helping students understand basic features of language and criteria for classifying languages	1, 3,4	A
3-Aims at helping students remember the evolution of Turkish	1,3,4	A
4-Aims at teaching students features of Turkish and how to apply them	1,3,4	A
5-Aims at improving students' skills in written and oral narration	1,3,4	A

Teaching Methods:	1. Lecture 2. Case study 3. Discussion 4. Demonstration 5. Group work 6. Microteaching 7. Problem solving
Assessment Methods:	A. Classical exam B. Multiple-choice test C. Incomplete D. True-False E. Oral exam F. Portfolio G. Performance type H. Report

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction/orientation: Giving students information about the content of the course and how the material will be covered	Related readings
2	Punctuation, general rules of spelling	Related readings
3	Definition and basic features of, language, relationship /parallel between language and culture	Related readings

4	Types of languages	Related readings
5	Morphological classification of world languages	Related readings
6	Language Families	Related readings
7	Information about Short story-which is one of the genres of written narrative	Related readings
8	Midterm Exam	Related readings
9	Historical evolution of Turkish-alphabets used by Turks	Related readings
10	Phonetical characteristics and features of Turkish	Related readings
11	Clichés	Related readings
12	Ungrammatical sentences-examples(wrong word use)	Related readings
13	Ungrammatical sentences-examples (badly constructed sentences)	Related readings
14	Information about Essay-which is one of the genres of written narrative	Related readings

RECOMMENDED SOURCES	
Textbook	Aksan, Doğan(1975), "Anadili", Türk Dili,31/285,s. 423-434 Aksan, Doğan(1987), Her Yönüyle Dil, Ana Çizgileriyle Dilbilim,3 cilt , Ankara Aksan, Doğan (2000), Türkiye Türkçesinin Dünü, Bugünü, Yarını, Ankara, Bilgi yayınevi Ali, Sabahattin (2005), Yeni Dünya, İstanbul, YKY Ataç, Nurullah (2010), Günlerin Getirdiği-Sözden Söze, 7.b., İstanbul, YKY Atay, Oğuz (2000), Korkuyu Beklerken, İstanbul, İletişim Yayınları Çotuksöken, Yusuf (2007), Uygulamalı Türk Dili, İstanbul,Papatya Yayıncılık Hepçilingirler, Feyza (2013),Türkçe "Off", 43.b.,İstanbul, Everest Yayınları Korkmaz, Zeynep ve diğerleri (1995), Türk Dili ve Kompozisyon Bilgileri, Ankara, Yüksek Öğretim Kurulu Matbaası Montaigne (1991),Denemeler,(Türkçesi: Sabahattin Eyüboğlu), İstanbul,Cem Yayınevi Özdemir, Emin (2008), Sözlü Yazılı Anlatım Sanatı Kompozisyon, İstanbul, Remzi Kitabevi Taner, Haldun(1995), Çok Güzelsin Gitme Dur, İstanbul, Bilgi Yayınevi Taner, Haldun (2005), Şişhane'ye Yağmur Yağıyordu/Ayışığında "Çalışkur", Ankara, Bilgi Yayınevi Türkçe Ders Notları -TKL 201 (Haz. Bedri Selimhocaoğlu) Türk Dili,Yazılı Anlatım-Sözlü Anlatım (2009), (Ed.Nurettin Demir, Emine Yılmaz),Ankara, Nobel Yayın Dağıtım Türkçe Sözlük (2011), Türk Dil Kurumu Yayınları, 11. b., Ankara Yazım Kılavuzu (2009), Türk Dil Kurumu Yayınları, 26. b., Ankara
Additional Resources	

MATERIAL SHARING	
Documents	Xerox copies given to students before class.
Assignments	

Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Laboratory		
Assignment		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Humanities, Communication and Management Skills Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					
3	Ability form and interpret the relations between research topics in mathematics					
4	Ability to define, formulate and solve mathematical problems					
5	Consciousness of professional ethics and responsibilty					
6	Ability to communicate actively					
7	Ability of self-development in fields of interest					
8	Ability to learn, choose and use necessary information technologies					
9	Lifelong education					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	15	2	30
Hours for off-the-classroom study (Pre-study, practice)	15	1	15
Mid-terms (Including self study)	1	2	2
Quizzes			

Assignments (Term Paper)	1	1	1
Final examination (Including self study)	1	2	2
Total Work Load			50
Total Work Load / 25 (h)			2
ECTS Credit of the Course			2

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Turkish Language 2	TKL 202	2	2 + 0	2	2

Prerequisites	

Language of Instruction	Turkish 
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The course aims at helping students improve their skill in written and oral narration, by teaching them characteristics and rules of the language
Content	Lexicon of Turkish, study of literary texts, rules for formal correspondence, format and rules for scientific research writing and genres of oral narration

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1-Aims at helping students understand the subject, point of view and the main theme in fiction and informative texts	1, 3,4	A
2-Aims at helping students understand the means and possibilities of Turkish narration	1, 3,4	A
3-Aims at helping students understand, interpret and apply fiction and informative texts?	1,3,4	A
4-Aims at teaching how to write a petition, report, minutes, business letters	1,3,4	A
5-Aims at improving the students' skills in written and oral narration	1,3,4	A

Teaching Methods:	1. Lecture 2. Case study 3. Discussion 4. Demonstration 5. Group work 6. Microteaching 7. Problem solving
Assessment Methods:	A. Classical exam B. Multiple-choice test C. Incomplete D. True-False E. Oral exam F. Portfolio G. Performance type H. Report

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction/orientation: Giving students information about the content of the course and how the material will be covered	Related readings
2	Informative texts, fiction , subject / topic, point of view, main theme of the text.	Related readings
3	Kinds of vocabulary,(what)a parapraph (is),genres of narrative	Related readings
4	how to write a petition, ,preparing a CV	Related readings

5	Written narrative genres: memoirs, travel, diary and letter	Related readings
6	Written narrative genres :article, essay, newspaper article / column, critique	Related readings
7	(writing) reports, minutes (of a meeting)	Related readings
8	Midterm Exam	Related readings
9	Scientific research, writing summary, taking notes, bibliography and rules for footnote writing	Related readings
10	Lexicon of Turkish of Turkish(native words, loan words, idioms)	Related readings
11	Turkish Lexicon (proverbs, cliches, reduplication of words)	Related readings
12	Syntax of Turkish and semantics	Related readings
13	Fiction (novel, poetry, theatre)	Related readings
14	Genres of oral narrative	Related readings

RECOMMENDED SOURCES	
Textbook	Aksan, Doğan (1999), Anlambilim, Ankara, Engin yayınevi Aksan, Doğan(1987), Her Yönüyle Dil, Ana Çizgileriyle Dilbilim,3 cilt , Ankara Aksan, Doğan(1996), Türkçenin Sözvarlığı, Ankara, Engin Yayınevi Aksan, Doğan (2000), Türkiye Türkçesinin Dünü, Bugünü, Yarını, Ankara, Bilgi yayınevi Atay, Falih Rıfkı (2004), Çankaya, İstanbul, Pozitif yayınları Atay, Oğuz (2012), Bir Bilim Adamının Romanı Mustafa İnan,36.b., İstanbul,İletişim Yay. Atay, Oğuz(2013), Günlük,16. b., İstanbul, İletişim Yay. Boysan, Aydın(1997), Yollarda, Dünyadan Gezi Yazıları, 2. b., Ankara, Bilgi Yayınevi Çotuksöken, Yusuf (2007), Uygulamalı Türk Dili, İstanbul,Papatya Yayıncılık Kongar, Emre (2008), Kızlarıma Mektuplar Yaşamdan Satırbaşları, 45.b., İstanbul, Remzi Kitabevi Korkmaz, Zeynep ve diğerleri (1995), Türk Dili ve Kompozisyon Bilgileri, Ankara, Yüksek Öğretim Kurulu Matbaası Özdemir, Emin (2008), Sözlü Yazılı Anlatım Sanatı Kompozisyon, İstanbul, Remzi Kitabevi Özdemir, Emin (1994), Yazınsal Türler, 2. b.,Ankara, Ümit Yayıncılık Tanpınar, Ahmet Hamdi (2004), Saatleri Ayarlama Enstitüsü, İstanbul, Dergah Yayınları Türkçe Ders Notları -TKL 202 (Haz. Bedri Selimhocaoğlu) Türk Dili,Yazılı Anlatım-Sözlü Anlatım (2009), (Ed.Nurettin Demir, Emine Yılmaz),Ankara, Nobel Yayın Dağıtım Türkçe Sözlük (2011), Türk Dil Kurumu Yayınları, 11. b., Ankara Yazım Kılavuzu (2009), Türk Dil Kurumu Yayınları, 26. b., Ankara
Additional Resources	

MATERIAL SHARING	
Documents	Xerox copies given to students before class.
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Laboratory		
Assignment		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Humanities, Communication and Management Skills Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)						
2	Acquiring fundamental knowledge on fundamental research fields in mathematics						
3	Ability form and interpret the relations between research topics in mathematics						
4	Ability to define, formulate and solve mathematical problems						
5	Consciousness of professional ethics and responsibilty						
6	Ability to communicate actively						
7	Ability of self-development in fields of interest						
8	Ability to learn, choose and use necessary information technologies						
9	Lifelong education						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	15	2	30
Hours for off-the-classroom study (Pre-study, practice)	15	1	15
Mid-terms (Including self study)	1	2	2
Quizzes			
Assignments (Term Paper)	1	1	1

Final examination (Including self study)	1	2	2
Total Work Load			50
Total Work Load / 25 (h)			2
ECTS Credit of the Course			2

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
History of Turkish Revolution	HTR 301	1	2+0	2	2

Prerequisites	

Language of Instruction	Turkish 
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The basic purpose of the programme is to provide the students with a common understanding on the usefulness and the effective methods of studying history, on the importance of revolutionary history of Turkey and on the role of Ataturk,
Content	The fields of study of the programme are the Ottoman history, war of independence, achievements and leadership values of Mustafa Kemal Ataturk the process of founding the Turkish Republic, social and political history of the 20th century.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Expresses the historical background of Republic of Turkey	1,2,3	A
2) Analyzes Turkish War of Independence after the First World War,	1,2,3	A
3) Relates National Movement and its aims.	1,2,3	A
4) Explains the foundation philosophy of The Grand National Assembly of Turkey	1,2,3	A
5) Interprets the fully independence of a new Turkish state	1,2,3	A
6) Teaches the basic principles of Republic	1,2,3	A

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion,
Assessment Methods:	A: Exam ,B; Test C: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	The Enlightenment Period	
2	Industrial and French Revolutions	
3	The Europe in 19th century and the processes which caused to the First World War	

4	Trials for the modernization in Ottoman state	
5	Tanzimat - Islahat Reforms and Constitutionalism	
6	The war of Trablusgarp and Balkans and their results	
7	The First World War and Armistice	
8	Midterm Exam	
9	The developments after Armistice and Mustafa Kemal's departure to Samsun	
10	The Aim of National Movement, Methods and the period of Congress	
11	National Ant, the period of Grand National Assembly of Turkey	
12	The Fronts and final treaties which closed the Fronts	
13	Sakarya War, Battle of Dumlupınar, Armistice of Mudanya and the treaty of Laussanne, Abolishment of Sultanate	
14	General Revision	

RECOMMENDED SOURCES	
Textbook	
Additional Resources	- **İmparatorluktan Ulus Devlete Türk İnkılap Tarihi,** Öztürk, Cemil (Prof.Dr.) (Editör) Yazarlar : Tülay Alim BARAN (Prof.Dr.),Edip Başer (Dr.), Süleyman Beyoğlu(Prof.Dr.), Handan Diker(Dr.), Vahdettin Engin (Prof.Dr.), Cezmi Eraslan (Prof.Dr.), Arzu M.Erdoğan (Dr.), Cemil Öztürk (Prof.Dr.) **- Nutuk**

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Laboratory		
Assignment		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Humanities, Communication and Management Skills Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)					
2	Acquiring fundamental knowledge on fundamental research fields in mathematics					
3	Ability form and interpret the relations between research topics in mathematics					
4	Ability to define, formulate and solve mathematical problems					
5	Consciousness of professional ethics and responsibilty					
6	Ability to communicate actively					
7	Ability of self-development in fields of interest					
8	Ability to learn, choose and use necessary information technologies					
9	Lifelong education					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	16	2	32
Hours for off-the-classroom study (Pre-study, practice)	16	1	16
Mid-terms (Including self study)	1	1	1
Quizzes			
Assignments			
Final examination (Including self study)	1	1	1
Total Work Load			50
Total Work Load / 25 (h)			2
ECTS Credit of the Course			2

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
History of Turkish Revolution	HTR 302	2	2+0	2	2

Prerequisites	

Language of Instruction	Turkish 
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The basic purpose of the programme is to provide the students with a common understanding on the usefulness and the effective methods of studying history, on the importance of revolutionary history of Turkey and on the role of Ataturk,
Content	The fields of the programme are to study the external and internal events in the new state after Laussane Treaty. Moreover following Ataturk's period, it is discussed the Turkish Foreign Policy in the new period which was particularly established after the Second World War.(Turkey's joining to security pacts and the relations with European Union)

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Expresses Republic of Turkey's position in International arena after Lausanne treaty	1,2,3	A
2) Analyzes Social and Political reforms	1,2,3	A
3) Relates Ataturk's Principles and Revolutions	1,2,3	A
4) Explains Ataturk's Foreign Policy notion	1,2,3	A
5) Interprets Turkey's position in the 21st century	1,2,3	A

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion,
Assessment Methods:	A: Exam ,B; Test C: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Lausanne Peace Treaty (compare to treaty of Sevres)	
2	The reforms in political areas (abolition of Sultanate-the establishment of Republic)	
3	The reactions against Political reforms and trial for Multi-Party system	

4	Social and Cultural Reforms	
5	Economic Developments	
6	The developments in Science and Education systems	
7	Midterm Exam	
8	Turkish Foreign Policy in 1939-1945	
9	Economic and Law developments after 1938	
10	The Second World War, Turkish Foreign Policy in the Second World War	
11	The developments after Second World War, the membership for European Union, the relations between Turkey and the United States, National Security	
12	Atatürk's Principles	
13	General Review	
14	General Revision	

RECOMMENDED SOURCES	
Textbook	
Additional Resources	- **İmparatorluktan Ulus Devlete Türk İnkılap Tarihi,** Öztürk, Cemil (Prof.Dr.) (Editör) Yazarlar : Tülay Alim BARAN (Prof.Dr.),Edip Başer (Dr.), Süleyman Beyoğlu(Prof.Dr.), Handan Diker(Dr.), Vahdettin Engin (Prof.Dr.), Cezmi Eraslan (Prof.Dr.), Arzu M.Erdoğan (Dr.), Cemil Öztürk (Prof.Dr.) **- Nutuk**

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	100
Laboratory		
Assignment		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50

Total		**100**

COURSE CATEGORY	Humanities, Communication and Management Skills Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)						
2	Acquiring fundamental knowledge on fundamental research fields in mathematics						
3	Ability form and interpret the relations between research topics in mathematics						
4	Ability to define, formulate and solve mathematical problems						
5	Consciousness of professional ethics and responsibilty						
6	Ability to communicate actively						
7	Ability of self-development in fields of interest						
8	Ability to learn, choose and use necessary information technologies						
9	Lifelong education						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x Total course hours)	16	2	32
Hours for off-the-classroom study (Pre-study, practice)	16	1	16
Mid-terms (Including self study)	1	1	1
Quizzes			
Assignments			
Final examination (Including self study)	1	1	1
Total Work Load			50
Total Work Load / 25 (h)			2
ECTS Credit of the Course			2