Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Abstract Algebra-1	MATH 601-3	3	-	3	1	1	MATH 323-3 or Equivalent

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	140
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54 ~ 47**		Total	**217**
Total Learning Hours = **264**			Equivalent **ECTS points** = Total LH/28 = **9.04**	

(1) Brief Course Description

This course provides an introduction to abstract algebra, so it is designed to cover the basic concepts of the abstract algebra and entrench the algebraic ideas in the students mind, which lead to use mathematical logic concepts to prove basic theories, which easily lead to study deeply an advanced courses.

(2) Course Objectives

The main objectives of this course are focused to:

1. Demonstrate basic concepts of abstract algebra, able to deal with abstract concepts as well as use mathematical logic to prove basic theories.
2. Describe algebraic construction and its conditions.
3. Discover and apply the abstract algebra is the main theory of mathematics that study the important algebraic construction such as groups, rings, fields and other.

(3) Course Contents

Groups, subgroups, lattices of subgroups, cosets and normal subgroups, quotient group, homorphism, isomorphism and related theorems. Rings, subrings, ideals, ring homomorphism, quotient rings, polynomial rings and irreducibility criteria. Fields, field extensions, algebraic extensions, algebraic closure and fundamental theorem of algebra.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1. I. N. Herstein, Topics in Algebra, John Wiley and Sons, 2006.
2. J.B. Farleigh, A first course in abstract algebra, Wesley Publishing Co. London, 7th edition, 2003.

(7) Reference Books

1. D. Dummit and R. Foote, Abstract Algebra, John Wiley & Sons, 3rd edition, 2004.
2. Thomas W. Hungerford, Algebra, Springer, 2003.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Real Analysis-1	MATH 602-3	3	-	3	1	1	MATH 315-3 or Equivalent

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	140
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**217**
Total Learning Hours = **264**			Equivalent **ECTS points** = Total LH/28 = **9.04**	

(1) Brief Course Description

Real analysis is a branch of mathematics that deals with real numbers and the idea of sets, functions, and limits. Real analysis has become an important component in areas of natural science, social science, engineering, business and computer science. This course develops and examines the basic materials in real analysis in a systemic and rigorous manner in the context of real-valued functions of real variable. It covers the fundamentals of real analysis: the real number system, sequences, continuity, differentiation ,the Riemann-Stieltjes integral and sequence and series of functions .

(2) Course Objectives

The main objectives of this course are focused to:

1. Describe the fundamental properties of the real numbers.
2. Demonstrate an understanding of limits and how they are used in sequences series and differentiation.
3. Apply the properties of sequences to solve related problems.
4. Analyze continuity of a function and distinguish between continuity and uniform continuity.
5. Construct rigorous mathematical proofs of basic results in real analysis.
6. Distinguish between point-wise convergence and uniform convergence.
7. Apply the properties of the Riemann-Stieltjes integral to identify integrable functions.

(3) Course Contents

Real number, Countable and uncountable sets, Sequences and Series, Limits and Continuity of real functions, Derivative of real functions, Riemann-Stieltjes integral, Functions of more than one variables

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
4.	Assignment-1 / Quiz-1/ Presentations-1	5%
5.	Midterm Exam-1	20%
6.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1. Walter Rudin , Principle of Mathematical Analysis; Third Edition, McGraw –Hill. Inc. ISBN 1976

(7) Reference Books

1- R.G. Bartle and D.G. Sherbert,'' Introduction to Real Analysis'', , 3rd Edition JohnWiley and Sons, 2000

2- Richard R. Goldberg,''Methods of Real Analysis '',3rd Edition, John Wiley and Sons .Inc. 1976.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Complex Analysis	MATH 603-3	3	-	3	1	1	MATH 314-3 or Equivalent

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	140
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**217**
Total Learning Hours = **264**			Equivalent **ECTS points** = Total LH/28 = **9.04**	

(1) Brief Course Description

Complex analysis is a branch of mathematical analysis that deals with functions of complex variables. It has a wide range of applications in various areas such as engineering, physics, differential equations and in number theory . The main focus of these course is on the study of analytic functions and their basic properties. Topics covered are: complex number system, limits, differentiation, analytic functions, Mobius transformations, complex line integral, Cauchy theorem, Cauchy integral formula and Taylor's theorem.

(2) Course Objectives

The main objectives of this course are focused to:

1. Prove basic results relating to analytic functions.
2. Apply the Cauchy Integral formula to evaluate certain class of complex line integrals.
3. Express analytic functions in power series.
4. Find a harmonic conjugate of a given harmonic function in an appropriate domain.
5. Apply the Cauchy Riemann equations to problems related to differentiability of function of complex variable.
6. Apply the properties of Mobius transformation in mappings and related problems in analytic functions

(3) Course Contents

The complex number system, metric space and the topology of C, analytic function, power series, analytic function as mapping Mobius transformation, complex integration, power series representation of analytic function, zeros of an analytic function, Cauchy's theorem, integral formula, the homotopic version of Cauchy's theorem, simply connectivity, counting zeros, the open mapping theorem and Goursat's theorem..

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
7.	Assignment-1 / Quiz-1/ Presentations-1	5%
8.	Midterm Exam-1	20%
9.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1. Jerrold E. Marsden and Michael J. Hoffman ,''Basic Complex Analysis'', third edition, W.H Freeman, New York, 1999.

(7) Reference Books

1- I, John B. Conway ,''Function of one Complex Variable'', Second edition, Springer, New York, 1978.

2- 1 Richard A. Silverman,''Introductory Complex Analysis'', ISBN, New York, Dover Publications, 1967.

3- B. Choudhary, Wiley Eastern ,''Elements of Complex Analysis'' Ltd., New Delhi, 1993.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Numerical Analysis	MATH 604-3	3	-	3	1	1	MATH 419-3 or Equivalent

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	130
Exams and quizzes	5		Working for lab	50
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**257**
Total Learning Hours **= 304**			Equivalent **ECTS points** = Total LH/28 = **10.9**	

(1) Brief Course Description

Numerical analysis is the area of mathematics and computer science that creates, analyzes, and implements algorithms for solving numerically the problems of continuous mathematics. Which involves systems, approximation functions, solutions for ordinary and partial differential equations, Numerical differentiation and integration, methods to solve initial and boundary values problems, stability and convergence of the solutions that occur in different areas of sciences.

(2) Course Objectives

The main objectives of this course are focused to:

1. Solve linear and non-linear systems with different numerical methods.
2. Distinguish between different numerical methods.
3. Formulate appropriate method to approximate numerical solutions.
4. Apply the appropriate method to solve mathematical problems and prove the stability and convergence of these methods.
5. Explain some new numerical methods that have different areas of research

(3) Course Contents

Linear and nonlinear systems; Iterative methods ; Interpolation ; Approximation of solutions ; Error estimate ; Data fitting ; Numerical differentiation and integration ; Numerical solutions of boundary value problems ; Stability and convergence of solutions ; Finite difference method ; Finite element method.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
10.	Assignment-1 / Quiz-1/ Presentations-1	5%
11.	Midterm Exam-1	20%
12.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1. Richard Burden and J.Dougias Faires,"Numerical Anlysis",Brooks/Cole, Cengage Learning, 2011

(7) Reference Books

1. Alfio Quarteroni ,Riccardo Sacco and Fausto Saleri, 'Numerical Mathematics ' Springer, 2007

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Theory of Differential Equations	MATH 605-3	3	-	3	1	1	MATH 352-3 or Equivalent

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	130
Exams and quizzes	5		Working for lab	50
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**257**
Total Learning Hours **= 304**			Equivalent **ECTS points** = Total LH/28 = **10.9**	

(1) Brief Course Description

The basic theory of differential equations as covered in all applied mathematics. Indeed, modern applied mathematics essentially began when Newton developed the calculus in order to solve the differential equations that followed from his laws of motion. However, this theory is not only of interest to the applied mathematician: indeed, it is an integral part of any rigorous mathematical training, and is developed here in a systematic way.

(2) Course Objectives

The main objectives of this course are focused to:

1- Describe the most technique of studying differential equations.
2- Solve various systems of differential equations.
3- Prove the existence and uniqueness of solutions.
4- Interpret the qualitative behavior of solutions for system of differential equations.

(3) Course Contents

Systems of differential equations, Existence and Uniqueness proofs, Singular points, Asymptotic behavior of solutions, Existence, Stability and Uniqueness for Initial-Value Problems, Sturm-Liouville Theory, Eigenvalues and Eigen functions, **Lyapunov's Second Method** , Rayleigh- Rietz methods, Perturbation theory.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
13.	Assignment-1 / Quiz-1/ Presentations-1	5%
14.	Midterm Exam-1	20%
15.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1. R. Kent Nagle, E. B. Saff, A. D. Snider, Fundamentals of Differential Equations and Boundary Value Problems, Pearson Addison-Wesley 2008.

(7) Reference Books

1. Wolfgang Walter, Ordinary Differential Equations, (Translated by Russel Thompson), Springer 1998.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Mathematical Statistics-I	MATH 606-3	3	-	3	1	1	MATH 352-3 & MATH 453-3 or Equivalent

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	130
Exams and quizzes	5		Working for lab	50
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**257**
Total Learning Hours = **304**			Equivalent **ECTS points** = Total LH/28 = **10.9**	

(1) Brief Course Description

This is the first graduate course in mathematical statistics and it aims to use the probability techniques to build a statistical theory. It gives a rigorous mathematical foundation for Estimation theory and Testing hypothesis. It provides a firm basis for work on Statistical theory and its applications.

(2) Course Objectives

The main objectives of this course are focused to:

1- Demonstrate and understand the language of probability theory to build Statistical Theory.
2- State random variables and order variables and its distribution.
3- Distinguish between concepts of Conditioning, Transforms and Convergence.
4- Discover and apply Sampling and methods of Sampling.
5- Integrate knowledge to collect data and analyze problems in a critical manner and make a decision
6- Analyze advanced work on Statistical Theory and applications.

(3) Course Contents

a - Theoretical side

Axioms and foundations of probability. Conditional probability and Bayes' theorem. Independence. Random variables and distribution functions and moments. Characteristic functions, Laplace transforms and moment generating functions. Function of random variables. Random vectors and their distributions. Convergence of sequences of random variables. Laws of large numbers and the central limit theorem. Random samples, Sampling and sampling distributions, Sample moments and their distributions. Order statistics and their distributions.

b - The practical side (if applicable)

Using computer Statistical Software such as Minitab or any other computer tools.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
16.	Assignment-1 / Quiz-1/ Presentations-1	5%
17.	Midterm Exam-1	20%
18.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- R. V. Hogg and Allen T. Craig ,''Introduction to Mathematical Statistics'', Mcmillan, 1978, 1995

2- **R.V. Hogg, J. Mckean and A.T.Craig** ,''Introduction to Mathematical Statistics'',Prentice Hall, 2005

(7) Reference Books

1. D V.K. Rohatgi,''Introduction to Probability Theory and Mathematical Statistics'' **Wiley**, 1976

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Probability Theory-1	MATH 607-3	3	-	3	1	1	MATH 352-3 or Equivalent

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	132
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**209**
Total Learning Hours = **256**			Equivalent **ECTS points** = Total LH/28 = **9.1**	

(1) Brief Course Description

This is the first graduate course in probability theory and measure-theoretic probability. It provides a solid background and understanding of the basic results and methods in measure and probability theory before entering into a more advance measure-theoretic probability course. It develops the measure probability basis that is required in modern probability theories. The material in this course is fundamental not only in probabilistic analysis, but also in a various applied areas such as stochastic processes, queuing theory, mathematical finance and reliability.

(2) Course Objectives

The main objectives of this course are focused to:

1- Demonstrate the basic theorems in measure and probability Theory
2- Distinguish between mathematical transforms and operators in Probability Theory
3- Understanding the convergence theory and limits theory
4- Apply the concept of conditional probability and martingale theory.
5- Explain theoretical problem-solving abilities. Probabilistic intuitions and problem-solving insight
6- Interpret knowledge to establish a solid foundation for advanced studies in probability and measure.

(3) Course Contents

a - Theoretical side

Foundations of probability theory. Fundamentals of measure theory. Measure-theoretic approach to definitions of probability space, construction of probability spaces, measure constructions, random variables and distribution functions. Measurable functions and random variables. Independence. Tails events. Zero-one laws and Borel-Cantelli lemmas. Integration and Expectation. Modes of convergence and relations between the various modes. Laws of large numbers and sum of Independent variables. Convergence in distribution. Characteristic functions. The central limit theorem. Weak convergence of probability measures. Conditional expectations and martingales.

b - The practical side (if applicable)

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
19.	Assignment-1 / Quiz-1/ Presentations-1	5%
20.	Midterm Exam-1	20%
21.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- Patrick Billingsely .''Probability and Measure, , 2nd edition'', Wiley1986, 1995.

2- Richard Durrett ,''Probability: Theory and Example', Wadsworth and Brools/cole, ca, 1995

(7) Reference Books

1- Allan Gut ,''Probability: A graduate Course'', Springer, **2007**

2- Sidney Resnick ,''Probability Path'', Birkhauser, 1999.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Abstract Algebra-2	MATH 620-3	3	-	3	2	1	MATH 601-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	132
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**209**
Total Learning Hours = **256**			Equivalent **ECTS points** = Total LH/28 = **9.1**	

(1) Brief Course Description

This course continues the study of algebra begun in the Abstract Algebra1. It places emphasis on the study of abelian groups (the classifications of finite abelian groups) as well as Direct products. Furthermore, we study the sylow theorems and its application and we also study the Jordan–Holder theorem and solvable groups. Moreover, we study the unique factorization in polynomial rings and we provide a brief summary of Galois theory.

(2) Course Objectives

The main objectives of this course are focused to:

1- Understand that the abstract algebra is the main theory of mathematics that study the important algebraic construction such as groups, rings, fields and other.
2- Familiar with the algebraic construction and its conditions.
3- Able to develop the ability to think logically and positively, and the development of his skill in dealing with the abstract proofs.

(3) Course Contents

Number Theory, the study of the integer numbers is one of the oldest branches of mathematics and yet it continues to be a very active area of research today. Number Theory is rich with beautiful theorems and elegant patterns. It's unsolved problems have challenged the greatest mathematical minds and given rise to much of modern mathematics. So, this course is designed as an introduction to number theory, suited scientifically for students interested in developing their mathematical skills, and to enhance and reinforce the student's understanding of concepts through the theory of the integers from a list of axioms.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
22.	Assignment-1 / Quiz-1/ Presentations-1	5%
23.	Midterm Exam-1	20%
24.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1. I. N. Herstein, Topics in Algebra, John Wiley and Sons, 2006.
2. J.B. Farleigh, A first course in abstract algebra, Wesley Publishing Co. London, 7th edition, 2003.

(7) Reference Books

1. D. Dummit and R. Foote, Abstract Algebra, John Wiley & Sons, 3rd edition, 2004.
2. Thomas W. Hungerford, Algebra, Springer, 2003.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Topics in Algebra	MATH 622-3	3	-	3	2	1	MATH 601-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	132
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**209**
Total Learning Hours **= 256**			Equivalent **ECTS points** = Total LH/28 = **9.1**	

(1) Brief Course Description

The course discusses advanced topics in the field of Algebra. This course provides introduction to advance algebra, so it is designed to cover the advance concepts of algebra and entrench the algebraic ideas in the student mind, which lead to use mathematical logic and reasoning based ideas to prove theorems, which easily lead to know and develop ideas of other higher courses in algebra.
The topics in the course may vary from year to year

(2) Course Objectives

The main objectives of this course are focused to:

1. Distinguish between the basic and advance concepts of algebra.
2. Discover and apply abstract concepts as well as use mathematical logic to prove theorems and related results.
3. Understand and analyze the algebraic construction and its conditions.
4. Conduct research work on topics related to algebra.

(3) Course Contents
To be decided by the instructor as per research requirements

(4) Assessment Criteria		
No	**Assessment Activities**	**Percentage of Total Assessment Score**
1	Assignment-1 / Quiz-1/ Presentations-1	5%
2	Midterm Exam-1	20%
3	Assignment-2 / Quiz-2/ Presentations-2	5%
4	Midterm Exam-2	20%
5	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book
To be decided by the course instructor

(7) Reference Books
To be decided by the course instructor

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Real Analysis-2	MATH 630-3	3	-	3	1	1	MATH 602-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	132
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**209**
Total Learning Hours = **256**			Equivalent **ECTS points** = Total LH/28 = **9.1**	

(1) Brief Course Description

Measure theory is the study of measures. It generalizes the intuitive notions of length, area, and volume. The earliest and most important examples are Jordan measure and Lebesgue measure, but other examples are Borel measure, probability measure, complex measure, and Haar measure. Measure theory is applied in various disciples of mathematics in probability theory and Ergodic theory. This course focus on the construction of the Lebesgue measure on the real line and deals with measurable functions, integration with to respect to Lebesgue's measure, the monotone convergence theorem, Fatou's Lemma, dominated convergence theorem and differentiation and integration.

(2) Course Objectives

The main objectives of this course are focused to:

1- Demonstrate the basic theorems and supply their proofs correctly.
2- Understand the concept of measurable sets and measure and how they are used in integration.
3- Construct rigorous mathematical proofs of basic results in measure theory.
5. Apply monotone convergence theorem in proofs and in evaluating integrals.
6. Calculate the Lebesgue integral of some functions.

(3) Course Contents

Lebesgue Measure: Outer measure, measurable sets, countable additively, continuity, non-measurable sets. Lebesgue Measurable functions: Definition and examples of measurable functions, sum, product and composition, sequential limits and approximations, Egoroff's theorem and Lusin's theorem. Lebesgues integration: The Lebesgue integral of a bounded measurable function, Lebesgue integral of a measurable nonnegative function, the monotone convergence theorem, the general Lebesgue integral, Lebesgue dominated convergence theorem. Differentiation and integration: Monotone functions, functions of bounded variation, absolutely continuous function, differentiating indefinite integrals.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
14.	Assignment-1 / Quiz-1/ Presentations-1	5%
15.	Midterm Exam-1	20%
16.	Assignment-2 / Quiz-2/ Presentations-2	5%
17.	Midterm Exam-2	20%
18.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- H.L.Royden and P.M.Fitzpatrick,'' Real Analysis'', Fourth Edition ; Prentice Hall,2010

(7) Reference Books

1- Gerald .B. Folland ,''Real Analysis –Modern techniques and their Applications'', Second Edition ,John Wiley & Sons, 2013.
2- Walter Rudin ,''Real and complex analysis'', Third Edition ,McGraw-Hill, 1987.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Topology	MATH 631-3	3	-	3	2	1	MATH 602-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	132
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**209**
Total Learning Hours **= 256**			Equivalent **ECTS points** = Total LH/28 = **9.1**	

(1) Brief Course Description

Topology is an abstract study of mathematical concepts in some position ignoring the geometry of that position. Studying topology and the relations between the topological concepts increase the skills of the researcher and give him a deep and fair vision in most topics in pure mathematics

(2) Course Objectives

The main objectives of this course are focused to:

1- Analyze topological concepts and its properties
2- Distinguish between topological concepts and wave the value of that joint.
3- Understand and apply the value of Topology in Pure Mathematics
4- Discover and apply Topology in some real life problems.
5- Integrate knowledge for open problems and future researches

(3) Course Contents

Topological spaces, neighborhood structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- AkosCsazar,'' General Topology'' Adm. Hilger LTD, Bristol, 1978, 1978

(7) Reference Books

1- M. A. Armstrong, Basic Topology, Springer, 1983

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Functional Analysis	MATH 632-3	3	-	3	2	1	MATH 602-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	132
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**209**
Total Learning Hours **= 256**			Equivalent **ECTS points** = Total LH/28 = **9.1**	

(1) Brief Course Description

Functional Analysis is an advance course of analysis in which theory and concepts from calculus and analysis generalized and study in more details.

(2) Course Objectives

The main objectives of this course are focused to:

1- Demonstrate the metric space and convergence and divergence of sequences in the metric space.
2- Distinguish between complete and incomplete metric spaces; and between normed and metric space and Banach space.
3- Identify and implement the topology generated by the norm.
4- Integrate knowledge of the inner product space and Hilbert space.
5- Analyze and interpret some open problems.

(3) Course Contents

Metric Space: Metric Space, Continuous functions and Convergence in metric space, Complete Metric Space, Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in Normed Spaces, Topology Generated by Norm. Inner Product Space: Inner product Space, Hilbert Spaces.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- E.Kreyzing ,''Introduction to Functional Analysis with Applications'', John Wiley and Sons, 1989.

(7) Reference Books

1- 1 E.Kreyzing,''A Course in Functional Analysis'', 2th ed ., Springer, Berlin,(1990).
2- C.Goffman and G.Pedrick ,''First Course in Functional Analysis'', Prentice-Hall, (1974)
3- E.B.V.Limaye ,''Functional Analysis'', 2th ed., New Age International, New Delhi, (1996).
4- A. Taylor and Delay,'' Introduction to Functional Analysis'', Wiley, New York, (1980).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Topics in Analysis	MATH 633-3	3	-	3	2	1	MATH 602-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	32
Laboratory	0		Study for exam	132
Exams and quizzes	5		Working for lab	0
Presentation	4		Preparation for classes	45
Total	**54~47**		Total	**209**
Total Learning Hours **= 256**			Equivalent **ECTS points** = Total LH/28 = **9.1**	

(1) Brief Course Description

This course is designed to cover important and advanced topics Analysis that may be desired from time to time for specific students in the graduate program. It may also be used as a vehicle for development of new analysis courses for graduate program students.

(2) Course Objectives

The main objectives of this course are focused to:

1. Demonstrate more advanced and further topics in Analysis.
2. Apply theories and methodologies to solve problems that arise in research.
3. Apply and share knowledge to have a firm basis for advanced courses or research work.

(3) Course Contents

a- Theoretical side: Variable contents can be changed from year to year

b- The practical side (if applicable):

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- To be decided by instructor as required

(7) Reference Books

1- To be decided by instructor as required

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Numerical Method for Ordinary Differential Equation (ODEs)	MATH 640-3	3	-	3	2	1	MATH 604-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	75
Presentation	4		Preparation for classes	23
Total	**54~47**		Total	**236**
Total Learning Hours = **283**			Equivalent **ECTS points** = Total LH/28 = **10.1**	

(1) Brief Course Description

Numerical methods for ordinary differential equations are methods used to find numerical approximations to the solutions of ordinary differential equations (ODEs). Many differential equations cannot be solved analytically, and a numeric approximation to the solution is often sufficient for some applications. The methods studied in this course can be used to compute explicitly approximation for the solution and provide an error analysis to test how far from the exact solution.

(2) Course Objectives

The main objectives of this course are focused to:

1 Discover and apply the concept of numerical methods to solve ordinary differential equations.
2 Distinguish between the different types of numerical methods to solve ordinary differential equations.
3 Integrate knowledge to choose the appropriate method to solve ordinary differential equations.
4 Apply the appropriate methods to solve mathematical problems and prove the stability and convergence of the approximated solution.
5 Analyze and conclude the advantages of the methods used to solve ordinary differential equations in various fields.

(3) Course Contents

One step methods. Runge-Kutta methods. Multistep and predictor-corrector methods. Numerical analysis including stability. Convergence and error analysis. Boundary-value problems.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- Griffith and Higham,''Numerical Methods for Ordinary Differential Equations'', Springer, 2010.

(7) Reference Books

1- Richard Burden and J. Dougias Faires,"Numerical Analysis, Brooks/Cole Cengage Learning, 2011

2- Alfio Quarteroni ,Riccardo Sacco and Fausto Saleri, 'Numerical Mathematics ' Springer, 2007

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Approximation theory	MATH 642-3	3	-	3	2	1	MATH 604-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	75
Presentation	4		Preparation for classes	23
Total	**54~47**		Total	**236**
Total Learning Hours = **283**			Equivalent **ECTS points** = Total LH/28 = **10.1**	

(1) Brief Course Description

Approximation theory is concerned with how functions can best be approximated with simpler functions, and with quantitatively characterizing the introduced errors. The students, through this course will learn skills to prove convergence and existence for the solutions, and will be used to prove and conclude new results of mathematical theories.

(2) Course Objectives

The main objectives of this course are focused to:

1. Demonstrate the concept of convergence.
2. Distinguish between theories of convergence.
3. Discover and apply the appropriate mathematical approximation of the problem.
4. Apply appropriate theories to solve mathematical problems and prove the stability and convergence of the solutions.
5. Explain some theories that can be applied in various numerical methods courses.

(3) Course Contents

Introduction, Chebyshev polynomials and series, Weierstrass Approximation Theorem, Convergence for differentiable functions, Convergence for analytic functions, Best approximation, Best and near-best, Linear approximations, Nonlinear approximations, Spectral methods rational best approximation, Rational interpolation and least-squares.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- Nick Trefethen ,'' Approximation theory and approximation practice'', Siam , 2013

(7) Reference Books

1- Elliott Ward Cheney, Jr,'' A course in approximation theory'',MMS Chelsea 2000
2- Michael J. D. Powell,''Approximation theory and methods''. Press of U. Cambridge, 1996

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Optimization	MATH 643-3	3	-	3	2	1	MATH 604-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	75
Presentation	4		Preparation for classes	23
Total	**54~47**		Total	**236**
Total Learning Hours = **283**			Equivalent **ECTS points** = Total LH/28 = **10.1**	

(1) Brief Course Description

Problems in optimization are the most common applications of mathematics. The main aim of this course is to present different methods of solving optimization problems in the area of nonlinear programming. In addition to theoretical treatments, there will be some introduction to numerical methods for optimization problems.

(2) Course Objectives

The main objectives of this course are focused to:

1. Integrate knowledge to formulate optimization problems,
2. Discover and apply the most appropriate solution technologies and strategies,
3. Interpret the solution of an optimization problem,
4. Analyze the effects of problem variation on the optimal solution.

(3) Course Contents

a - Theoretical side:

Unconstrained Optimization Optimality Conditions , Convex Unconstrained , Optimization Optimality Conditions, Newton's Method , Quadratic Forms ,Steepest Descent Method , Constrained Optimization Optimality Conditions , Projection Methods for Equality Constrained Problems , Projection , Methods/Penalty Methods , Barrier Methods, Conditional Gradient Method, Interior-Point Methods for Linear Optimization ,Analysis of Convex Sets and Convex functions, Duality Theory , Sub gradient Optimization ,Semi definite Optimization.

b - The practical side (if applicable)

Using Matlab, or Mathematica software or any other programming software.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1. Weny u Sun, Ya-Xiang Yua,'' Optimization Theory and Methods: Nonlinear Programming'', Springer. (2010).

(7) Reference Books

1. David G. Luenberger, Yinyu Ye, ''Linear and Nonlinear Programming'', International Series in Operations Research & Management Science ,Springer 2013

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Integral Differential Equations	MATH 650-3	3	-	3	2	1	MATH 605-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	75
Presentation	4		Preparation for classes	23
Total	**54~47**		Total	**236**
Total Learning Hours **= 283**			Equivalent **ECTS points** = Total LH/28 = **10.1**	

(1) Brief Course Description

This course emphasizes concepts and techniques for solving integral equations from an applied mathematics perspective. Volterra and Fredholm theory, the Hilbert-Schmidt theorem; Wiener-Hopf Method; Wiener-Hopf Method; the Hilbert Problem and singular integral equations of Cauchy type. The models are taken from fluid and solid mechanics, acoustics, quantum mechanics, and other applications.

(2) Course Objectives

The main objectives of this course are focused to:

1- Use integral equations to communicate knowledge
2- Discover and apply the most appropriate method to use in studying integral equations.
3- Solve the problem involving integral equations.
4- Explore some integral equations that have different areas of research.

(3) Course Contents

Integral equations and Picard's method, Existence and Uniqueness, Homogeneous and non-Homogeneous linear equations, The Fredholm Alternative-Hilbert-Schmidt Theory, Transform methods, Green's Functions and Boundary-value Problems, Elements of Theory of Fredholm Integral Equations, Wiener-Hopf Integral Equations, Voltera Integral equations, Nonlinear Integral Equations.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- Michio Masujima, ''Applied Mathematical Methods in Theoretical Physics- Integral Equations and Calculus of Variations'', Wiley-Vch. Verlag GmbH & Co. KGaA, 2005.

(7) Reference Books

1- *Linear Integral Equations: Theory and Technique''*, Birkhauser , Boston, 1996
2- Stakgold, I.'' *Green's Functions and Boundary-value Problems''*. Wiley, NY, 1998

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Mathematical Modeling	MATH 651-3	3	-	3	2	1	MATH 605-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	75
Presentation	4		Preparation for classes	23
Total	**54~47**		Total	**236**
Total Learning Hours **= 283**			Equivalent **ECTS points** = Total LH/28 = **10.1**	

(1) Brief Course Description

This course covers many mathematical models one variable, multivariable and computational optimization. It includes application on dynamic system and study of probability models.

(2) Course Objectives

The main objectives of this course are focused to:

1- Demonstrate knowledge to formulate and analyze mathematical models.
2- Understand stochastic models.
3- Apply Monte Carlo simulation.
4- Solve optimization problems computationally.
5- Analyze dynamic models.
6- Simulate models using MATLAB or Maple.

(3) Course Contents

a - Theoretical side:

Optimization models (one variable and multivariable), discrete programming, discrete optimization. steady state analysis, dynamic system, discrete time systems, analysis of dynamic models, simulation of dynamic models. discrete and continuous probability models, stochastic models, Monte Carlo simulation, Markov property, particle tracking, fractional diffusion.

b - The practical side (if applicable): Simulation techniques using MATLAB or Maple software.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1. Mark M. Meerschaert,'' Mathematical Modeling'', 2nd edition, 2013. , Elsevier, 2013

(7) Reference Books

1- Frank R. Giordano, William P. Fox, Steven B,'' A First Course in Mathematical Modeling'', 5th Edition, Horton, 2014.
2- Amos Gilat,'' MATLAB: An Introduction with Applications'', 5th Ed., Wiley, 2014.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Mathematical Statistics-2	MATH 660-3	3	-	3	2	1	MATH 607-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	93.75
Presentation	4		Preparation for classes	15
Total	**54~47**		Total	**246.75**
Total Learning Hours = **293**			Equivalent **ECTS points** = Total LH/28 = **10.5**	

(1) Brief Course Description

This is the second graduate course in mathematical statistics and it aims to build a more advanced statistical theories and techniques. It provides a firm basis for advanced work on Statistical theory and its applications

(2) Course Objectives

The main objectives of this course are focused to:

1- Demonstrate more advanced concepts of probability theory to build Statistical Theory.
2- Distinguish between Learning tools and techniques in Sampling Theory and Statistical Inference
3- Applying methods of Statistical Inference
4- Integrate knowledge of Linear Models and application in regression and analysis of variance.
5- Discover and apply concepts of decision theory and Nonparametric theory
6- Conduct scientific research and provide a firm basis for advanced work on Statistical Theory and applications.

(3) Course Contents

a - Theoretical side:
Theory of point estimation, Properties of estimators, including unbiasedness, efficiency, consistency, sufficiency, minimum variance unbiased estimator, Rao-Blackwell theorem and Rao-Cramer inequality. Methods of moments and maximum likelihood. Bayes' and minimax estimation. Sufficient and Minimal sufficient statistics. Tests of hypothesis, Neymann-Pearson theory of testing of hypotheses. UMP tests, UMPU tests, likelihood Ration tests, Unbiased and invariant tests. Confidence estimation. Confidence intervals (shortest length, unbiased and Bayes'). The general linear hypothesis, regression and Analysis of variance. Decision theory. Nonparametric statistical inference.
b - The practical side (if applicable): Using Computer Package for simulation and modeling

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- John Freund ,''Mathematical Statistics'', Prentice Hall, 1992.
2- Casella and Berger ,''Statistical Inference'', Wadsworth and Brooks/Cole, Ca, 2001.

(7) Reference Books

1- Lehmann ,''Theory of Point Estimation'', Wiley. 1983
2- Lehmann.''Testing of Statistical Hypothesis'', Wiley 1986
3- Peter Bickel and Kjell Doksum ,''Mathematical Statistics'', Holden Day 1977
4- Ferguson ,''Mathematical Statistics'', Academic Press, 1986
5- Sahai and Ageel ,''ANOVA: Fixed, Random and Mixed Models'', Springer 2001

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Regression and Experimental Design	MATH 661-3	3	-	3	2	1	MATH 606-3 & MATH 607-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	93.75
Presentation	4		Preparation for classes	15
Total	**54~47**		Total	**246.75**
Total Learning Hours **= 293**			Equivalent **ECTS points** = Total LH/28 = **10.5**	

(1) Brief Course Description

This course is a global term that includes both the formal design of an experiment and the regression analysis by which the result of the experiment is analyzed. It provides the principles of experimental design and the techniques of analysis of variance in a manner that illustrates the aspects of statistical analysis. Also it covers important topic on screening design.

(2) Course Objectives

The main objectives of this course are focused to:

1- Understanding Least Squares methods and its properties
2- Demonstrate Work on linear regression and testing of intercept and slope.
3- Estimate parameters through regression analysis.
4- Construct regression analysis table to describe relationship between variables.
5- Distinguish between the concept of residual analysis and prediction.
6- Explain the assumptions necessary to perform ANOVA
7- Describe appropriate ways to transform data are not normally distributed
8- Solve Analyze the importance of statistical design of experiments and its benefits

(3) Course Contents

a - Theoretical side:

Least Square Methods and Properties, Simple linear regression. Testing of intercept and slope. Simple and Multiple linear regressions with matrix approach. Estimation of parameters and testing of regression coefficients. Prediction and correlation analysis. , Development of Linear models, Residual Analysis and Prediction, Polynomial Regression, Dummy Variable, Model Building and Variable Selection. Analysis of variance techniques, Concepts of Statistical Designs and Linear Model. Completely randomized and randomized block designs. Latin square designs models: Fixed, random and mixed models. Incomplete block design. Factorial design, 2k factorial design and blocking and confounding in 2k factorial design

b - The practical side (if applicable):

Using R programming software, Minitab or any other computer packages for implementation of the methods.

(4) Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

1- John O. Rawlings .''Applied Linear Regression: A Research Tool'', Wiley, 1988.
2- Montgomery D. C., John Wiley & Sons ,''Design and Analysis of Experiments'', New York, 2013.

(7) Reference Books

1- Oehlert. G. W ,''A First course in Design and Analysis of Experiments'', University of Minnesota, 2010
2- Cox, D. R. and Ried, N ,''The theory of the design of experiment'', CHAPMAN & HALL / CRC, 2000

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Topics in Mathematical Statistics	MATH 663-3	3	-	3	2	1	MATH 606-3 & MATH 607-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	93.75
Presentation	4		Preparation for classes	15
Total	**54~47**		Total	**246.75**
Total Learning Hours = **293**			Equivalent **ECTS points** = Total LH/28 = **10.5**	

1. Brief Course Description

This course is designed to cover important topics in Mathematical Statistics that may be desired from time to time for specific needs. It may also be used as a vehicle for development of new Mathematical Statistics course for graduate program students

2. Course Objectives

The main objectives of this course are focused to:

1- Demonstrate more advanced and further topics in mathematical Statistics and Statistical Inference.
2- Apply theories and methodologies to solve problems that arise in other disciplines.
3- Integrate knowledge to have a firm basis for advanced courses or research work.

3. Course Contents

Theoretical side :
Variable contents and Topics change from year to year.

The practical side (if applicable)
Using computer Statistical Software and programming as possible.

4. Assessment Criteria		
No	**Assessment Activities**	**Percentage of Total Assessment Score**
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

5. Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

6. Text Book

1. Instructor will decide at the time of course offer

2. Reference Books

1. Instructor will decide at the time of course offer

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Stochastic Processes	MATH 672-3	3	-	3	2	1	MATH 606-3 & MATH 607-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	93.75
Presentation	4		Preparation for classes	15
Total	**54~47**		Total	**246.75**
Total Learning Hours = **293**			Equivalent **ECTS points** = Total LH/28 = **10.5**	

1. Brief Course Description

This is the first graduate course in Stochastic Processes. It is a non-measure theoretic introduction to stochastic processes and as such assumes knowledge of calculus and probability. It gives the basic of stochastic processes to indicate its diverse range of applications and to give students some probabilistic intuitions and insight in thinking about problems. The materials of this course are also essential for other applied areas and various field. This course is also designed for those graduate students who are going to need to use stochastic processes in their research but do not have the measure-theoretic backgrounds.

2. Course Objectives

The main objectives of this course are focused to:

1- Distinguish between the theory and basic concepts of Stochastic Processes
2- Demonstrate different forms of stochastic processes and its diverse range of applications.
3- Integrate knowledge about probabilistic intuitions and insight in thinking about problems.
4- Develop probabilistic problems-solving skills
5- Establish a solid foundation for advanced stochastic process research

3. Course Contents

a - Theoretical side:

Simple random walk as approximation of Brownian motion. Discrete time Markov chains. Continuous time Markov chains; Poisson, compound Poisson, and birth-and-death chains; Kolmogorov's backward and forward equations; steady state. Diffusions as limits of birth-and-death processes. Examples drawn from diverse fields of application.

b - The practical side (if applicable):

Using computer Software and programming, as its possible.

4. Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

5. Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

6. Text Book

1- Sheldon Ross ,''Stochastic Processes'', Wiley, 1996

7. Reference Books

1- S. Karlin and H. Taylor ,''A First Course in Stochastic Procesees'', Academic Press, 1975
2- Sidney Resnick ,''Adventures of stochastic Process'', Birkhauser, 1992
3- Cinlar, E ,''Introduction to Stochastic Procesees'', , Prentice Hall, 1975

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Selected Topics in Analysis	MATH 696-3	3	-	3	2	1	MATH 323-3

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	20
Laboratory	0		Study for exam	118
Exams and quizzes	5		Working for lab	75
Presentation	4		Preparation for classes	23
Total	**54~47**		Total	**236**
Total Learning Hours **= 283**			Equivalent **ECTS points** = Total LH/28 = **10.1**	

1. Brief Course Description

It will be added at the time of offer of this course.

2. Course Objectives

The main objectives of this course are focused to:

1- Distinguish between the theory and basic concepts of advanced analysis
2- Demonstrate different forms of advanced analysis and its diverse range of applications.
3- Describe some probabilistic intuitions and insight in thinking about problems.
4- Develop problems-solving skills
5- Establish a firm basis for advanced work on advanced analysis theory

3. Course Contents

It will be added at the time of offer of this course.

4. Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	5%
2.	Midterm Exam-1	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	5%
4.	Midterm Exam-2	20%
5.	Final Exam	50%

5. Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

6. Text Book

It will be added at the time of offer of this course.

7. Reference Books

It will be added at the time of offer of this course.

Course Name	Course Code	No of Study Hours			Year	Level	Prerequisite
		Theory	Lab/Tut	Credit Hours			
Thesis	MATH 699-3	6	0	6	2	2	90 Hours

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Orientation and discussion	30		Preparation for project work	113
Lab or theoretical work	45		Working on data and analysis or theoretical work	450
Presentation	15		Tasks accomplishments and report writing	150
Assignments	8		Preparation for presentation	45
Total	**98~75**		Total	**758**
Total Learning Hours **= 833**			Equivalent **ECTS points** = Total LH/28 = **29.8**	

1. Brief Course Description

The master program is designed to expand and consolidate existing mathematics knowledge and to develop skills in undertaking research projects in mathematics. The thesis is undertaken under the direction of a supervisor and will typically involve examining and writing in a specific area of mathematics with the requirement of obtaining original results.

2. Course Objectives

The main objectives of this course are focused to:

1- Develop skills to Communicate knowledge of key mathematical and statistical concepts, both explicitly and by applying them to the solution of Mathematical problems.
2- Show responsibility for personal outputs, intellectual independence through thesis related tasks.
3- Produce generalized problem solvers of great versatility, capable of modeling in mathematical applications to real world situations.
4- Provide a significant contribution to the computational techniques & mathematical modeling and demonstrate leadership qualities with sense of commitment and accountability in scientific development as well as in the general education of the society.
5- Practice in technical writing reports for the project / research findings and coordinating research collaboration to meet the standard in modes of scientific communication.
6- Establish a firm basis for advanced work in mathematics in order to conduct scientific research on certain fields of Mathematics.

3. Course Contents

1. Revision of coursework and develop computing skills (MATLAB) and Latex typing etc. to get ready for thesis work.
2. Explore existing literature to develop student's interest towards the research area in particular mathematical stream i.e. pure or applied or statistics.
3. Choose the area and topic for your thesis.
4. Perform literature survey to explore and get latest/advanced research in the specific chosen area.
5. Develop mathematical model or design experimental set up for your research problem practical/ lab work whichever applicable.
6. Thesis Preparation: The following items are to be included in the bound copy of a thesis/dissertation write-up in the exact order as given below:
   (a) Title Page
   (b) Approval Page
   (c) Dedication
   (d) Acknowledgement
   (e) Table of Contents
   (f) List of Tables
   (g) List of Figures
   (h) Abstract
   (i) Main Body
   (j) Appendix
   (k) Nomenclature
   (l) References

4. Assessment Criteria

No	Assessment Activities	Percentage of Total Assessment Score
1.	Obtain the required scientific material	5 %
2.	Result Analysis	5 %
3.	Respond to the guidance of supervisors	5 %
4.	Writing the thesis	5 %
5.	Candidate's commitment to attend and perform research	5%
6.	Presentation/Open Seminar/Viva Voce	10%
7.	Proposal for Defense	65%

5. Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Presentations

- Home work
- Mini-model education
- Assignments to prepare scientific projects
- Assignments to prepare thesis

6. Text Book
It will be decided by concerned thesis supervisors

7. Reference Books
It will be decided by concerned thesis supervisors