p

	Course name: MATH 424 Real Analysis			**Department:** Mathematics			Semester 8
	Methods of Education						Credit (ECTS)
	Lecture	Recitation/ (Etud)	Lab	Exams	Homework/ Quiz	Other	Total	6
	42	0	0	44	0	84	180	

Language	English
Compulsory/Elective	Elective
Prerequisites	None
Course Contents	Sigma-algebras, Borel sets of real numbers, the Lebesgue outer measure and the Lebesgue measure on the real line, nonmeasurable sets of reel numbers, measurable functions, convergence of sequences of measurable functions, approximation by simple functions, Lebesgue integral: definition and basic properties, relationship of the Lebesgue and Riemann integrals, Fatou's Lemma, the Monotone Convergence Theorem, The Lebesgue Dominated Convergence Theorem.

Weekly Detailed Course Contents

Weeks	Subjects
1	Motivation- The Riemann Integral
2	Algebras, and sigma-algebras
3	Sigma-algebras and Borel sigma-algebras on the real numbers
4	Measures
5	Borel measures
6	Outer measures, and Lebesgue outer measures on the real numbers
7	Lebesgue measurable subsets of the real numbers
8	Outer and Inner approximation of Lebesgue measurable sets
9	The Cantor set
10	Measurable Functions
11	Properties that hold almost everywhere
12	The Lebesgue Integral
13	Limit Theorems (Fatou's Lemma, and the Monotone Convergence Theorem)
14	Limit Theorems (Lebesgue Dominated Convergence Theorem)

Course Objectives

The purpose of this course is to

- teach the measure theory which is a fundamental part of analysis
- introduce the measure theory, in particular, measurable sets and functions, convergence of measurable functions
- give the knowledge of Lebesgue measure and integral

Learning Outcomes and Competences

Upon completion of this course students will be able to

- understand why a more sophisticated theory of integration and measure is needed

<table>
<tr><td></td><td colspan="3">understand and describe the sigma-algebras and measure in integration theory; use the basic concepts of the theory
calculate Lebesgue measure of some basic sets in the real line and show that certain functions are measurable
prove basic results of measure theory and integration theory
Use Fatou's lemma, the monotone convergence theorem, and Lebesgue's dominated convergence theorem</td></tr>
<tr><td>Textbook and /or References</td><td colspan="3">Main texbooks :
Donald L. Cohn, Measure Theory, 2nd ed., Springer Science+Business Media, LLC, 2013.
Hals L. Royden and Patrick M. Fitzpatrick, Real Analysis, 4th ed., Pearson Education, Inc., 2010
Terence Tao, An Introduction to Measure Theory, American Mathematical Society, 2011.</td></tr>
<tr><td rowspan="9">Assessment Criteria</td><td></td><td>If any, mark as (X)</td><td>Percentage (%)</td></tr>
<tr><td>Midterm Exams</td><td>X</td><td>35</td></tr>
<tr><td>Quizzes</td><td>X</td><td>15</td></tr>
<tr><td>Homeworks</td><td></td><td></td></tr>
<tr><td>Projects</td><td></td><td></td></tr>
<tr><td>Term Paper</td><td></td><td></td></tr>
<tr><td>Laboratory work</td><td></td><td></td></tr>
<tr><td>Other</td><td></td><td></td></tr>
<tr><td>Final Exam</td><td>X</td><td>50</td></tr>
</table>