



SYLLABUS

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Teaching Language
MAT	611	Introduction to Measure and Integration	4	3	0	1	8		1	English

A. Course Description

This course describes the most important ideas, theoretical results, and applications in measure and integration on the real line. The course includes the essential fundamentals of σ -algebra, measurable sets and functions, Lebesgue integral, convergence theorem and the L^1 space on \mathbb{R} . It covers classical topics in Riemann's integral and makes comparison with the Lebesgue integral. The emphasis is on theoretical results and their applications.

B. Course Outcomes

At the end of this course the student will be able to:

1. Describe the basic concepts and theorems in measure and integration.
2. Construct the Lebesgue measure and the Lebesgue integral on the real line.
3. Prove the main convergence theorems, including differentiation theorem.
4. Be familiar with the L^1 -space.

C. References:

Required Textbook

Real Analysis, H.L. Royden & P.M. Fitzpatrick, 4th Edition, Prentice Hall, 2010

Other references:

- *Measure, Integral and Probability*, M. Capinski, P.E. Kopp, Springer, 2003.
- *Introduction to Real Analysis*, R.G. Bartle & D.R. Sherbert, 3rd Edition, John Wiley & Sons, 2000.
- *Real and Complex Analysis*, 3rd Edition, W. Rudin, Mc Graw Hill, 1987.

Course Website: Google Classroom Webpage: <http://www.imamm.org/>



D. Topics Outline

1. **Basics:** The Set \mathbf{R} of the Real Line and its Topology (Open And Closed Sets, Completion), Countable and Uncountable Sets, Sigma-Algebras, Borel Sets, Axioms of Choice and Zorn's Lemma.
2. **Lebesgue Measure:** Outer Measure and The Sigma-Algebra of Measurable Sets, Zero Measure, Cantor's Set, Nonmeasurable Sets.
3. **Lebesgue Measurable Functions:** Review of Sequences of Functions: Pointwise and Uniform Convergence of Sequences, Interchange of Limits (Limit and Continuity, Limit and Derivative), Measurable Functions: Main Properties, Step Functions, Approximation Lemma, Lusin's Theorem.
4. **Lebesgue Integration:** The Riemann Integral: Definition, Properties, Fundamental Theorems of Calculus, Interchange of Limit and Integral, The Lebesgue Integral: Bounded Measurable Function, Measurable Nonnegative Function, and the General Lebesgue Integral, Comparison with Riemann's Integral, Lebesgue's Integrability Criterion of Riemann Integral.
5. **Convergence Theorems:** Monotone Convergence Theorem, Fatou's Lemma, Beppo-Levi Theorem, and Lebesgue Dominated Theorem, Continuity and Differentiation Theorems.
6. **The Normed Space L^1 :** Main Properties, Riesz-Fischer Theorem, Riesz Representation Theorem, The Dual Space $(L^1)' = L^\infty$.

E. Office Hours

Office hours give students the opportunity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

F. Exams & Grading System

The semi-official dates of the exams for this course are:

- **Midterm:** 8th or 9th week.
- **Quizzes & Homework:** During the semester.
- **Final Exam:** 16th week.

Your course grade will be based on your semester work as follows:

Midterm : 30 %	Final Exam: 40 %
4 Quizzes + 4 Homeworks, Attendance & Participation: 30 %	

The grading distribution:

A ⁺	A	B ⁺	B	C ⁺	C	F
[95, 100]	[90, 95)	[85, 90)	[80, 85)	[75, 80)	[70, 75)	[0, 70)



G. Student Workload:

#	Teaching/learning activities	Contact Hours	Frequency	Total Contact hours	Self-study hours	Total self-study hours	Student Learning Time
1	Lecture	3	15	45	1.5	22.5	67.5
2	Tutorial	1	15	15	3	45	60
3	Lab\Practical	0	0	0	0	0	0
4	Homework	0	4	0	1.5	22.5	22.5
5	Quiz	0.25	4	1	1	4	5
6	Test (Midterm)	2	1	2	12	12	14
7	Final Exam	2	1	2	12	12	14
Total				65		118	183

Independent self-study = $118/15 \cong 8$ hrs per week

H. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. (“Immediate family” is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

[Executive Rules for Study Regulations and Exams](https://www.examsgoo.gl/ykm7t3)
[goo.gl/ykm7t3](https://www.examsgoo.gl/ykm7t3)

