SVEUČILIŠTE U RIJECI
ODJEL ZA MATEMATIKU

Sveučilište u Rijeci •Odjel za matematiku
Radmile Matejčić 2 • 51 000 Rijeka • Hrvatska
T: (051) 584-650 • F: (051) 584-699
http://www.math.uniri.hr• e-adresa: math@math.uniri.hr

COURSE SYLLABUS

General information		
Course title	Measure and Integral	
Study programme	Graduate course Discrete Mathematics and Its Applications	
Year of study	1	
Course status	C	
Course homepage	https://moodle.srce.hr	
Language of instruction	English	
Credit values and modes of instruction	***ECTS credits / student workload***	6
	Hours (L+E+S)	30+30+0
Lecturer	***Name and surname***	Davor Dragičević
	Office	O-320
	Office hours	by appointment via email
	Phone number	584 658
	E-mail	ddragicevic@math.uniri.hr
Teaching assistant	***Name and surname***	Lokesh Singh
	Office	
	Office hours	Wednesday, 14:00-16:00
	Phone number	
	E-mail	lokesh.singh@math.uniri.hr

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with the basic notions of the measure and integral theory. For this purpose it is necessary within the course to:

- define the measure and analyse its properties,
- describe basic examples of a measure space,
- define the Lebesgue measure and analyse its properties,
- define the notion of a measurable function,
- define the integral of a function on a measure space and analyse its properties,
- prove Lebesgue's monotone and dominated convergence theorem and Fatou's lemma,
- describe the construction of a product measure and prove Fubini's theorem,
- describe the notions of absolute continuity and singularity of a measure,
- prove Radon – Nikodym theorem,
- analyse the connection between Riemann and Lebesgue integral.

1.2. Course prerequisites

None

1.3. Learning outcomes

After completing this course, the students are expected to:
• use and understand the properties of a measure and integral (A7, B7, C7),

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• analyse examples of a measure with a special emphasis on the Lebesgue measure (A7, B7, C7), • use and understand the convergence theorems in problem solving (A7, B7, C7, F7), • use and understand the Fubini's theorem in problem solving (A7, B7, C7, F7), • analyse the notions of absolute continuity and singularity of a measure and the relations among them (A7, B7, C7, F7), • analyse the connections and differences between Riemann and Lebesgue integral (A7, B7, C7), • mathematically prove validity of all procedures and formulas that are used within the course (A7, B7, C7, F7).
1.4. Course content
Ring, algebra, σ-algebra of sets, Borel sets. Measure, outer measure. Lebesgue measure. Monotone and dominated convergence theorem, Fatou lemma. Product measures. Fubini's theorem. Absolute continuity and singularity of a measure. Radon-Nikodym theorem. Relationship between the Riemann and Lebesgue integral.

1.5. Modes of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☒ e-learning ☐ field work	☒ independent work ☒ multimedia and the internet ☐ laboratory ☐ tutorials ☐ mentoring work ☐ consultative teaching ☐ other
1.6. Comments		

1.7. Student requirements
Students' work will be evaluated and assessed during the semester via two written tests and on the final oral exam. The total number of points student can earn during the semester is 50, while on the final exam student can achieve 50 points.

2. GRADING POLICY

2.1. Grading of students' work during the semester and on the final exam

2.2. Minimal requirements for access to the final exam / passing grade

ACTIVITY	MINIMAL NUMBER OF POINTS REQUIRED
Tests	25
TOTAL:	25
OTHER REQUIREMENTS:	

2.3. Final grade – grading scale

GRADE	POINTS
Excellent (5) , A	90% - 100%
Very good (4), B	75% - 89,9%
Good (3), C	60% - 74,9%

Sufficient (2), D	50% - 59,9%
Insufficient (1), F	0% - 49,9%

3. LITERATURE

3.1. Required literature

1. G. B. Folland: Real Analysis: Modern Techniques and their Applications, Wiley, 2013.
2. Donald L. Cohn: Measure theory, Birkhäuser Boston, 1994.

3.2. Recommended literature

1. P. Halmos, Measure Theory, Springer-Verlag, New York, 1974.
2. N. Antonić, M. Vrdoljak: Mjera i integral, PMF-Matematički odjel, Zagreb 2001.

4. ADDITIONAL INFORMATION

4.1. Class attendance

It is the responsibility of the students to be informed about the classes they missed. Any form of disruption during the class will not be tolerated as well as the usage of mobile phones.

4.2. Informing students

All relevant informations will be provided via the online platform Merlin. It is the responsibility of a student to be regularly informed.

4.3. Other relevant information

4.4. Assessment of quality and performance for the course

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

4.5. Examination period

Final exam (1st examination period)	24.6.2021., 10:00
Final exam (2nd examination period)	8.7.2021., 10:00
Final exam (3rd examination period)	3.9.2021., 10:00

5. COURSE OUTLINE*

DATE	*TIME*	*MODE OF INSTRUCTION*	*TOPIC*	*GROUP*	*LECTURE HALL*

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2.3.2021.	***12:15-13:45***	***L***	***Basic notions: sigma-algebra, measure, measure space. Basic examples***	***All***	***O-335***
4.3.2021.	***10:15-11:45***	***E***	***Basic notions: sigma-algebra, measure, measure space. Basic examples***	***All***	***O-335***
9.3.2021.	***12:15-13:45***	***L***	***Construction of the Lebesgue measure I***	***All***	***O-335***
11.3.2021.	***10:15-11:45***	***E***	***Measurable spaces***	***All***	***O-335***
16.3.2021.	***12:15-13:45***	***L***	***Construction of the Lebesgue measure II***	***All***	***O-335***
18.3.2021.	***10:15-11:45***	***E***	***Construction of measures. Examples***	***All***	***O-335***
23.3.2021.	***12:15-13:45***	***L***	***Construction of the Lebesgue measure III***	***All***	***O-335***
25.3.2021.	***10:15-11:45***	***E***	***Lebesgue measure***	***All***	***O-335***
30.3.2021.	***12:15-13:45***	***L***	***Borel measures on R***	***All***	***O-335***
1.4.2021.	***10:15-11:45***	***E***	***Borel measures on R***	***All***	***O-335***
6.4.2021.	***12:15-13:45***	***L***	***Measurable functions***	***All***	***O-335***
8.4.2021.	***10:15-11:45***	***E***	***Measurable functions***	***All***	***O-335***
13.4.2021.	***12:15-13:45***	***L***	***Lebesgue integral and its basic properties. Relationship between Riemann and Lebesgue integral***	***All***	***O-335***
15.4.2021.	***10:15-11:45***	***E***	***Lebesgue integral***	***All***	***O-335***
20.4.2021.	***12:15-13:45***	***L***	***Monotone and dominated convergence theorems. Fatou's lemma***	***All***	***O-335***
22.4.2021.	***10:15-11:45***	***E***	***Monotone and dominated convergence theorems***	***All***	***O-335***
27.4.2021.	***12:15-13:45***	***L***	***Lp spaces I***	***All***	***O-335***
29.4.2021.	***10:15-11:45***	***E***	***First test***	***All***	***O-335***
4.5.2021.	***12:15-13:45***	***L***	***Lp spaces II***	***All***	***O-335***
6.5.2021.	***10:15-11:45***	***E***	***Lp spaces***	***All***	***O-335***
11.5.2021.	***12:15-13:45***	***L***	***Modes of convergence***	***All***	***O-335***
13.5.2021.	***10:15-11:45***	***E***	***Modes of convergence***	***All***	***O-335***
18.5.2021.	***12:15-13:45***	***L***	***Absolute continuity and singularity of measures***	***All***	***O-335***
20.5.2021.	***10:15-11:45***	***E***	***Absolute continuity and singularity of measures***	***All***	***O-335***
25.5.2021.	***12:15-13:45***	***L***	**Radon–Nikodym *theorem. Fubini's theorem***	***All***	***O-335***
27.5.2021.	***10:15-11:45***	***E***	**Radon–Nikodym *theorem. Fubini's theorem***	***All***	***O-335***
1.6.2021.	***12:15-13:45***	***L***	**Fubini's theorem.**	***All***	***O-335***
8.6.2021.	***12:15-13:45***	***E***	***Second test***	***All***	***O-335***
10.6.2021.	***10:15-11:45***	***E***	***Remedial activities***	***All***	***O-335***

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**Minor changes are possible.*

L – lectures
E – exercises
S – seminars