

Course description

Course abbreviation:	KMA/MA5	Page:	1 / 4
Course name:	Measure and Integral		
Academic Year:	2021/2022	Printed:	26.12.2021 01:15

Department/Unit /	KMA / MA5			Academic Year	2021/2022
Title	Measure and Integral			Type of completion	Exam
Accredited/Credits	Yes, 5 Cred.			Type of completion	Combined
Number of hours	Lecture 3 [Hours/Week] Seminar 2 [Hours/Week]			Course credit prior to	YES
Occ/max	Status A	Status B	Status C	Counted into average	YES
Summer semester	0 / -	0 / -	0 / -	Min. (B+C) students	1
Winter semester	2 / -	0 / -	0 / -	Repeated registration	NO
Timetable	Yes			Semester taught	Winter semester
Language of instruction	Czech			Internship duration	0
Optional course	Yes			Ev. sc. – cred.	S/N
Evaluation scale	1 2 3 4				
No. of hours of on-premise					
Auto acc. of credit	No				
Periodicity					
Substituted course	None				
Preclusive courses	N/A				
Prerequisite courses	N/A				
Informally recommended courses	N/A				
Courses depending on this Course	KMA/MMA, KMA/OBM				

Course objectives:

The aim of this course is an introduction to metric spaces and their properties, to the theory of measure and integral and theory of Fourier series. The theoretical tools will be demonstrated on illustrative examples.

Requirements on student

Demonstrate knowledge of fundamentals of theory of measure and integral. The ability to apply theoretical results in solving problems on the topics in the syllabus.

Content

Chapter 1. Measure and Lebesgue integral

- 2.1 Fundamentals of measure theory
- 2.2 Measurable functions and integral
- 2.3 Integrals depending on parameters
- 2.4 Lebesgue integral in \mathbb{R} and functions with bounded variation

Chapter 2. Spaces of integrable functions

- 2.1 Basic properties
- 2.2 Completeness, separability
- 2.3 Mappings in these spaces, continuous embeddings

Chapter 3. Fourier series

- 3.1 Orthogonal and orthonormal systems of functions
- 3.2 Pointwise and uniform convergence of Fourier series

Fields of study

Guarantors and lecturers

- **Guarantors:** Doc. Ing. Petr Girg, Ph.D. (100%)
- **Lecturer:** Doc. RNDr. Jiří Benedikt, Ph.D. (100%), Doc. Ing. Petr Girg, Ph.D. (100%)
- **Tutorial lecturer:** Doc. RNDr. Jiří Benedikt, Ph.D. (100%), Doc. Ing. Petr Girg, Ph.D. (100%)

Literature

- **Recommended:** Rudin, Walter. *Analýza v reálném a komplexním oboru*. Vyd. 2., přeprac. Praha : Academia, 2003. ISBN 80-200-1125-0.
- **Recommended:** Jarník, Vojtěch. *Diferenciální počet II*. Praha : Academia, 1976.
- **Recommended:** Jarník, Vojtěch. *Integrální počet. II*. Praha : Academia, 1976.
- **Recommended:** Nagy, Jozef; Nováková, Eva; Vacek, Milan. *Lebesgueova míra a integrál*. 1. vyd. Praha : SNTL, 1985.
- **Recommended:** Nagy, Jozef. *Vybrané partie z moderní matematiky*. Vyd 1. Praha : SNTL, 1976.
- **Recommended:** Kolmogorov, A. N.; Fomin, S.V. *Základy teorie funkcí a funkcionální analýzy*. Vyd. 1. Praha : SNTL, 1975.

Time requirements

All forms of study

Activities	Time requirements for activity [h]
Contact hours	65
Preparation for an examination (30-60)	55
Preparation for comprehensive test (10-40)	40
Total:	160

assessment methods

Knowledge - knowledge achieved by taking this course are verified by the following means:

- Combined exam
- Skills demonstration during practicum
- A) Basics of abstract measure theory.
- B) Basics of theory of the abstract Lebesgue integration.
- C) Basic theory of the Lebesgue spaces.
- D) Lebesgue integration in \mathbb{R} .
- E) Basic theory of Fourier series.

Skills - skills achieved by taking this course are verified by the following means:

- Combined exam
- A) Work with abstract structures of measure theory.
- B) Use of limit theorems in calculating integrals. Smazat
- C) Use of the Fubini and Tonelli theorems in calculating multiple integrals.
- D) Analysis of integrals depending on parameters.

Competences - competence achieved by taking this course are verified by the following means:

- Combined exam

prerequisite

Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:

- define and explain basic notions of mathematical analysis in one and/or several dimensions

explain the definition and basic properties of Newton integral
 explain the definition and basic properties of Riemann integral
 explain basics of Fourier series.

Skills - students are expected to possess the following skills before the course commences to finish it successfully:

calculate indefinite and/or definite integrals (of certain types) in one dimension using integrations-by-parts and/or substitution methods
 calculate multiple integrals using Fubini theorem within Riemann theory
 derive and prove the convergence of Fourier series for piecewise smooth functions

Competences - students are expected to possess the following competences before the course commences to finish it successfully:

N/A

teaching methods

Knowledge - the following training methods are used to achieve the required knowledge:

Lecture supplemented with a discussion
 Interactive lecture
 Task-based study method

Skills - the following training methods are used to achieve the required skills:

Practicum

Competences - the following training methods are used to achieve the required competences:

Task-based study method

learning outcomes

Knowledge - knowledge resulting from the course:

define and explain basic notions of abstract measure theory
 define and explain basic notions of theory of the abstract Lebesgue integration
 define and explain basic notions of theory of the Lebesgue spaces
 define and explain basic notions of theory of Lebesgue integration in \mathbb{R}
 define and explain basic notions of theory of Fourier series

Skills - skills resulting from the course:

work with abstract structures of measure theory
 use of limit theorems in calculating integrals
 use of the Fubini and Tonelli theorems in calculating multiple integrals
 analyze integrals depending on parameters

Competences - competences resulting from the course:

N/A

Course is included in study programmes:

Study Programme	Type of	Form of	Branch	Stage	St. plan v.	Year	Block	Status	R.year	R.
Mathematics	Postgraduate Master	Full-time	Mathematics	1	2017	2021	Mathematics - Core Segment	A	1	ZS
Mathematics and its Applications	Postgraduate Master	Full-time	Matematika a její aplikace	1	2018 akr	2021	Mathematics - Core Segment	A	1	ZS
Geomatics	Postgraduate Master	Full-time	Geomatics	1	2020	2021	Povinně volitelné předměty specializační	B	2	ZS
Geomatics	Postgraduate Master	Full-time	Geomatics	1	2017	2021	Povinně volitelné předměty specializační	B	2	ZS

Study Programme	Type of	Form of	Branch	Stage	St. plan v.	Year	Block	Status	R.year	R.
Mathematics	Postgraduate Master	Full-time	Mathematics for Business Studies	1	2016	2021	Povinně volitelné oborové předměty	B	1	ZS
Mathematics for Business Studies	Postgraduate Master	Full-time	Matematika a finanční studia	1	2018 akr	2021	Povinně volitelné předměty	B	1	ZS