ACE Network Subject Information Guide

Real Analysis and Measure Theory

Semester 1, 2020

Administration and contact details

Host Department	Department of Mathematics and Statistics
Host Institution	University of Western Australia
Name of lecturer	Enrico Valdinoci
Phone number	+61 8 6488 7321
Email Address	enrico.valdinoci@uwa.edu.au
Homepage	https://research-repository.uwa.edu.au/en/persons/enrico-valdinoci

Subject details

Start date:	**24 February, 2020**
End date:	**20 May, 2020**
Contact hours per week:	**Monday h 9-10 (Western Australia time zone)**
Lecture day and time:	**Monday h 10-12** **Wednesday h 9-10** **(Western Australia time zone)**

Subject content

1. Subject content description

The course will present the basics of **measure theory**, in a way which is fully accessible to students. The teaching style will be rigorous, so to endow participants with the necessary technical skills to exploit measure theory in the continuation of their careers, but also as close as possible to intution, to favour the understanding of the main ideas driving such a deep and important theory.
The unit will follow Chapters 3-9 of the classical textbook

Richard L. Wheeden, Antoni Zygmund, *Measure and Integral: An Introduction to Real Analysis*. Second Edition. Chapman & Hall/CRC Pure and Applied Mathematics, 2015. ISBN: 1498702899, 9781498702898.

In principle this would cover:

Lebesgue Measure and Outer Measure
Lebesgue Measurable Functions
The Lebesgue Integral
L^p Spaces
Repeated Integration
Lebesgue's Differentiation Theorem
Vitali Covering Lemma
Convex Functions
Fourier Series and Parseval's Formula
Approximations of the Identity and Maximal Functions

2. Week-by-week topic overview

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Week #	Date Starting	Topic
1	24/02/2020	Lebesgue Measure and Outer Measure
2	02/03/2020	Lebesgue Measurable Functions
3	09/03/2020	The Lebesgue Integral
4	16/03/2020	L^p Spaces
5	23/03/2020	Repeated Integration
6	30/03/2020	Lebesgue's Differentiation Theorem
7	06/04/2020	Vitali Covering Lemma
8	13/04/2020	STUDY BREAK
9	20/04/2020	Convex Functions
10	27/04/2020	Fourier Series and Parseval's Formula (I)
11	04/05/2020	Fourier Series and Parseval's Formula (II)
12	11/05/2020	Approximations of the Identity and Maximal Functions (I)
13	18/05/2020	Approximations of the Identity and Maximal Functions (II)

3. Assumed prerequisite knowledge and capabilities

Basic calculus.

4. Learning outcomes and objectives

Learning the basics of measure theory, being able to understand the main ideas and exploit them in a rigorous and creative way.

Learning Outcome Descriptors at AQF Level 8
Knowledge
K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines
K2: knowledge of research principles and methods
Skills
S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence
S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas
S3: cognitive skills to exercise critical thinking and judgement in developing new understanding
S4: technical skills to design and use in a research project
S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences
Application of Knowledge and Skills
A1: with initiative and judgement in professional practice and/or scholarship
A2: to adapt knowledge and skills in diverse contexts
A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters
A4: to plan and execute project work and/or a piece of research and scholarship with some independence

5. Learning resources

Textbook:
Richard L. Wheeden, Antoni Zygmund, *Measure and Integral: An Introduction to Real Analysis*. Second Edition. Chapman & Hall/CRC Pure and Applied Mathematics, 2015. ISBN: 1498702899, 9781498702898.

6. Assessment

The assessment is based on *weekly assignments* (to be turned in two weeks later). Each exercise is worth 10 points (the total amount of points obtained by the different exercises is then rescaled to produce a final mark up to 100). No intermediate tests or final exams are expected for this unit.