

ACE Network Subject Information Guide

Topological Groups

Semester 2, 2021

Administration and contact details

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Subject details

Handbook entry URL	Click here to enter text.
Subject homepage URL	Click here to enter text.
Honours student hand-out URL	Click here to enter text.
Start date:	July 19th, 2021

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End date:	October 29th, 2021
Contact hours per week:	2
Census date:	August 13th, 2021
Lecture day(s) and time(s):	тва
Description of electronic access arrangements for students (for example, WebCT)	Click here to enter text.

Subject content

1. Subject content description

Topological groups combine continuity and symmetry. The focus of this course is on locally compact groups, which are the exact setting to which the methods of differentiation, integration and linear algebra seen in 1st-year mathematics extend. These extended methods then apply to such fields as mathematical physics, harmonic analysis and number theory. The course is thus offers a deeper perspective on key topics in undergraduate mathematics and provides a foundation for further work in several fields.

The course develops the theory of locally compact groups to the point where the solution of Hilbert's Fifth problem (a major milestone of 20th century mathematics) and the existence of the Haar integral can be understood. These theorems will be illustrated with examples and proved in special cases. (Complete proofs would take another course.) The latter part of the course introduces recent introduces much more recent ideas on totally disconnected, or 0-dimensional, groups.

2. Week-by-week topic overview

- 1. Definition of topological groups. Examples.
- 2. Basic structure of topological groups. Locally compact groups and fields.
- 3. Continuous functions and uniform continuity. Integrals on function spaces.
- 4. Ttranslation-invariant (Haar) integrals exists and are unique. Examples.
- 5. The modular function. More examples.
- 6. Matrix groups are examples of Lie groups. Projective limits. Profinite groups.
- 7. Hilbert's Fifth Problem. Approximation by Lie groups. Examples.

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- 8. Approximation of compact groups by matrix groups.
- 9. Totally disconnected, locally compact (t.d.l.c.) groups. Van Dantzig's Theorem. Examples.
- 10. The scale function and minimising subgroups.
- 11. Tidy subgroups, characterisation of minimising subgroups. Proofs and examples.
- 12. Either a) proof of existence of the Haar integral on t.d.l.c. groups, or b) flat groups of automorphisms of a t.d.l.c. group.

3. Assumed prerequisite knowledge and capabilities

Topology: compactness, connectedness, the product topology.

Algebra: groups and fields, linear algebra.

Analysis: Riemann integration.

Discrete mathematics: graphs, modular arithmetic.

Students are expected to transfer their current knowledge to new contexts, work independently on exercises, write clear solutions, and follow logical arguments.

4. Learning outcomes and objectives

- Advanced knowledge in topological algebra.
- View of higher level connections between elementary topics in the undergraduate program.
- Foundation for further work in functional analysis, algebra, mathematical physics, or number theory.
- Experience with writing proofs.

AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):

AQF Program Learning Outcomes addressed in this subject	Associated AQF Learning Outcome Descriptors for this subject
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below

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Insert Program Learning Outcome here

Choose from list below

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Le	earning Outcome Descriptors at AQF Level 8
K	nowledge
K	1: coherent and advanced knowledge of the underlying principles and concepts in one or
m	nore disciplines
K	2: knowledge of research principles and methods
Sł	kills
S	1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and
pr	rovide solutions to complex problem with intellectual independence
SZ	2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge
ar	nd theoretical concepts with advanced understanding in some areas
SE	3: cognitive skills to exercise critical thinking and judgement in developing new understanding
S2	4: technical skills to design and use in a research project
S	5: communication skills to present clear and coherent exposition of knowledge and ideas to a
Va	ariety of audiences
A	pplication of Knowledge and Skills
A	1: with initiative and judgement in professional practice and/or scholarship
A	2: to adapt knowledge and skills in diverse contexts
A	3: with responsibility and accountability for own learning and practice and in collaboration
w	ith others within broad parameters
A	4: to plan and execute project work and/or a piece of research and scholarship with some
in	dependence

5. Learning resources

Complete lecture notes and exercise sheets will be provided.

6. Assessment

Exam	60	Assignment	40	Class work	Enter %
Assignmen	t due dates	August 6th, 2021	August 27th, 2021	September 17th, 2021	October 22nd, 2021
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	te exam date			November 10t	L 2024



Institution honours program details

Weight of subject in total honours assessment at host department	12.5%
Thesis/subject split at host department	37.5%/62.5%
Honours grade ranges at host department	
H1	85% - 100%
H2a	75% - 84%
Н2Ь	65% - 74%
НЗ	50% - 64%

Institution masters program details

Weight of subject in total masters assessment at host department	Click here to enter text.
Thesis/subject split at host department	Click here to enter text.
Masters grade ranges at host department	
H1	Enter range %
H2a	Enter range %
H2b	Enter range %
НЗ	Enter range %