Subject Information Guide

Topological Groups MATH4102

Semester 2, 2015

Administration and contact details

Host Department	School of Mathematical and Physical Sciences
Host Institution	The University of Newcastle
Name of lecturer	Colin Reid
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Subject details

Handbook entry URL	http://www.newcastle.edu.au/degrees/bachelor-of-mathematics-honours/handbook
Subject homepage URL	http://www.newcastle.edu.au/course/MATH4102
Honours student hand-out URL	To be advised
Start date:	Monday 27 July 2015
End date:	Friday 6 November 2015
Contact hours per week:	3 (2 hours lecture, 1 hour tutorial)
Lecture day and time:	To be determined
Description of electronic access arrangements for students (for example, WebCT)	Notes, exercises and assignments will be emailed to students. Assignments are submitted as pdf's and returned with annotations.

Subject content

1. Subject content description

An introduction to the theory of topological, and in particular locally compact, groups. The fundamental theorems will be explained and proved in special cases.

Course content

2. Week-by-week topic overview

The course will aim to cover the following topics. There may be some variation depending on the interests and backgrounds of students.

Weeks 1–2 General topological groups

(a) Definitions and notation, derivation of basic properties.

(b) Compact and locally compact groups.

(c) Subgroups, quotients by closed normal subgroups. Products of groups.

(d) Connected and totally disconnected groups.

Examples, many of which will be referred to throughout the course, are discussed in exercises and the first assignment.

Weeks 2–4 The Haar integral

(a) Existence and uniqueness of a left translation-invariant integral.

(b) The modular function. Unimodular groups.

(c) Proof of existence on compact groups.

Examples of explicit Haar integrals on particular groups will be given in lectures and exercises. Further examples on connected and totally disconnected groups seen later.

Weeks 5–8 Totally disconnected groups

(a) Compact open subgroups.

(b) Totally disconnected locally compact fields.

(c) Haar measure.

(d) The scale and minimizing subgroups for automorphisms.

(e) Flat groups of automorphisms.

(f) Applications and particular classes of totally disconnected groups.

Weeks 9–12 Connected groups

(a) Lie groups and matrix groups.

(b) Connected locally compact fields.

(c) Approximation by Lie groups. Hilbert's 5th problem.

(d) Compact connected groups.

(e) Haar measure on some connected matrix groups.

(f) Some consequences of approximation by Lie groups.

3. Assumed prerequisite knowledge and capabilities

(1) Point set topology or the metric spaces.

MATH3180 Topology http://www.newcastle.edu.au/course/MATH3180.html

(2) Groups, rings and fields.

MATH3120 Algebra http://www.newcastle.edu.au/course/MATH3120.html

(3) Linear Algebra.

MATH2320 Linear Algebra http://www.newcastle.edu.au/course/MATH2320.html

(4) Some combinatorics (graph theory) and number theory (modular arithmetic) would also be useful.

4. Learning outcomes and objectives

1. Demonstrate an understanding of the content and context of an advanced mathematical topic;

2. Apply advanced mathematical problem solving skills

3. Use sophisticated mathematical communication skills in the presentation of mathematical arguments

5. Learning resources

Notes and exercises provided.

6. Assessment

Exam/assignment/classwork breakdown					
Exam	60 %	**Assignment**	35 %	**Class work**	5%
Assignment due dates		To be advised			
Approximate exam date				Tuesday 9 June – Friday 26 June 2015	

Institution Honours program details

Weight of subject in total honours assessment at host department	Course is 10 units from a total of 80 units for the Honours year.
Thesis/subject split at host department	50 units for courses and 30 units for thesis.
Honours grade ranges at host department:	
H1	85-100 %
H2a	75-84 %
H2b	65-74 %
H3	50-63 %