

Subject Information Guide

RESEARCH TOPICS IN MATHEMATICS 3 – MATH706: Category Theory

Semester 2, 2016

Administration and contact details

Host Department	Department of Mathematics
Host Institution	Macquarie University
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Subject details

Handbook entry URL	http://www.handbook.mq.edu.au/2016/Units/ResearchUnit/MATH706
Subject homepage URL	To be advised
Honours student hand-out URL	To be advised
Start date:	8/08/2016
End date:	7/11/2016
Contact hours per week:	2
Lecture day and time:	Mondays 10:00-12:00
	Mid-semester break weeks starting 19/9 and 26/9
Description of electronic access arrangements for students (for example, WebCT)	To be advised

Subject content

1. Subject content description

This is an introductory course in category theory, covering the following basic notions:

- 1) Categories, functors, and natural transformations

- 2) Limits and colimits**
- 3) Free constructions**
- 4) Adjunctions**

2. Week-by-week topic overview

Weeks 1 and 2: Categories: definition and examples from mathematics and computer science. Constructions on categories. Types of morphisms in categories.

Weeks 3 and 4: Initial and terminal objects; products and coproducts. Functors. The category of categories.

Weeks 5–7: Limits and colimits; examples in Set and other categories. Construction of limits from products and equalisers.

Weeks 8–10: Natural transformations. Functor categories. Presheaf categories and the Yoneda lemma.

Weeks 11–12: Free functors. Definitions of adjunction. Right adjoints preserve limits.

3. Assumed prerequisite knowledge and capabilities

No strict prerequisites, but key concepts will be illustrated using notions from algebra (groups, rings, fields) and from topology (metric spaces, topological spaces), so familiarity with some of these notions would be an aid to understanding.

4. Learning outcomes and objectives

- 1. Understanding logical arguments and recognising any gaps or faults in such arguments.**
- 2. Solving problems, including: formulating a precise mathematical question from a “real world” problem; identifying and applying appropriate mathematical techniques.**
- 3. Expressing yourself clearly and logically in writing.**
- 4. More broadly, you are expected to improve your generic skills in the following areas: literacy and numeracy, self-awareness and interpersonal skills, communications, critical analysis, problem solving and creative thinking.**

5. Learning resources

Tom Leinster “Basic Category Theory”

Steve Awodey “Category Theory”

Saunders Mac Lane “Categories for the working mathematician”

6. Assessment: There are 4 assignments, worth 25% each. No final exam.

Exam/assignment/classwork breakdown					
Exam	0%	Assignment	100 %	Class work	0 %
Assignment due dates	2/09/2016	3/10/2016	28/10/2016	18/11/2016	
Approximate exam date					N/A

Institution Honours program details

Weight of subject in total honours assessment at host department	12.5% of BPhil
Thesis/subject split at host department	BPhil has no thesis; Thesis is 90% of MRES
Honours grade ranges at host department:	
H1	85
H2a	75
H2b	65
H3	50