



## MATH43052 - 2010/2011

### General Information

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- Title: Model Theory
- Unit code: MATH43052
- Credits: 15
- Prerequisites: MATH43001 *Predicate Logic*.
- Co-requisite units: None
- School responsible: Mathematics
- Members of staff responsible: Dr. M. Tressl

## Specification

### Aims

- To present the basic notions and results of model theory.
- To illustrate these in a variety of kinds of examples.
- To show some applications of realising types in elementary extensions.

### Brief Description of the unit

Model theory deals with those properties of mathematical structures which can be expressed using formulae of the predicate calculus. One theme is the investigation of the class of those structures which are the models of a set of sentences from predicate calculus. Another theme is the analysis of definability in individual structures and the use of elementary extensions to produce non-standard elements (such as infinitesimals in extensions of the set of real numbers).

### Learning Outcomes

On successful completion of this course unit students will be able to

- understand the relation between structure and syntax, definable sets and types, in the context of predicate logic;
- be able to analyse examples from a model-theoretic perspective;
- understand the fundamental results on the class of models of a theory in predicate logic;
- be able to use the technique of realising types.

### Future topics requiring this course unit

None.

### Syllabus

1. Review of predicate logic: languages, structures, theories, compactness theorem. [2 lectures]
2. Comparing structures: homomorphisms, embeddings, elementary embeddings, diagrams. [4 lectures]
3. Lowenheim-Skolem theorems; elementary chains. [2 lectures]
4. Definable sets; the space of types; saturation. [8 lectures]
5. Elimination of quantifiers and model completeness, basic examples. [8 lectures]
6. Decidability of the complex and the real field. [6 lectures]

### Textbooks

- Marker, David *Model theory. An introduction*. Graduate Texts in Mathematics, 217. Springer-Verlag, New York, 2002. viii +342 pp.

- Hodges, Wilfrid *Model theory*. Encyclopedia of Mathematics and its Applications, 42. Cambridge University Press, Cambridge, 1993. xiv+772 pp.

## **Teaching and learning methods**

Three lectures each week with some time used for discussion of exercises. In addition students should expect to do at least seven hours private study each week for this course unit.

## **Assessment**

Mid-semester coursework: two take home tests weighting 20%

End of semester examination: two and a half hours weighting 80%

## **Arrangements**