

MODULE TITLE	Topology and Metric Spaces	CREDIT VALUE	15
MODULE CODE	MTH3040	MODULE CONVENER	Dr Demi Allen (Coordinator)
DURATION: TERM	1	2	3
DURATION: WEEKS	0	11 weeks	0
Number of Students Taking Module (anticipated)	24		

DESCRIPTION - summary of the module content

Topology and metric spaces provide a set of powerful tools that are used in many other branches of mathematics (from Algebraic Topology and Numerical Analysis to Dynamical Systems and Ergodic Theory). Fundamental to these topics is the idea of generalising the idea of “closeness” of two objects in a set to a very general setting. These techniques are fundamental to the understanding of more advanced topics in mathematics such as Measure Theory, Functional Analysis, Algebraic Topology and Algebraic Geometry.

This course aims to give an introduction to topology and metric spaces as well as applications to basic concepts of measure theory. In every section covered in this course we will start by studying the definitions and then we will present examples and some basic properties. Some important theorems will be stated and proved. With this module you will have the opportunity to further refine your skills in problem-solving, axiomatic reasoning and the formulation of mathematical proofs.

Pre-requisite - MTH2001 or MTH2008

AIMS - intentions of the module

The objective of this module is to provide you an introduction to Topology and Metric Spaces. Our main objective will be to define the basic concepts clearly and to provide proofs of useful theorems.

INTENDED LEARNING OUTCOMES (ILOs) (see assessment section below for how ILOs will be assessed)

On successful completion of this module *you should be able to:*

Module Specific Skills and Knowledge

1. Recall and apply key definitions in Analysis;
2. State, prove and apply core theorems in Topology and metric spaces.

Discipline Specific Skills and Knowledge

3. Extract abstract problems from a diverse range of problems;
4. Use abstract reasoning to solve a range of problems.

Personal and Key Transferable / Employment Skills and Knowledge

5. Think analytically and use logical argument and deduction;
6. Communicate results in a clear, correct and coherent manner.

SYLLABUS PLAN - summary of the structure and academic content of the module

- Review of some real analysis: Real numbers, real sequences, limits of functions, continuity, intervals, set theory. (3 lectures)
- Metric spaces: Definition and examples, open and closed sets in metric spaces, equivalent metrics, examples. (4 lectures)
- Topological spaces: Bases, sub-bases and weak topologies, topologies of subspaces and products, homeomorphisms. (4 lectures)
- The Hausdorff condition: separation axioms, Hausdorff space, regular topological space. (3 lectures)
- Compact spaces: Definition, Compactness of $[a,b]$, properties of compact spaces, continuous maps on compact spaces. An inverse function theorem. (3 lectures)
- Connected spaces: Connectedness, components, path-connectedness. (3 lectures)
- Complete metric spaces: Definition and examples, Fixed point theorems, the contraction mapping theorem. (4 lectures)
- Introduction to measure theory: Measure of plane sets. Outer and inner measure of a set. Measurable set (in the sense of Lebesgue). Some fundamental properties of Lebesgue measure and measurable sets. Definition and fundamental properties of measurable functions. (3 lectures)
- If time allows, a selection from the following: σ -algebras. Positive Borel measures. The Riesz representation theorem. L_p -spaces. Elementary Hilbert space theory. Banach spaces. Baire's theorem. (3 lectures)
- Revision (3 lectures)

LEARNING AND TEACHING

LEARNING ACTIVITIES AND TEACHING METHODS (given in hours of study time)

Scheduled Learning & Teaching Activities	33.00	Guided Independent Study	127.00	Placement / Study Abroad	0.00
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DETAILS OF LEARNING ACTIVITIES AND TEACHING METHODS

Category	Hours of study time	Description
Scheduled learning and teaching activities	33	Lectures Example classes
Example classes Guided Independent Study	127	Studying additional recordings complementing lectures, and reading material, examples sheets and revision

ASSESSMENT

FORMATIVE ASSESSMENT - for feedback and development purposes; does not count towards module grade

Form of Assessment	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Coursework problem sheets	10 hours	All	Written comments on scripts

SUMMATIVE ASSESSMENT (% of credit)

Coursework	20	Written Exams	80	Practical Exams	0
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DETAILS OF SUMMATIVE ASSESSMENT

Form of Assessment	% of Credit	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Coursework 1- based on questions submitted for assessment	10	15 hours	All	Annotated script and written/verbal feedback
Coursework 2- based on questions submitted for assessment	10	15 hours	All	Annotated script and written/verbal feedback
Written Exam- closed book	80	2 hours (Summer)	All	Written/verbal on request, SRS

DETAILS OF RE-ASSESSMENT (where required by referral or deferral)

Original Form of Assessment	Form of Re-assessment	ILOs Re-assessed	Time Scale for Re-assessment
Written Exam *	Written Examination (2 hours)	All	August Ref/Def Period
Coursework 1 *	Coursework 1	All	August Ref/Def Period
Coursework 2 *	Coursework 2	All	August Ref/Def Period

*Please refer to reassessment notes for details on deferral vs. Referral reassessment

RE-ASSESSMENT NOTES

Deferrals: Reassessment will be by coursework and/or written exam in the deferred element only. For deferred candidates, the module mark will be uncapped.
 Referrals: Reassessment will be by a single written exam worth 100% of the module only. As it is a referral, the mark will be capped at 40%.

RESOURCES

INDICATIVE LEARNING RESOURCES - The following list is offered as an indication of the type & level of information that you are expected to consult. Further guidance will be provided by the Module Convener

Basic reading:

ELE: <http://vle.exeter.ac.uk/>

Web based and Electronic Resources:

Other Resources:

Reading list for this module:

Type	Author	Title	Edition	Publisher	Year	ISBN	Search
Set	Falconer, K.	Fractal Geometry	2nd edition	Wiley	2003	978-0470848623	[Library]
Set	Sutherland, W.A.	Introduction to Metric and Topological Spaces		Oxford Science Publications			[Library]
Set	Rudin, W.	Real and Complex Analysis	Third	McGraw Hill	1987	978-0070619876	[Library]
Set	Charles Chapman Pugh	Real Mathematical Analysis		Undergraduate Texts in Mathematics, Springer			[Library]
Set	James R Munkres	Topology		Prentice Hall			[Library]

CREDIT VALUE	15	ECTS VALUE	7.5
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PRE-REQUISITE MODULES	MTH2001, MTH2008
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CO-REQUISITE MODULES

NQF LEVEL (FHEQ)	6	AVAILABLE AS DISTANCE LEARNING	No
ORIGIN DATE	Tuesday 10 July 2018	LAST REVISION DATE	Thursday 26 January 2023

KEY WORDS SEARCH	None Defined
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