

# MAST30026 Metric and Hilbert Spaces

<b>Credit Points:</b>	12.50															
<b>Level:</b>	3 (Undergraduate)															
<b>Dates &amp; Locations:</b>	This subject is not offered in 2014. Lectures and practice classes.															
<b>Time Commitment:</b>	Contact Hours: 3 x one hour lectures per week, 1 x one hour practice class per week Total Time Commitment: Estimated total time commitment of 120 hours															
<b>Prerequisites:</b>	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 60%;">Subject</th> <th style="width: 20%;">Study Period Commencement:</th> <th style="width: 20%;">Credit Points:</th> </tr> </thead> <tbody> <tr> <td>MAST20022 Group Theory and Linear Algebra</td> <td>Semester 2</td> <td>12.50</td> </tr> </tbody> </table> <p>and one of</p> <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 60%;">Subject</th> <th style="width: 20%;">Study Period Commencement:</th> <th style="width: 20%;">Credit Points:</th> </tr> </thead> <tbody> <tr> <td>MAST20026 Real Analysis</td> <td>Semester 1, Semester 2</td> <td>12.50</td> </tr> <tr> <td>MAST10009 Accelerated Mathematics 2</td> <td>Semester 2</td> <td>12.50</td> </tr> </tbody> </table>	Subject	Study Period Commencement:	Credit Points:	MAST20022 Group Theory and Linear Algebra	Semester 2	12.50	Subject	Study Period Commencement:	Credit Points:	MAST20026 Real Analysis	Semester 1, Semester 2	12.50	MAST10009 Accelerated Mathematics 2	Semester 2	12.50
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MAST10009 Accelerated Mathematics 2	Semester 2	12.50														
<b>Corequisites:</b>	None															
<b>Recommended Background Knowledge:</b>	None															
<b>Non Allowed Subjects:</b>	Students who have completed either of the following may not enrol in this subject for credit. # 620-311 Metric Spaces (prior to 2010) # 620-312 Linear Analysis (prior to 2010)															
<b>Core Participation Requirements:</b>	For the purposes of considering request for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005), and Students Experiencing Academic Disadvantage Policy, academic requirements for this subject are articulated in the Subject Description, Subject Objectives, Generic Skills and Assessment Requirements of this entry. The University is dedicated to provide support to those with special requirements. Further details on the disability support scheme can be found at the Disability Liaison Unit website: <a href="http://www.services.unimelb.edu.au/disability/">http://www.services.unimelb.edu.au/disability/</a>															
<b>Contact:</b>	Third Year Coordinator <b>Email: <a href="mailto:tycoord@ms.unimelb.edu.au">tycoord@ms.unimelb.edu.au</a> (mailto:tycoord@ms.unimelb.edu.au)</b>															
<b>Subject Overview:</b>	<p>This subject provides a basis for further studies in modern analysis, geometry, topology, differential equations and quantum mechanics. It introduces the idea of a metric space with a general distance function, and the resulting concepts of convergence, continuity, completeness, compactness and connectedness. The subject also introduces Hilbert spaces: infinite dimensional vector spaces (typically function spaces) equipped with an inner product that allows geometric ideas to be used to study these spaces and linear maps between them.</p> <p>Topics include: metric and normed spaces, limits of sequences, open and closed sets, continuity, topological properties, compactness, connectedness; Cauchy sequences, completeness, contraction mapping theorem; Hilbert spaces, orthonormal systems, bounded linear operators and functionals, applications.</p>															
<b>Learning Outcomes:</b>	<p>On completion of this subject, students should understand:</p> <ul style="list-style-type: none"> <li># the definition and fundamental properties of metric spaces, including the ideas of convergence, continuity, completeness, compactness and connectedness;</li> <li># the definition and fundamental properties of Hilbert spaces, and bounded linear maps between them;</li> </ul>															

	<p># how basic concepts of geometry and linear algebra can be generalised to infinite dimensional spaces;</p> <p>and should be able to:</p> <p># prove simple results about metric spaces and Hilbert spaces;</p> <p># analyse bounded linear maps between Hilbert spaces;</p> <p># apply general results on metric and Hilbert spaces to solve problems in other areas of mathematics and physics, including numerical methods and differential equations.</p>
<b>Assessment:</b>	Two or three written assignments due at regular intervals during semester amounting to a total of up to 50 pages (20%), and a 3-hour written examination in the examination period (80%).
<b>Prescribed Texts:</b>	None
<b>Recommended Texts:</b>	<p>J. J. Koliha, Metrics, Norms and Integrals: An introduction to Contemporary Analysis, World Scientific, 2008</p> <p>L. Debnath and P. Mikusinski, Introduction to Hilbert Spaces with Applications, 2nd Ed, Academic Press, 1999</p> <p>E. Kreyszig, Introductory Functional Analysis with Applications, Wiley, 1989</p>
<b>Breadth Options:</b>	<p>This subject potentially can be taken as a breadth subject component for the following courses:</p> <p># <b>Bachelor of Commerce</b> (<a href="https://handbook.unimelb.edu.au/view/2014/B-COM">https://handbook.unimelb.edu.au/view/2014/B-COM</a>)</p> <p># <b>Bachelor of Environments</b> (<a href="https://handbook.unimelb.edu.au/view/2014/B-ENVS">https://handbook.unimelb.edu.au/view/2014/B-ENVS</a>)</p> <p># <b>Bachelor of Music</b> (<a href="https://handbook.unimelb.edu.au/view/2014/B-MUS">https://handbook.unimelb.edu.au/view/2014/B-MUS</a>)</p> <p>You should visit <b>learn more about breadth subjects</b> (<a href="http://breadth.unimelb.edu.au/breadth/info/index.html">http://breadth.unimelb.edu.au/breadth/info/index.html</a>) and read the breadth requirements for your degree, and should discuss your choice with your student adviser, before deciding on your subjects.</p>
<b>Fees Information:</b>	Subject EFTSL, Level, Discipline & Census Date, <a href="http://enrolment.unimelb.edu.au/fees">http://enrolment.unimelb.edu.au/fees</a>
<b>Generic Skills:</b>	<p>In addition to learning specific skills that will assist students in their future careers in science, they will have the opportunity to develop generic skills that will assist them in any future career path. These include:</p> <p># problem-solving skills: the ability to engage with unfamiliar problems and identify relevant solution strategies;</p> <p># analytical skills: the ability to construct and express logical arguments and to work in abstract or general terms to increase the clarity and efficiency of analysis;</p> <p># collaborative skills: the ability to work in a team;</p> <p># time-management skills: the ability to meet regular deadlines while balancing competing commitments.</p>
<b>Notes:</b>	This subject is available for science credit to students enrolled in the BSc (both pre-2008 and new degrees), BASc or a combined BSc course.
<b>Related Majors/Minors/Specialisations:</b>	<p>Mathematical Physics</p> <p>Pure Mathematics</p> <p>Pure Mathematics</p> <p>Pure Mathematics (specialisation of Mathematics and Statistics major)</p> <p>Science credit subjects* for pre-2008 BSc, BASc and combined degree science courses</p> <p>Science-credited subjects - new generation B-SCI and B-ENG.</p> <p>Selective subjects for B-BMED</p>