620-232 Mathematical Methods

Credit Points 12.5

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Tutor Coordinator Michael Patterson


Contact 3 lectures + 1 hour tutorial per week.

You will be assigned a tutorial time by the Alloc8 timetabling system. You can view or edit your timetable from the student information web page (http://sis.unimelb.edu.au/) until the end of the second week of semester. You will be not be assigned to a tutorial until you have viewed your timetable on Alloc8.

Lecture Notes Printed lecture notes can be purchased from the bookroom.

Problem Sheets Problem sheets together with some answers can be obtained from week 1.

Expectations This is a core 200 level applied mathematics subject for students interested in pure and applied mathematics and for students interested in the physical sciences, engineering, and quantitative aspects of economics and commerce.

You are expected to work through a significant number of the problems on the Problem Sheets. This is the only way to gain mastery of the material. It is essential that you do all the unstarred problems. Optional extension problems are starred. The revision problems are optional; you can decide whether you need such revision.

Subject Description Many phenomena in the biological and physical sciences as well as engineering and modern finance are described by differential equations. Examples include tissue engineering, contaminant transport, epidemic models, electrical circuits, dynamical systems and quantum mechanics. This subject describes analytical methods to solve linear ordinary and partial differential equations, as well as qualitative methods for linear and nonlinear systems of differential equations.

Transform methods for ordinary differential equations are introduced via the Laplace transform. The most common partial differential equations - Laplace’s equation, the wave equation and the heat equation - are introduced and solved in simple geometries by separation of variables. This requires the development of Fourier series to repre-
sent functions and leads to an introduction to Fourier transforms. Linear systems of 
on-ordinary differential equations are solved by matrix methods and the phase plane is 
deﬁned. Qualitative ideas such as stability and phase portraits are extended to non-
linear systems of differential equations. Applications include topics such as population 
models and normal modes.

Assessment

The assessment consists of 2 parts

1. A three (3) hour exam (E) out of 100.
2. Three (3) tests (T₁, T₂, T₃) each out of 5.

The ﬁnal mark F will be computed as follows: \[ F = 0.85E + T₁ + T₂ + T₃ \]

Reference Books

You are not expected to purchase a textbook. The subject 
printed lecture notes should be adequate. However, you may want to look up books in 
the library. There are many that cover these topics. Here are some:

- Advanced engineering mathematics, by E Kreysig, Wiley
- Advanced mathematics for engineers and scientists, by M R Spiegel, Schaums 
  Outline Series, MacGraw-Hill
- Differential equations and their applications, by M Braun, Springer-Verlag

If you do further study in applied mathematics, the following book is good for 620-331 

- Elementary applied partial differential equations, by R Haberman, Prentice Hall