COURSE OUTLINE

MATH2301
MATHEMATICAL COMPUTING

Semester 1, 2015
MATH 2301 - Course outline

Information about the course

Course Authority: Dr. Q. T. Le Gia

Lecturer/Tutor:
   Dr. Q. T. Le Gia
   Room: Red Center, RC - 2084
   Phone: 9385 7049
   Email: qlegia@unsw.edu.au

Consultation times:
   Thu 2-4pm or by appointment

Credit, Prerequisites, Exclusion:

   • 6 UOC
   • Pre-requisites: MATH1031 (CR) or MATH1231 or MATH1241 or MATH1251
   • Exclusions: MATH2089, CVEN2002, and CVEN2702

Location and times: There are 2 lectures, 1 class tutorial and 1 lab tutorial per week. Tutorials commence in Week 2 and run until Week 13.

Lectures (weeks 1-12)

   Mon 09:00 -- 10:00: The Michael Hintze Theatre (K-H6-LG03)
   Wed 16:00 -- 17:00: The Michael Hintze Theatre (K-H6-LG03)

Tutorials:

   Class tutorials: (weeks 2-13)

      Thu 10:00 -- 11:00  Old Main Building G32 (K-K15-G32)
      OR
      Thu 12:00 – 13:00  Old Main Building G32 (K-K15-G32)

   Lab tutorials: (weeks 2-13)

      Tue 16:00 - 17:00  Red Centre Central Wing M020 (K-H13-M020)
      OR
      Thu 13:00 - 14:00  Red Centre Central Wing G12C (K-H13-G12C)

During the lab tutorials, you will mostly work on your own, using MATLAB to complete a set of exercises. Try to make the most of the tutorials, as these provide the opportunity for you to receive individual help with the computing part of the course.
Moodle

Further information, skeleton lecture notes, and other material will be provided via Moodle.

Course aims

The main aim of MATH2301 is to provide a general introduction to scientific computing, so that you will be able to solve at least a few simple types of standard problems, and have an understanding of what is involved in more realistic applications. In this course, you will perform all numerical computations using a software package called MATLAB. Accordingly, the syllabus is made up of three kinds of topics:

- commands and programming techniques in MATLAB (including graphics);
- numerical methods;
- applications.

Relation to other mathematics course

This course provides valuable backgrounds for the third-year courses MATH3101 (Computational Mathematics) and MATH3311 (Mathematical Computing for Finance).

Student Learning Outcomes

At the end of the course, students are expected to understand the basic of computational mathematics: interpolation, quadrature formulas, numerical methods for nonlinear systems and for ordinary differential equations.

The tutorial exercises will provide practice in written presentation of mathematics, and the laboratory exercises will improve students programming skills.

Relation to graduate attributes

The above outcomes are related to the development of the Science Faculty Graduate Attributes, in particular: 1. Research, inquiry and analytical thinking abilities, 4. Communication, 6. Information literacy

Teaching strategies underpinning the course

New ideas and skills are introduced and demonstrated in lectures, then students develop these skills by applying them to specific tasks in tutorials and assessments.

Rationale for learning and teaching strategies
We believe that effective learning is best supported by a climate of enquiry, in which students are actively engaged in the learning process. To ensure effective learning, students should participate in class as outlined below.

We believe that effective learning is achieved when students attend all classes, have prepared effectively for classes by reading through previous lecture notes, in the case of lectures, and, in the case of tutorials, by having made a serious attempt at doing for themselves the tutorial problems prior to the tutorials.

Furthermore, lectures should be viewed by the student as an opportunity to learn, rather than just copy down lecture notes.

Effective learning is achieved when students have a genuine interest in the subject and make a serious effort to master the basic material.

The art of logically setting out mathematics is best learned by watching an expert and paying particular attention to detail. This skill is best learned by regularly attending classes and doing the homework.

Lab and class tests are mainly to provide feedback on a student's progress and help students to identify problems early. Assessment in this course will use problem-solving tasks of a similar form to those practiced in tutorials, to encourage the development of the core skills underpinning this course and the development of analytical thinking.

**Assessment**

<table>
<thead>
<tr>
<th>Assessment component</th>
<th>Due date</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matlab quizzes</td>
<td>Weeks 2,3,4</td>
<td>4%</td>
</tr>
<tr>
<td>Lab participation</td>
<td>Throughout semester</td>
<td>6%</td>
</tr>
<tr>
<td>Written test</td>
<td>Week 7</td>
<td>12%</td>
</tr>
<tr>
<td>Lab test</td>
<td>Week 10</td>
<td>12%</td>
</tr>
<tr>
<td>Project</td>
<td>Week 13</td>
<td>10%</td>
</tr>
<tr>
<td>Final exam</td>
<td>June (2 hours)</td>
<td>56%</td>
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**Matlab quizzes**: the online quizzes are designed to familiarise the student with simple MATLAB commands. You should start as soon as possible and you can try as many times as you would like. The due dates are
- Friday 13 March 2015, 2pm for Lessons 0 to 3
- Friday 20 March 2015, 2pm for Lessons 4 to 7
- Friday 27 March 2015, 2pm for Lessons 8 to 10
The quizzes are accessed via Moodle.

**Lab participation**: Three random submissions of lab tutorial questions will be called for and marked (2% each). Marked scripts will **not** be returned.

**Tests**: the tests will give students feedback on their progress and mastery of the material.
• The **written test** (50 minutes) will take place during your class tutorial time in Week 7.
• The **lab test** (50 minutes) will take place in the lab during your lab tutorial time in Week 10. You will be asked to write some MATLAB codes using the computer.

**Project**: To provide experience with team work, a group project will be given. Each group will consist of 3 students. The project description will be released in week 9 with a due date in week 13.

**Final exam**: the final exam will assess student mastery of the material covered in the lectures, tutorials and laboratory classes

### Additional resources and support

**Tutorial Exercises**

A set of tutorial exercises will be given out. These problems are for YOU to do to enhance mastery of the course.

SOME of the problems will be done in tutorials, but you will learn a lot more if you try to do them before the tutorial.

**Lecture notes**

A set of skeleton notes containing only definitions, theorems and proofs will be provided on Moodle.

**Textbooks**

There is no set text for this course.

The content of the course will be defined by the lectures. Any book on Numerical Analysis may prove to be useful.

**UNSW Moodle**

The School of Mathematics and Statistics makes extensive use of the centrally provided electronic learning environment known as “UNSW Moodle”. Access to this server is via any suitably configured web browser from any computer with an internet connection. The URL for UNSW Moodle is

[http://moodle.telt.unsw.edu.au](http://moodle.telt.unsw.edu.au)

The School of Mathematics and Statistics web pages for Current Students also have a quick link to UNSW Moodle. For UNSW Moodle your “Username” is z immediately followed by your student number, and your “Password” is your zPass. The Blackboard login page has information on how to activate your zPass in order to
login and various warnings about difficulties you may encounter with your zPass. There is also a link to the IDM Self Service page where you can reset or "unlock" your zPass if needed. Help for using Moodle is available via links from the UNSW Moodle login page or directly via the URL

https://student.unsw.edu.au/moodle

Once logged in to the UNSW Moodle you will have a choice of modules for all your courses including MATH2301. Outline lecture notes for this course will be made available in this module. Note that these notes are not a substitute for attendance at lectures and tutorials.

Outline of Syllabus

1. Matlab programming (week 1)

Data types, arrays, sparse matrices, functions, logical expressions, strings, graphics (simple plots, surface plots, handles), script files, function files, if statements, loops, efficiency.

2. Floating-point arithmetic (week 2)

IEEE Standard 754, machine epsilon, strategies to reduce round-off errors, examples (roots of quadratic, numerical differentiation, etc).

3. Linear systems (weeks 3-4)

LU factorization, pivoting, Cholesky factorization, conditioning.

4. Interpolation (weeks 5-6)

Lagrange interpolation, Newton interpolation.

5. Nonlinear equations (weeks 7-8)

Fixed point iteration, Newton's method.

6. Quadrature (week 9)

Newton-Cotes rules, Gauss rules

7. Ordinary differential equations (weeks 10-12)

Euler methods, Runge-Kutta methods, multistep methods, stiff equations.

Additional References

Students seeking resources can also obtain assistance from the UNSW Library. One starting point for assistance is: www.library.unsw.edu.au

**Course Evaluation and Development**

The School of Mathematics and Statistics evaluates each course each time it is run. We carefully consider the student responses and their implications for course development. It is common practice to discuss informally with students how the course and their mastery of it are progressing.

**Administrative matters**

**School Rules and Regulations**

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the policies of the University. Please take the time to read the following policies.

Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages School of Mathematics and Statistics web site.

http://www.maths.unsw.edu.au/currentstudents/help-students-undergraduate

UNSW assesses students under a standards based assessment policy. For how this policy is applied in the School of Mathematics and Statistics see

http://www.maths.unsw.edu.au/currentstudents/assessment-policies

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedures in it.

**Plagiarism and academic honesty**

Plagiarism is the presentation of the thoughts or work of another as one’s own. Issues you must be aware of regarding plagiarism and the university’s policies on
academic honesty and plagiarism can be found at
http://www.lc.unsw.edu.au/plagiarism
and