FACULTY OF SCIENCE
SCHOOL OF MATHEMATICS AND STATISTICS

MATH2620
HIGHER COMPLEX ANALYSIS

Session 2, 2012
MATH2620 – Course Outline

Information about the course

Course Authority:  P.G. Brown
Lecturer: P.G. Brown  RC-3073, email peter@unsw.edu.au.
Consultation: Please use email to arrange an appointment.

Credit, Prerequisites, Exclusions:
This course counts for 3 Units of Credit (3UOC).
MATH1141/MATH1241 is assumed knowledge for this course.
Exclusions: MATH2520, MATH2069.

Lectures:  There will be two lecturers per week:

<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday 11 am</td>
<td>CLB-1</td>
</tr>
<tr>
<td>Thursday 12 noon</td>
<td>CLB-4</td>
</tr>
</tbody>
</table>

Tutorials: There will be one tutorial per week.

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

Course aims

This course aims to extend our understanding of differential and integral calculus from functions of a single real variable to functions of a complex variable. The differences between the two are often unexpected and very surprising. The theory of complex valued functions will give us many new insights into the real variable theory.

Relation to other mathematics courses

Mathematics may be divided into the broad categories of analysis (calculus), algebra, geometry and logic.

This subject fits into the analysis category and follows on from material you will have learned in first year algebra and calculus.

This course is part of the compulsory core aimed at those majoring in Mathematics.
Student Learning Outcomes

Students taking this course will gain an understanding of the basic theory of functions of a complex variable. They will:

• understand the main properties and examples of analytic functions;

• be able to compute and manipulate series expansions for analytic functions;

• know and be able to use the major integral theorems;

• be able to identify and classify zeroes and poles of functions and find their residues;

• understand the relationship between complex function theory and the theory of functions of a real variable.

• be able to calculate certain real improper and trigonometric integrals using complex analytic methods.

• understand and be able to use Rouche’s theorem and other arguments to find the number of zeros a function has in a given region.

New ideas and concepts will be introduced in lectures and then applied to specific tasks in tutorials.

Through regularly attending lectures and applying themselves in tutorial exercises, students will reach the above outcomes.

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.

Assessment

Assessment in this course will consist of two tests (10% each), and a final examination (80%) covering all of the course.

The Class tests will be in tutorials.

Assessment criteria: The main criteria for marking all assessment tasks will be clear and logical presentation of correct solutions.

Test

Rationale: The Tests will give students feedback on their progress and mastery of the material.

Sample Tests will appear on the Blackboard.

You must do the test in your OWN tutorial in which you are enrolled.

You may bring your own non-programmable hand-held Scientific Calculator to the test. Calculators will not be provided for you.

<table>
<thead>
<tr>
<th>Task</th>
<th>Date</th>
<th>Weighting</th>
<th>Duration</th>
<th>Material tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>Week 5</td>
<td>10%</td>
<td>30 mins</td>
<td>Weeks 1-4</td>
</tr>
<tr>
<td>Test</td>
<td>Week 10</td>
<td>10%</td>
<td>30 mins</td>
<td>Weeks 5-9</td>
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</table>

If you are absent from the test, you must provide a medical certificate. In that case an M will be recorded and your final mark will be calculated from the other assessment tasks. If you are absent without a medical certificate you will receive an A which gives a mark of zero for that task.
Examination

Duration: Two hours.

Rationale: The final examination will assess student mastery of the material covered in the lectures.

Weighting: The final examination will count for 80% of your final mark.

Further details about the final examination will be available in class closer to the time.

Additional resources and support

Tutorial Exercises

A set of tutorial exercises will be available through Blackboard.

These problems are for YOU to do to enhance mastery of the course.

SOME of the problems may 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 lecture notes for the course will appear on Blackboard.

Textbooks


The content of the course will be defined by the lectures.

Blackboard

All course materials will be available on Blackboard. You should check regularly for new materials.

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**

**Additional Assessment**

See the School Webpage.

**School Rules and Regulations**

Fuller details of the general rules regarding attendance, release of marks, special consideration etc are available via the School of Mathematics and Statistics Web page at http://www.maths.unsw.edu.au/currentstudents/assessment-policies.

**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 http://www.lc.unsw.edu.au/plagiarism/plagiarism_STUDENTBOOK.pdf.
Course Schedule:

Here is a rough guide as to the schedule of material taught.

<table>
<thead>
<tr>
<th>Theme</th>
<th>No. of Lects.</th>
<th>Weeks</th>
<th>Text</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>1. Introduction:</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td>Revision, basic topology functions and mappings</td>
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<tr>
<td>2. Limits, continuity, differentiability</td>
<td>1</td>
<td>2</td>
<td>2.14-2.21</td>
<td></td>
</tr>
<tr>
<td>3. Analytic and harmonic functions</td>
<td>1</td>
<td>2</td>
<td>2.23-2.26</td>
<td></td>
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<tr>
<td>4. Exponential, trigonometric and hyperbolic functions</td>
<td>2</td>
<td>3</td>
<td>3.28, 3.33</td>
<td>3.34</td>
</tr>
<tr>
<td>5. Principal logarithms, and and complex exponents</td>
<td>2</td>
<td>4</td>
<td>3.29-3.32</td>
<td>3.35</td>
</tr>
<tr>
<td>6. Arcs, contour integrals and antiderivatives</td>
<td>2.5</td>
<td>5,6</td>
<td>4.36-4.43</td>
<td>Test 1, Week 5 Themes 1-4</td>
</tr>
<tr>
<td>7. Cauchy-Goursat theorem and the Cauchy integral formula</td>
<td>3.5</td>
<td>6,7</td>
<td>4.44-4.50</td>
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<tr>
<td>8. Taylor and Laurent Series</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td></td>
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<tr>
<td>9. Evaluating integrals</td>
<td>2</td>
<td>9</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10. Singularities and residues</td>
<td>2</td>
<td>10</td>
<td>6</td>
<td>Test 2, Week 10 Themes 5-9</td>
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<tr>
<td>11. Real Improper integrals</td>
<td>2</td>
<td>11</td>
<td>7.71-7.74</td>
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<tr>
<td>12. Trigonometric integrals</td>
<td>1</td>
<td>12</td>
<td>7.78</td>
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<tr>
<td>13. Rouche’s Theorem</td>
<td>1</td>
<td>12</td>
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