DEPARTMENT OF MATHEMATICS

MATH3401      COMPLEX ANALYSIS
(2 units)      First Semester 2005

Lecturer
Phil Diamond, Priestley, Room 744, email pmd@maths.uq.edu.au

Consultation Times: 8-8.45am, Mon; 7.15-8.50am Tues; 10-10.50am Wed.

Timetable:
Lectures: Monday 9–10am (78-343),
           Tuesday 8–9am (78-343)
           Wednesday 11–12am (78-343)
Tutorial: Wednesday 3–4pm (68-214) [Chemistry].

Purpose of the course:
This subject is an introduction to the theory of functions of a complex variable. In particular it will
explore the consequences of differentiability on an open connected set, especially Cauchy’s Integral
Theorem, and demonstrate some of the applications.

Course outline:
Complex Numbers, Analytic Functions, Elementary Functions, Mapping by Elementary Functions,
Integrals, Cauchy’s Theorem, Power and Laurent Series, Residues and Poles, Conformal Mapping.

Textbook:
The prescribed textbook is
Theory and Problems of Complex Variables, by Murray R. Spiegel (Schaum’s Outline Series)

Some lecture notes covering topics associated with the course, and containing some material specific
to the course, is available at www.maths.uq.edu.au/ asj/COMP/comp.html, while there is another set
of different emphasis that can be accessed from my webpage.

DO NOT DO THE TUTORIAL SHEETS AND ASSIGNMENTS THERE!
THE ASSIGNMENTS ARE AT Phil’s HOMEPAGE

Assignments and Assessment
There will be weekly assignments which will count 10% towards the
final result. These will contain practice problems to reinforce and develop the lecture material. These
problem sheets are a primary means of preparing for the final examination, so you should make a
serious attempt at them all. Solutions will be provided at a later date, in the tutorials.

There will be an assignment to be handed in most weeks. Your attempts at these are to be handed
direct to the tutors by the end of the tutorial at which they are due. They will be marked and returned
to you the following week. Solutions will be available when the assignments are returned.

These assignments will count for 10% of the assessment
There is no provision for late assignments. Late assignments are deemed to be missed assignments. If
you wish to submit an assignment after the due date, it may be marked, but no credit will be given.
However, note “Exemptions” below.

Exemptions
In case of illness (or bereavement) you may be exempted from an assignment if a medical certificate
(or other documentation) is received by your lecturer and tutor within one week of the due date of
the assignment. If you are exempted from any assignment, then an average for the other assignments
is taken and a total mark out of 5% (for each half) will be returned. Please note that ad hoc excuses
(car trouble, and similar!) will not be accepted; only documentation in connection with illness or
bereavement. If you enrolled late, then exemption will automatically be granted for any assignments
missed before the date of enrolment.
Medical certificates
If you are concerned about privacy with regard to medical certificates, please contact the University Health Service. With your permission, the Director will contact your treating practitioner to clarify the extent of your medical condition or other incapacity, and provide us with a report — the Director is bound by confidentiality obligations. In any case, we prefer this course of action, as we are not qualified to assess medical evidence. The procedure outlined here accords with the University’s policy on student privacy and confidentiality.

Assessment
The summative assessment for this subject is:

10% for assignment work
30% for a Midsemester examination done in the tutorial time
60% from an end-of-semester examination, of length TWO HOURS.
The end-of-semester examination will be centrally timetabled.

Plagiarism
Plagiarism involves the use of others’ ideas and words without clearly acknowledging the source of that information. Plagiarism is not allowed, and a mark of 0 (zero) will be given for any assignment which is found to be plagiarised. See also “Stopping Plagiarism” at http://www.library.uq.edu.au/useit/.

Disabled Students
Any student with a disability who may require alternative academic arrangements in the course is encouraged to seek advice at the commencement of the semester from a Disability Adviser at Student Support Services.

Assumed background: Students are assumed to know the definition and basic properties of complex numbers and to be able to perform simple algebraic manipulations with them. Students are assumed to have undertaken introductory courses in Calculus and Multivariate Calculus (such as MATH1051 and MATH1052) and in Real Analysis (such as MATH2400).

Course goals/rationale: On completing this course, students will:

- Be able to define a number of elementary functions on complex variables
- Know identities relating elementary functions
- Be able to define limits, continuity, and derivatives in the context of functions of complex variables
- Be able to determine limits and derivatives of certain functions of complex variables
- Be able to define analytic and entire functions and give some examples
- Be able to describe mappings by certain functions of complex variables
- Be able to define contour integrals and antiderivatives
- Understand and be able to clearly define and use the following: the Cauchy-Riemann equations and associated theorems, the Cauchy-Goursat theorem, the Cauchy integral formula and related theorems, Morera’s theorem, Liouville’s theorem, the Fundamental Theorem of Algebra, Taylor series, Laurent series, and the residue theorem
- Be able to recall proofs of some of the above results
- Be able to solve certain boundary value problems by conformal mapping and by applying integral formulae
- Be able to determine whether certain power series converge, and perform certain analytic and algebraic manipulations with power series
- Be able to evaluate certain integrals using the residue theorem.

Graduate Attributes:
The following graduate attributes will be developed in the course

In-Depth Knowledge of the Field of Study:
A comprehensive and well-founded knowledge of the field of study.
An understanding of how other disciplines relate to the field of study.
The ability to collect, analyse, and organise information and ideas, and to convey those ideas clearly and fluently, in both written and spoken forms.

The ability to select and use the appropriate level, style and means of communication.

Independence and Creativity:
The ability to work and learn independently.
The ability to identify problems, create solutions, innovate and improve current practices.

Critical Judgement:
The ability to define and analyse problems.
The ability to apply critical reasoning to issues through independent thought and informed judgement.
The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.

For more information on the University policy on development of graduate attributes in courses, refer to the web http://www.uq.edu.au/hupp/contents/view.asp?s1 = 3&s2 = 20&s3 = 5.

Teaching and Learning Methods:
(1) Come to lectures and take notes.
(2) Do the assignments and study the lecture notes.
(3) Come to Tutorials and ask questions on matters which interest or puzzle you (relating to the course).

There will be no formal printed lecture notes for the course.

MATH3401 ASSESSMENT CRITERIA:

Work will be marked for accuracy, appropriateness of mathematical techniques and clarity of presentation, as demonstrated by examples presented in lectures and tutorials.

- To earn a Grade of 7, a student would normally achieve a final mark of 85–100% and demonstrate an excellent understanding of the course material. This includes clear expression of nearly all their deductions and explanations, the use of appropriate and efficient mathematical techniques and accurate answers to nearly all questions and tasks with appropriate justification. They will be able to apply mathematical techniques to completely solve both theoretical and practical problems.

- To earn a Grade of 6, a student would normally achieve a final mark of 75–84% and demonstrate a comprehensive understanding of the course material. This includes clear expression of most of their deductions and explanations, the general use of appropriate and efficient mathematical techniques and accurate answers to most questions and tasks with appropriate justification. They will be able to apply mathematical techniques to partially solve both theoretical and practical problems.

- To earn a Grade of 5, a student would normally achieve a final mark of 65–74% and demonstrate an adequate understanding of the course material. This includes clear expression of some of their deductions and explanations, the use of appropriate and efficient mathematical techniques in some situations and accurate answers to some questions and tasks with appropriate justification. They will be able to apply mathematical techniques to solve fundamental problems.

- To earn a Grade of 4, a student would normally achieve a final mark of 50–64% and demonstrate an understanding of the basic concepts in the course material. This includes occasionally expressing their deductions and explanations clearly, the occasional use of appropriate and efficient mathematical techniques and accurate answers to a few questions and tasks with appropriate justification. They will have demonstrated knowledge of techniques used to solve problems and applied this knowledge in some cases.

- To earn a Grade of 3, a student would normally achieve a final mark of 45–49% and demonstrated some knowledge of the basic concepts in the course material. This includes occasional expression of their deductions and explanations, the use of a few appropriate and efficient mathematical techniques and attempts to answer a few questions and tasks accurately and with appropriate justification. They will have demonstrated knowledge of techniques used to solve problems.

- To earn a Grade of 2, a student would normally achieve a final mark of 20–44% and demonstrate some knowledge of the basic concepts in the course material. This includes attempts at expressing their deductions and explanations and attempts to answer a few questions accurately.

- To earn a Grade of 1, a student would normally achieve a final mark between 0–19%, demonstrating an extremely poor knowledge of the basic concepts in the course material. This includes possible attempts at answering some questions but showing an extremely poor understanding of the key concepts.