**School of Mathematics**

**Course 414 — Complex Analysis**                                        2003–04
(Optional JS & SS Mathematics, SS Two-subject Moderatorship )

**Lecturer:** Dr. Richard M. Timoney

**Requirements/prerequisites:** 221

**Duration:** 21 weeks.

**Number of lectures per week:** 3

**Assessment:** Regular assignments.

**End-of-year Examination:** One 3-hour examination

**Description:**

1. Review of the definition of analytic functions, the Cauchy-Riemann equations, differentiation of power series, and contour integrals. Various forms of Cauchy's theorem and the Cauchy integral formula; winding numbers and homotopy.

2. Logarithms, simple connectedness and antiderivatives.

3. Identity theorem for analytic functions, maximum modulus theorem.

4. Open mapping theorem, argument principle, inverses of analytic functions and Rouché's theorem. Removable singularities, Casorati-Weierstrass theorem, Residue theorem.

5. Metric space structures on $H(G)$ and $C(G)$. Boundedness and compactness in $H(G)$.

6. Normal families; metric space structure of $M(G)$.

7. Hurwitz's theorem, the Schwarz lemma, the Riemann mapping theorem.

8. Iteration (dynamics) of complex polynomial functions. Julia set, Fatou set, fixed points, complete invariance of Fatou and Julia sets.

Further detailed information about the course will become available via the web site for the course at `http://www.maths.tcd.ie/~richardt/414`
**Objectives:** This course will build on material covered in 221. Initially it will cover some familiar material in greater detail and then continue on to cover basic material in complex analysis. Some functional analytic techniques will be developed and applied to prove results in complex analysis.
**Textbooks:**

[1] L. V. Ahlfors, *Complex Analysis,* Third Edition, McGraw-Hill, New York, 1978.

[2] John B. Conway, *Functions of One Complex Variable,* Second Edition, Graduate Texts in Mathematics 11, Springer-Verlag, New York, 1978.

[3] Reinhold Remmert, *Theory of Complex Functions,* Graduate Texts in Mathematics 122, Springer-Verlag, New York, 1991.

[4] W. Rudin, *Real and Complex Analysis,* Second Edition, McGraw-Hill, New York, 1974.

April 28, 2003