

Syllabus for MAA 5406 Complex Analysis, Class # 18057, Spring 2012

Book: G. Jones and D. Singerman “Complex Functions: an Algebraic and Geometric Viewpoint”; Cambridge University Press, 1987, ISBN 0-521-30893-3.

This is a graduate course on functions of one complex variable. As the title of the course book suggests, the course will be emphasizing on the algebraic and geometric nature of those functions. Starting in the middle of 19th Century with the work of Abel, Riemann, Weierstrass, Klein, Mobius, Hurwitz, Fuchs and others, it became clear that the complex analytic functions can be naturally associated with geometric objects (Riemann surfaces) which in turn have rich algebraic properties. The Riemann surfaces, introduced by B. Riemann in his doctoral dissertation *Foundations of a General Theory of Functions of a Complex Variable* in 1857, are built out of plane regions (open non-empty path-connected subset of the complex plane), and the properties of these surfaces are studied by using those regions. But knowing only these local patches well is not enough: one needs to “glue” them into a Riemann surface in order to study thoroughly the properties of the functions. Here is a related quote taken from H. Weyl’s book *The Concept of a Riemann Surface* published in 1913:

... Riemann surfaces are not merely a device for visualizing the many-valuedness of analytic functions, but rather an indispensable essential component of the theory; not a supplement, more or less artificially distilled from the functions, but their native land, the only soil on which the functions grow and thrive.

All analytical considerations in the course will be motivated by a deeper understanding of the algebra and geometry related to the analytic functions. This is a bit non-traditional approach, but provides a direct pathway to the modern Mathematics (and Physics). The course can be considered also as a gentle introduction to the Differential and Algebraic Geometry over the field of complex numbers.

The course begins with a quick review of the needed concepts and facts from the undergraduate course Complex Variable. These facts can be found in Appendix 1 at the end of the book. The sections from the main body of the book which we will cover are as follows 1.1-1.5, 2.1-2.5, 3.1-3.15, and 4.1-4.14.

Grading policy: The progress of the students in the course will be monitored through Homework Assignments and Participation in class.

Remark: The Instructors reserves the right to make academically acceptable changes in the content of the course if need be.