

MAT 542: COMPLEX ANALYSIS I
OFFICIAL SYLLBUS

- (1) The field of complex numbers, geometric representation of complex numbers
- (2) Analytic functions
 - Definition, Cauchy-Riemann equations
 - Elementary theory of power series, uniform convergence
 - Elementary functions: rational, exponential and trigonometric functions
 - The logarithm
- (3) Analytic functions as mappings
 - Conformality
 - Linear fractional transformations
 - Elementary conformal mappings
- (4) Complex integration
 - Line integrals and Cauchy's theorem for disk and rectangle
 - Cauchy's integral formula
 - Cauchy's inequalities
 - Morera's theorem, Liouville's theorem and fundamental theorem of algebra
 - The general form of Cauchy's theorem
- (5) Local properties of analytic functions
 - Removable singularities, Taylor's theorem
 - Zeros and poles, classification of isolated singularities
 - The local mapping theorem
 - The maximum modulus principle, Schwarz's lemma
- (6) The calculus of residues
 - The residue theorem
 - The argument principle
 - Rouché's theorem
 - Evaluation of definite integrals
- (7) Power series
 - Weierstrass theorem
 - The Taylor and Laurent series
 - Partial fractions and infinite products
 - Normal families
- (8) The Riemann mapping theorem
- (9) Harmonic functions
 - The mean-value property
 - Harnack's inequality
 - The Dirichlet problem

REFERENCES

- [A] Ahlfors, L., *Complex analysis. An introduction to the theory of analytic functions of one complex variable*. Third edition. International Series in Pure and Applied Mathematics. McGraw-Hill Book Co., New York, 1978. xi+331 pp.
- [BG] Berenstain, C.; Gay, R., *Complex variables. An introduction*. Graduate Texts in Mathematics, 125. Springer-Verlag, New York, 1991. xii+650 pp.
- [C] Conway, J., *Functions of one complex variable. Second edition*. Graduate Texts in Mathematics, 11. Springer-Verlag, New York-Berlin, 1978. xiii+317 pp.

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