UNIVERSITY OF CRAIOVA
Faculty of Mathematics and Natural Sciences
Department of mathematics
Fundamental domain : Mathematics
Specialization: Mathematics
Education form: full time
Duration of studies : 3 years
Academic year : 2013-2014

Subject : ***Complex Analysis***
Code: M2304
Instructor : Lect.dr. Monica Roşiu
Number of credits : 5
Year/Semester : Year II, Semester I
Number of hours/week : 2 Classes + 2 Seminar classes
Number of weeks : 14
Type discipline: Fundamental
Objectives: The presentation of fundamentals results of complex analysis and related topics
Content :

1. **Preliminaries to Complex Analysis (2 courses)**
   1.1.Complex numbers and the complex plane
   1.2.Topology of **C** and $\overline{C}$. Connectedness. Sequences and completeness. Compactness. Uniform convergence
   1.3.Elementary functions. Mobius transformations. The exponential function. The trigonometric and hyperbolic functions. The logarithmic function. Complex powers and inverse trigonometric functions
2. **Differential calculus in the Complex Plane (2 courses)**
   2.1.Continuity
   2.2.C-diferentiability. Complex derivatives.The Cauchy-Riemann differential equations. Derivability. Olomorphy.
   2.3.Harmonic functions
3. **Integral calculus in the Complex plane (Cauchy's theory) (4 courses)**
   3.1.Complex line integrals. Properties. Fundamental Theorem of Calculus for contour integrales.
   3.2.Independence of path
   3.3.Goursat's theorem
   3.4.Homotopy and simple connectivity
   3.5.Cauchy's theorem
   3.6.Winding number
   3.7.Cauchy's integral formula
   3.8.Further applications: Cauchy's inequalities. Liouville's theorem. Morera's theorem
   3.9.Maximus modulus theorem. Schwarz lemma.
4. **Sequences and Series of holomorphic functions (4 courses)**

4.1.Uniform approximation
4.2.Power series
4.3.Taylor's theorem
4.4.Laurent's series
4.5.Classification of singularities. Casorati-Weierstrass theorem

5. **Residue theory and its Applications (2 courses)**
   5.1.The residue theorem
   5.2.Trigonometric integrals over $[0,2\pi]$
   5.3.Improper integrals of certain functions over $(-\infty,\infty)$
   5.4.Improper integrals involving trigomnometric functions
   5.5.Integrals involving multiple-valued functions
   5.6.The Argument Principle

Bibliography :

1. Ahlfors L. , *Complex analysis*, McGraw-Hill Book Company, New York, 1976.
2. Marsden J., Hoffman M., *Basic complex analysis*, W. H. Freeman and Company, 1987.
3. Nevanlinna R., Paatero V., *Introduction to Complex Analysis*, Birkhäuser Verlag Basel,1964.
4. Roşiu M., Kessler P., *Culegere de probleme şi exerciţii de analiză complexă*, Editura Universitaria, Craiova, 2005.
5. Rudin W. , *Real and complex analysis*, McGraw-Hill Book Company, New York, 1966.
6. Stoilow S., *Teoria funcţiilor de o variabilă complexă*, Ed. Academiei, Bucureşti, 1954-58.

Working language : Romanian
Evaluation : Exam (partial exam)
Evaluation mode : Written examination