Syllabus

I. **Course Name**: Complex Analysis-II

II. **Course description and objective**

III. The main objectives of the discipline are to teach students the theoretical basics and methods of complex analysis and to apply these methods in other mathematical disciplines.

IV. **Compulsory**

V. **Master Program, 2st Term, 64 Hours, 5 Credits**

VI. **Course content**

Section 1. Fundamentals of Complex Analysis - I

1. Functions of complex variable, derivative.

2. The Cauchy theorem, the Cauchy formula.

3. Weierstrass theorem and power series.

4. Zeros of holomorphic functions and their properties.

5. Isolated singularities and residuals.

Section 2. Holomorphic and entire functions

Theme 2. The order of growth of integer functions and their zeros

1. The order and type of entire functions

2. Connection of growth with the coefficients of the power series.

3. Jensen's theorem.

4. The order and type of the sequence of zeros, the class of convergence of the sequence of zeros.

5. Adamar's theorem.

Theme 3. Entire functions of the exponential growth

1. Lindeleph's theorem for exponential growth functions.

2. Necessary and sufficient conditions for zeros of exponential growth functions.

Theme 4. Fragman-Lindeleph theorems

1. Generalized maximum principle.

2. Fragman-Lindeleph theorems for angle.

3. Fragman-Lindeleph theorems for a strip.

4. Fragman-Lindeleph theorems for half-plane.

Section 3. Complex analysis theorems and their applications

Theme 5. The Wiener-Peli theorem

1. Formulation of the theorem and its discussion.

2. Proof of the Theorem.

3. Consequences.

Theme 6. The Riemann Theorem on conformal mapping

1. Compact families of holomorphic functions. Montel's Theorem.

2. Formulation of the Riemann theorem.

3. Proof of the Riemann theorem.

Theme 7. The Kotelnikov theorem

1. The auxiliary lemma.

2. Proving the Kotelnikov formula.

3. Uniqueness.

Section 4. Boundary value problems of function theory

Theme 8. The Cauchy integral

1. A special integral of the Cauchy type.

2. Sochotsky's formulas.

3. The conditions under which the function has an analytical extension to the region from its boundary.

Theme 9. The Hilbert-Privalov Problem

1. The case of a homogeneous problem with zero index

2. The case of a homogeneous problem with a nonzero index

3. Nonhomogeneous problem

4. The Riemann-Hilbert problem.

VI. Pre-taken courses

Complex Analysis, Functional Analysis, Measure Theory and Integration

VII. Form of the final test: examination (four-level evaluation scale)

VIII. Teaching materials and reference books

Basic Literature

1. B.V.Shabat. Introduction to complex analysis. V.1, M., "Science", 1985 (Russian).
3. M.A. Lavrentiev, B.V. Shabat. Methods of the theory of functions of a complex variable. M., "Science", 1973 (Russian).
4. P.Koosis. The logatithmic integral, p.1.Cambridge University Press, 1988.

Additional literature

1 E.C. Titchmarsh The Theory of Functions Oxford University Press 1939

2. L. Alfors. Complex analysis. N.J., “Kluver”, 1981.

3. B.Levin.Distribution of values of entire functions. (Translations of mathematical monographs), AMS, 1964

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