**DSE3-N II Metric Spaces and Complex Analysis**

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**Semester 6**

# Objectives

1. To introduce students to elementary complex functions such as exponential, logarithmic, and trigonometric functions and their properties.
2. To develop understanding of integration in complex analysis, including contour integrals, Cauchy-related theorems, and analytic functions.
3. To familiarize students with series expansions and complex analysis concepts such as convergence, residues, poles, and their applications.

# Expected Outcomes

1. Students will be able to understand and apply elementary complex functions including exponential, logarithmic, and trigonometric functions.
2. Students will gain the ability to evaluate contour integrals and understand fundamental theorems in complex integration.
3. Students will be able to analyze series expansions and identify singular points, residues, and poles in complex functions.

**Unit 6: Elementary Functions**
6.1 The Exponential functions
6.2 The Logarithmic function, Branches and derivatives of logarithms, Some identities involving logarithms
6.3 Complex exponents, Trigonometric functions

**Unit 7: Integrals**
7.1 Derivatives of functions, Definite integrals of functions
7.2 Contours, Contour integral, Examples
7.3 Upper bounds for Moduli of contour integrals, Anti-derivatives (Only Examples)
7.4 Cauchy-Goursat Theorem (without proof), Simply and multiply Connected domains, Cauchy integral formula, Derivatives of analytic functions, Liouville's Theorem and Fundamental Theorem of Algebra (Without Proof)

**Unit 8: Series**
8.1 Convergence of sequences and series (Theorems without proof)
8.2 Taylor's series (without proof), Laurent series (without proof), examples only

**Unit 9: Residues and Poles**
9.1 Isolated singular points, Residues
9.2 Cauchy residue theorem (Without Proof), residue at infinity, types of isolated singular points, residues at poles
9.3 Zeros of analytic functions, zeros and poles