

UNIVERSITY OF MADRAS
B.Sc. DEGREE PROGRAMME IN MATHEMATICS
 SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Course		COMPLEX ANALYSIS (Common to B.Sc Maths with Computer Applications)					
Paper Number		CORE M14					
Category	Core	Year	III	Credits	4	Course Code	334C6B
		Semester	VI				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		12th Standard Mathematics					
Objectives of the Course		<ul style="list-style-type: none"> • Apply concept and consequences of analyticity and C-R equations. • Understand the concept of mappings and transformations. • Compute complex contour integrals and applying Cauchy's integral in various versions. • Understand zeros and singularities of an analytic function, apply their properties in the evaluation of definite integral. 					
Course Outline		<p>UNIT-I: Analytic functions: Functions of a Complex variable –Limits –Theorem on limits –Continuity – Derivatives – Differentiation formulas – Cauchy Riemann equation – Sufficient conditions for differentiability – Polar coordinates– Analytic functions– Examples– Harmonic functions. Hours: 15</p> <p>Chapter 2- Sections- 11- 25 (Omit Sections 12, 13 and 16)</p>					
		<p>UNIT-II: Mappings – Mapping with exponential function – Linear transformation – The transformation $w = \frac{1}{z}$ – Mappings by $z \mapsto \frac{az+b}{cz+d}$ – Linear fractional transformations (bilinear) - An Implicit form.</p> <p>Chapter 2- Sections: 12, 13 Hours: 15</p> <p>Chapter 8- Sections: 83-87</p>					
		<p>UNIT-III: Complex Integration: Contour integrals–Examples – Simply and Multiply connected domains– Cauchy integral formula –Derivatives of Analytic Functions– Liouville's theorem and Fundamental theorem of Algebra– Maximum modulus principle.</p> <p>Chapter 4- Sections- 39, 40, 46-50. Hours:15</p>					

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	<p>UNIT – IV: Sequences and Series: Convergence of sequences – Convergence of series– Taylor series –Examples- Laurent series– Examples- Absolute and uniform convergence of power Series</p> <p>Chapter 5- Sections: 51-57. Hours:15</p> <p>UNIT-V: Residues and Poles:– Residues – Cauchy Residue theorem – The three types of isolated singular points – Residues at poles- Examples – Zeros of analytical functions – Zeros and poles – Evaluation of Improper Integrals.</p> <p>Chapter 6- Sections: 62-69 (omit Section 64) Hours: 15</p> <p>Chapter 7 – Section 71.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Total Hours: 75
Skills acquired from this course	<p>Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved</p> <p>(To be discussed during the Tutorial hour)</p>
Skills acquired from this course	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
Recommended Text	<p>Complex variables and application, Seventh Edition by James Ward Brown and Ruel V. Churchill, Mc-Graw Hill Book Co., International Edition, 2009.</p>
Reference Books	<ol style="list-style-type: none"> 1. Theodore W. Gamelan, Complex Analysis, Springer Verlag, 2008 2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997. 3. Richard A. Silverman, Introductory Complex Analysis. Dover Publications, 1972. 4. S. Ponnusamy and H. Silverman, Complex variables with applications, Birkhauser, 2006.
Website and e-Learning Source	<p>https://nptel.ac.in</p> <p>https://www.mathhelp.com/</p>

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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain about analytic functions, their differentiation and continuity and to verify the Harmonic functions using analyticity conditions

CLO 2: Explain the concept of Conformal mappings and mappings by linear transformations and linear fractional transformations

CLO 3: Explain about the integrations of functions over simply and multiply connected domains and to derive the Cauchy integral formula, Liouville's theorem, Fundamental theorem of Algebra and Maximum Module Principle

CLO 4: Find the convergence the sequences and series, to derive Taylor's and Laurent's series

CLO 5: Find the nature of singularities, to find the residue of a given function at a given singular point, to Explain about zeros and poles and to evaluate real improper integrals (Excluding poles on the real axis)

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO 1	3	3	3	2	1	-	3	3	2
CLO 2	3	3	3	2	1	-	3	3	2
CLO 3	3	3	3	2	1	-	3	3	2
CLO 4	3	3	3	2	1	-	3	3	2
CLO 5	3	3	3	2	1	-	3	3	2