



Lahore University of Management Sciences

Math-300 COMPLEX VARIABLES

Course Outline (Tentative)

Fall 2023-2024

Instructor	Masood H. Shah
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Office Hours	11:00am – 01:00pm, Tuesday and Thursday
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Course URL (if any)	Lms.lums.edu.pk

Course Basics				
Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	75 minutes
Recitation/Lab (per week)	Nbr of Lec(s) Per Week	TBA	Duration	
Tutorial (per week)	Nbr of Lec(s) Per Week	TBA	Duration	

Course Distribution	
Core	
Elective	Elective
Open for Student Category	All
Close for Student Category	None

COURSE DESCRIPTION
<p>This course is an introduction to the functions of a complex variable. Topics include the complex number system, Cauchy-Riemann equations, analytic functions and their properties, special analytic functions including exponential, logarithm, trigonometric and hyperbolic functions of a complex variable, complex integration and contour integrals, Cauchy-Goursat theorem, Cauchy's integral formula, Taylor series and Laurent series, the calculus of residues, improper integrals, conformal mappings, and some applications of harmonic functions.</p>

COURSE PREREQUISITE(S)	
<ul style="list-style-type: none">•••	Math 205 (Introduction to (Real) Analysis - I)

COURSE OBJECTIVES	
<ul style="list-style-type: none">•	To learn about the Algebra of complex field \mathbb{C} and the Calculus(analysis) of complex-valued functions with domain as a subset of the complex plane \mathbb{C} .



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Learning Outcomes	
•	Ability to evaluate line integrals in the plane depending on the nature of the integrand. To derive and manipulate power series for complex functions.

Grading Breakup and Policy	
•	Quizzes: 20%
•	Mid-Term: 30%
•	Final Exam: 50%

Examination Detail	
Midterm Exam	Yes/No: Yes Combine Separate: Duration: 1hr 30min Preferred Date: Exam Specifications
Final Exam	Yes/No: Yes Combine Separate: Duration: 2 hours Exam Specifications: closed book, no calculators, no notes.

COURSE OVERVIEW			
(Tentative)Week/ Lecture/ Module	Topics	Recommended Readings	Objectives/ Application
1	Algebra of complex numbers		
2	Geometry of complex numbers		
3	Functions and linear mappings		
4	The mappings and		
5	Limits and continuity		
6	Branches of functions		
7	The reciprocal transformation		
8	Differentiable and analytic functions		
9	The Cauchy - Riemann equations		



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10	Harmonic functions		
11	Geometric series and convergence tests		
12	Power series functions		
13	Complex exponential function		
14	Complex logarithm and complex exponents		
15	Trigonometric, hyperbolic		
16	Inverse trigonometric and hyperbolic functions		
17	Contours and Contour integrals		
18	Cauchy-Goursat theorem		
19	Fundamental theorems of integration		
20	Cauchy's integral formula.		
21	Taylor series		
22	Laurent series		
23	Zeros and poles		
24	Residue theorem and calculation of residues		
25	Trigonometric integrals		
26	Improper integrals of rational functions		
27	Improper integrals involving trigonometric functions		
28	Indented contour integrals		
29	Integrands with branch points		
30	The Argument's principle and the Rouché's theorem		
31	Conformal mappings		
32	Applications of harmonic functions		

Textbook(s)/Supplementary Readings

Text:

- 1) Complex Variables and Applications, 9th edition, by J.W. Brown and R. V. Churchill, McGraw-Hill Education, 2013.
- 2) A First Course in Complex Analysis with Applications, by Dennis G. Zill and Patrick D. Shanahan, by Jones and Bartlett Publishers, Inc, 2003.

Reference: Mathematical Methods in the Physical Sciences, M. Boas