King Fahd University of Petroleum and Minerals
Department of Mathematics
SYLLABUS, Semester I, 2025-2026(251)
(Dr. Izhar Ahmad, drizhar@kfupm.edu.sa)

Course #: Math 533
Title: Complex Variables
Textbook: Complex Analysis by Lars V. Ahlfors (Third Edition)

Course description: Analytic functions. Cauchy's theorem and consequences. Singularities and expansion theorems. Maximum modulus principle. Residue theorem and its application. Compactness and convergence in spaces of analytic functions. Weierstrass's and Mittag-Leffler representation theorems. Elementary conformal mappings

Objectives:

1. Demonstrate accurate and efficient use of complex analysis techniques.
2. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from complex analysis.

Course Learning Outcomes: Upon successful completion of this course, a student should be able to:

1. Discuss basic concepts of complex analysis
2. Prove basic results in complex analysis
3. Apply the methods of complex analysis to evaluate definite integrals and infinite series
4. Explain how different theorems and concepts are connected and deduce relationships from the given theorems.

Wk	Chapters	Material
1	Chapter 1,2	The Algebra of Complex Numbers. Concept of Analytic Functions: Limits Continuity-Analyticity
2	Chapter 2	The Cauchy-Riemann Equations, Harmonic functions
3		The Exponential, Trigonometric and Logarithmic Functions.
4	Chapter 4	Fundamental Theorems
5		Cauchy's Integral Formula
6		Local Properties of Analytical Functions
7		General Form of Cauchy' Theorem
8		Calculus of Residues
9		Harmonic Functions
10	Chapter 5	Power Series Expansions
11		Partial Fraction and Factorization
12	Chapter 3	Linear Transformations
13	Chapter 6	Conformal Mapping. Dirichlet's Problem
14-15	Presentations	

Evaluation Policy: Assignments: 10%, Presentation: 5%, Exam-01: 25%, Exam -02: 25%, Final Exam: 35%.

References:

1. Conway, *Functions of One Complex Variable,* 2nd ed., Springer-Verlag, 1978
2. Ponnusamy and Silvermann, *Complex Variables with applications*, Birkhauser 2006
3. R.E. Greene, S.G. Krantz, *Function Theory of One Complex Variable*, AMS, 2001.
4. Elias M. Stein and R. Shakarchi, *Complex Analysis*, Princeton University Press, 2003