King Fahd University of Petroleum and Minerals
Department of Mathematics

Math 445 : *Introduction to Complex Variables*
Term-221
Dr. Adel Khalfallah

Textbook: E.B. Saff, A.D. Snider, *Fundamentals of Complex Analysis* (3rd ed.).

The Course Content: Complex numbers, Analytic functions, Harmonic functions and Harmonic conjugates, Cauchy's theorem and Cauchy integral formulas, Power series, Laurent series, Isolated singularities, Residues, Applications of the residue theorem to real integrals, Conformal transformations

The Course Learning Outcomes: Upon the completion of the coursework, Students are expected to be able to

1. Explain the geometry of the complex plane
2. State the main properties and examples of analytic functions.
3. Evaluate line integrals using parameterization
4. Compute the Taylor and Laurent expansions of standard functions.
5. Determine the nature of singularities and calculate residues.
6. Use Residue Theorem to evaluate integrals and series.
7. State main properties of conformal mappings.

Grading policy:

Homework: **15%**,	Presentations-projects **10** %
Exam 1, 2: **20 %** each	Final Exam (Comprehensive): **35**%

Homework:

Section-wise Homework Problems will be posted on the KFUPM Black Board. Students are advised to solve HW problems after the completion of relevant Text section.

Attendance:

A **DN *grade*** will be given to all students as soon as a student accumulates ***9*** unexcused ***absences.***

Wk	Date	Section	Topics
1	28 Aug – 1 Sep	1.1 1.2 1.3	The algebra of complex numbers Representation of complex numbers Vectors and Polar Forms
2	4 Sep – 8 Sep	1.4 1.5	The Complex Exponential Powers and Roots
3	11 Sep – 15 Sep	1.6 1.7	Planar Sets The Riemann Sphere
4	18 Sep – 21 Sep	2.1 2.2	Functions of a Complex Variable Limits and Continuity
5	25 Sep – 29 Sep	2.3 2.4 2.5	Analyticity The Cauchy-Riemann Equations Harmonic Functions
6	2 Oct – 6 Oct	3.1 3.2 3.3	Polynomial & Rational Functions Exp. & Trig. Functions. The Logarithmic Function.
7	09 Oct – 13 Oct	3.5 4.1 4.2	Power and Inverse Trig. Functions Contours Contour Integrals
8	16 Oct – 20 Oct	4.3 4.4	Independence of Path Cauchy's Integral Theorem
9	23 Oct – 27 Oct	4.5 4.6	Cauchy Formula & Consequences Bounds for Higher Derivatives
10	30 Oct – 3 Nov	5.1 5.4 5.2	Sequences and Series Convergence Taylor Sequences
11	6 Nov – 10 Nov	5.3 5.5	Power Sequences Laurent Series
12	13 Nov – 17 Nov	5.6 5.7 6.1	Zeros and Singularities The Point at Infinity The Residue Theorem
13	20 Nov – 24 Nov	6.3 6.2 6.4	Improper Integrals over R Trig. integrals over $[0,2\pi]$ Improper Integrals with Trig. Func.
14	4 Dec – 8 Dec	6.7	Rouche's Theorem
15	11 Dec – 15 Dec		Review of the material