

**King Fahd University of Petroleum and Minerals**  
**Department of Mathematics & Statistics**  
**Math- 445** (*Introduction to Complex Variables*)  
**2018-2019 (T-182)**  
**Instructor: Dr. Izhar Ahmad**

**Textbook:** E.B. Saff, A.D. Snider, *Fundamentals of Complex Analysis* (3rd ed.), Pearson Ltd, 2014.

**Prerequisites:** Familiarity with the concepts from MATH 101, Math 102 & Math 201 will help the students to follow the course easily, e.g.,

*polar coordinates in  $\mathbb{R}^2$ ,*  
*chain rule,*  
*Arc length,*  
*Taylor series,*

*partial derivatives,*  
*level curves and gradients,*  
*convergence criteria for sequences and series,*  
*directional derivatives*

### **Learning Outcomes**

Upon completion of this course, students should be able to

- Explain the geometry of the complex plane
- Explain the main properties and examples of analytic functions;
- Explain the relationship between complex function theory and the theory of functions of a real variable
- Compute line integrals using parameterization of path
- Compute the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues;
- Use Residue Theorem to evaluate integrals and series.
- Explain conformal mappings.

## Policies

### Grading policy:

Homework: 15 %,

Computer-based HW: 4 %

Exam 1, 2, 3: 17 % each

Final Exam (Comprehensive): 30%

### 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. The only way to *learn* the course material is to *attempt* the HW problems with self-effort.

The homework assignments *will be collected* on the due date *in the class*. Late homework will be accepted with a **25% reduction** of points *for each day of delay*.

If you plan to miss the class, drop the homework in my office prior to the due date.

### Copying/Cheating

Students are advised to refrain from copying the HW solution or cheating in the exams. Copying/cheating cases will be dealt with strictly according to the KFUPM policy

### Attendance:

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

**[Official Excuse for any absence must be stamped either from the KFUPM Clinic or the Deanship of Student Affairs]**

### Missing an Exam:

If a student misses an Exam due to a legitimate reason (medical emergency etc.), he must present an official excuse as early as possible. The make-up exam will be given within 10 days from the exam date.

### Guidance/Additional Help:

The students are welcomed to visit my office to seek guidance on the course material, homework and study habits. To discuss a homework problem, the student must come up with the partial solution/attempt.

### Office Hrs:

UTR: 9.05 am-9.45 am & 11.00am-12.10pm. Also by appointment

### Contact me

Off. Ph: 7767, e-mail: [drizhar@kfupm.edu.sa](mailto:drizhar@kfupm.edu.sa), WhatsApp:0551374781 (No mob calls please)

**Office Location:** Bld. 5, R. 327,

### Pace of coverage

Wk	Date	Section	Topics	HW*
1	Jan.06-10	1.1 1.2 1.3	The algebra of complex numbers Representation of complex numbers Vectors and Polar Forms	
2	Jan 13-17	1.4 1.5	The Complex Exponential Powers and Roots	1: Sec. 1.1-1.3
3	Jan 20-24	1.6 2.1	Planar Sets Functions of a Complex Variable	
4	Jan 27-31	2.2 2.3	Limits and Continuity Analyticity	2: Sec. 1.4-1.6
5	Feb 03-07	2.4 2.5 3.1	The Cauchy-Riemann Equations Harmonic Functions Polynomial & Rational Functions	3: Sec. 2.1-2.3
<b>Exam 1: Feb 04 (1.1-2.3)</b>				
6	Feb 10-14	3.2 3.3 3.5	Exp., Trig. & Hyperbolic Functions The Logarithmic Function. Complex Powers & Inverse Trig.Fun.	4. Sec.2.4-3.1
7	Feb 17-21	4.1 4.2 4.3	Contours Contour Integrals Independence of Path	
8	Feb 24-28	4.4 4.5	Cauchy's Integral Theorem Cauchy's Formula and Consequences	5: Sec. 3.2-4.3
9	Mar 03-07	4.6 5.1	Bounds for Analytic Functions Sequences and Series	6(i): Sec. 4.4-4.5
<b>Exam 2: March 07 (2.3-4.4)</b>				
10	Mar 10-14	5.4 5.2 5.3	Convergence Taylor Series Power Series	6(ii): Sec. 4.6-5.1
11	Mar 17-21	5.5 5.6	Laurent Series Zeros and Singularities	7: Sec 5.2-5.3
12	Mar 24-28	5.7 6.1 6.3	The Point at Infinity The Residue Theorem Improper Integrals over $\mathbb{R}$	8: Sec. 5.5-5.6
13	Mar 31-Apr04	6.2 6.4 6.7	Trig. integrals over $[0,2\pi]$ Improper Integrals Involving Trig. Functions Rouche's Theorem and Fundamental Theorem of Algebra	9: Sec. 5.7-6.3
<b>Exam 3: Apr 01 (4.5-6.1)</b>				
14	Apr 7-11	7.1 7.3 7.4	Invariance of Laplace's Equation Mobius Transformations Mobius Transformations Continued	10: Sec. 6.4-6.7
15	Apr 14-18		Review of the material	

**Final Exam: April 30 , 2019 (8.00AM)**

Section-wise Homework Problems will be posted on the Black Board 9.1.