

**King Fahd University of Petroleum and Minerals**  
**Department of Mathematics & Statistics**  
**Math- 430** (*Introduction to Complex Variables*)  
**2017-2018 (T-172)**  
**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: 11.00 am-11.50 am. 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. 21-25     | 1.1<br>1.2<br>1.3 | The algebra of complex numbers<br>Representation of complex numbers<br>Vectors and Polar Forms  |                     |
| 2                                 | Jan 28-Feb 01  | 1.4<br>1.5        | The Complex Exponential<br>Powers and Roots   | 1: Sec. 1.1-1.3     |
| 3                                 | Feb 04-08      | 1.6<br>2.1        | Planar Sets<br>Functions of a Complex Variable  |                     |
| 4                                 | Feb 11-15      | 2.2<br>2.3        | Limits and Continuity<br>Analyticity  | 2: Sec. 1.4-1.6     |
| 5                                 | Feb 18-22      | 2.4<br>2.5<br>3.1 | The Cauchy-Riemann Equations<br>Harmonic Functions<br>Polynomial & Rational Functions   | 3: Sec. 2.1-2.3     |
| <b>Exam 1: Feb 17(1.1-2.3)</b>    |                |                   |   |                     |
| 6                                 | Feb 25-Mar.01  | 3.2<br>3.3<br>3.5 | Exp., Trig. & Huperbolic Functions<br>The Logarithmic Function.<br>Complex Powers & Inverse Trig.Fun.                                       | 4. Sec.2.4-3.1      |
| 7                                 | Mar 04-Mar 08  | 4.1<br>4.2<br>4.3 | Contours<br>Contour Integrals<br>Independence of Path   |                     |
| 8                                 | Mar 11-15      | 4.4<br>4.5        | Cauchy's Integral Theorem<br>Cauchy's Formula and Consequences  | 5: Sec. 3.2-4.3     |
| 9                                 | Mar 18-22      | 4.6<br>5.1        | Bounds for Analytic Functions<br>Sequences and Series   | 6(i): Sec. 4.4-4.5  |
| <b>Exam 2: March 15 (2.3-4.4)</b> |                |                   |   |                     |
| 10                                | Mar 25-29      | 5.4<br>5.2<br>5.3 | Convergence<br>Taylor Series<br>Power Series  | 6(ii): Sec. 4.6-5.1 |
| 11                                | Apr 01-05      | 5.5<br>5.6        | Laurent Series<br>Zeros and Singularities   | 7: Sec 5.2-5.4      |
| 12                                | Apr 08-12      | 5.7<br>6.1<br>6.3 | The Point at Infinity<br>The Residue Theorem<br>Improper Integrals over $\mathbb{R}$  | 8: Sec. 5.5-5.6     |
| 13                                | Apr 15-19      | 6.2<br>6.4<br>6.7 | Trig. integrals over $[0,2\pi]$<br>Improper Integrals Involving Trig.<br>Funtions<br>Rouche's Theorem and Fundamental<br>Theorem of Algebra | 9: Sec. 5.7-6.3     |
| <b>Exam 3: Apr 10 (4.5-6.1)</b>   |                |                   |   |                     |
| 14                                | Apr 22-26      | 7.1<br>7.3<br>7.4 | Invariance of Laplace's Equation<br>Mobius Transformations<br>Mobius Transformations Continued  | 10: Sec. 6.4-6.7    |
| 15                                | Apr. 29-May 03 |                   | Review of the material  |                     |

**Final Exam: May 15 , 2018**

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