American University of Central Asia

Applied Mathematics and Informatics Department

Fall 2015

Syllabus - Complex Variables, MAT 326, ID 3699

Instructor		**Email**	**Office Hours**	**Phone**	**Office**
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Course ID	**Course Credits**	**Semester**	**Day and Time**	**Room**	**Lang.**
3699	3	Fall	Tu: 9.25	221	English

I. Course Description

Complex analysis is a core subject in pure and applied mathematics, as well as the physical and engineering sciences. While it is true that physical phenomena are given in terms of real numbers and real variables, it is often too difficult and sometimes not possible, to solve the algebraic and differential equations used to model these phenomena without introducing complex numbers and complex variables and applying the powerful techniques of complex analysis.

Complex variables is a beautiful area from a purely mathematical point of view, as well as a powerful tool for solving a wide array of applied problems. It is related to many mathematical disciplines, including in particular real analysis, differential equations, algebra and topology. The numerous applications include all kinds of wave propagation phenomena such as those occurring in electrodynamics, optics, fluid mechanics and quantum mechanics, diffusion problems such as heat and contaminant diffusion, engineering tasks such as the computation of buoyancy and resistance of wings, the flows in turbines and the design of optimal car bodies, and signal processing and communication theory.

II. Students Learning Objectives:

To develop in a rigorous and self contained manner the elements of complex variables and to furnish an introduction to applications and residues and conformal mappings.
Students will be able to :

- Effectively write mathematical solutions in a clear and concise manner.
- Effectively locate and use the information needed to prove theorems and establish mathematical results.
- Demonstrate the ability to integrate knowledge and ideas of complex differentiation and complex integration in a coherent and meaningful manner and use appropriate techniques for solving related problems and for establishing theoretical results.
- Demonstrate ability to think critically by proving mathematical conjectures and establishing theorems from complex analysis.
- In addition, students will be able to: operate with complex numbers, use the complex derivatives function, use and operate analytic functions, demonstrate knowledge of integration in the complex plane, use the Cauchy integral theorem and Cauchy integral formula, manipulate and use power series, understand residues and their use in integration, demonstrate the understanding of conformal mappings.

III. Course Policies

a. Students are expected to BE ON TIME for classes. If instructor marked the student absent in case that the student is late for the class, he is considered to be absent for the whole class, unless excused by instructor.

b. ATTENDANCE. Class attendance is required. If the student misses the class with an excuse, he shall provide necessary documents to prove it within a week after he/she missed a class. If the requirements mentioned above are not observed, student's absence

is considered to be unexcused. If a student missed over 15 classes, he/she will not be attested for the course.

c. WRITTEN ASSIGNMENTS must be submitted to instructor by the deadline. The student may submit assignment late: at the latest by the next day after the deadline before 5 pm, in that case 1 point will be deducted from the final grade for the work (e.g., if your grade is "A" for the work, after deduction, your grade will be "B"). ***This rule applies to any student who was aware or should have been aware of an assignment and the deadline no matter whether he was sick or had any other excuse on the date of a deadline***.

d. The student has to follow ACADEMIC HONESTY code. All types of cheating (plagiarism etc) **are strictly prohibited**. If a student fails to observe this requirement, instructor may give from an "F" for the work up to an "F" for the whole course depending on the type of assignment and other circumstances.

IV. Assessment

a. Grading will be based on following components:

Grades will be based on a total of 100 points, coming from**:**

Quiz 1	The lecturer sets day and time	10 points
Midterm Exam	October, xx, 2015 (The lecturer sets day and time)	30 points
Quiz 2	The lecturer sets day and time	10 points
Final Exam	December, xx, 2015 (The lecturer sets day and time)	40 points
Home works/ Activity	Every class	10 points

b. Grading scale:

The total grade of the student is as follows:

0 ≤ F ≤ 40 < D ≤ 45 < C- ≤ 50 < C ≤60 < C+ ≤65< B- ≤70 < B ≤ 80 < B+ ≤ 85< A- ≤ 90 < A≤100

Make-up Exams and Quizzes

- If the reason for missing the midterm exam is valid, the student's final exam will be worth up to 60 points.
- If the reason for missing a quiz is valid, the quiz can be taken at another time and will be worth 5 points.
- If the reason for missing the Final Exam is valid, the student can apply for the grade of "I".
- If a student misses both exams, he/she will not be attested for the course.
- If the reason for missing any exam or quiz is not valid, then the grade 0 will be given for the missing exam or quiz.

Calculators and cell phones

Using graphic calculators and cell phones during quizzes and exams prohibited.

V. Miscellaneous (as needed or desired)

Prerequisites: Linear Algebra and Analytic Geometry, Mathematical Analysis I

VI. Textbooks and References

1. Kreyszig E. Advanced Engineering Mathematics. - John Wiley & Sons, 2006.
2. Zill D., Shanahan P. - A first course in complex analysis with applications.- Jones and Bartlett Publishers, 2003.
3. Brown J., Churchill R. Complex Variables and Applications. - McGraw-Hill, 2009.
4. Spiegel M., Lipschutz S., Schiller J., Spellman D. Complex Variables with an Introduction to Conformal Mapping and its Applications. - McGraw-Hill, 2009.

VII. Tentative Academic Calendar

Week 1-4.

Complex Numbers. Complex Plane. Polar Form of Complex Numbers. Powers and Roots. Complex Functions. Complex Functions as Mappings. Linear Mappings. Special Power Functions. Reciprocal Function. Limits and Continuity. Derivative. Analytic Function. Cauchy-Riemann Equations. Harmonic Functions. Laplace's Equation.
([1]: ch. 13.1-13.4, [2] : ch. 1-3, [3] : ch. 1-2, [4] : ch. 1-3)

Week 5-8.

Complex Exponential and Logarithmic Functions. Complex Powers . Complex Trigonometric and Hyperbolic Functions. Line Integral in the Complex Plane . Cauchy's Integral Theorem. Cauchy's Integral Formula. Derivatives of Analytic Functions.
([1]: ch. 13.5-14.4, [2] : ch. 4-5, [3] : ch. 3-4, [4] : ch. 4)

Week 9-12.

Sequences, Series, Convergence Tests. Power Series. Functions Given by Power Series. Taylor and Maclaurin Series. Uniform Convergence. Laurent Series. Singularities and Zeros. Infinity. Residue Integration Method. Residue Integration of Real Integrals.
([1]: ch. 15-16, [2] : ch. 6, [3] : ch. 5-7, [4] : ch. 6-7)

Week 13-15.

Conformal Mapping. Linear Fractional Transformations. Schwarz-Christoffel Transformations. Poisson Integral Formulas. Riemann Surfaces. Applications.
([1]: ch. 17, [2] : ch. 7, [3] : ch. 8,10,11, [4] : ch. 8-9)