American University-Central Asia

SYLLABUS
MATHEMATICAL ANALYSIS - II
(MAT 316.2, CID: 3365)

Required for the students of "APPLIED MATHEMATICS AND INFORMATICS" and "SOFTWARE ENGINEERING"
Fall 2015 (September 1 – December 11)

1. **Instructors:** Sklyar Sergey Nikolaevich - Professor, Doctor nauk in Physics and Mathematics. Office: 415, Phone: +998(312)91-50-00(Ext: 426), E-mail: sklyar_s@auca.kg
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2. **Consultations:** according to the preliminary arrangement with instructor.
3. **Volume of academic load:** 2 classes per week (one lesson = 75 minutes); 15 working weeks, total **6** credits.
4. **Brief course description:** course will focus on advanced sections of mathematical analysis, such as: Infinite Series with constant and variable terms. Introduction to the theory of the Ordinary Differential Equations with discussion of techniques for relevant problem solving and Elements of Mathematical Modeling with Ordinary Differential Equations.
5. **Objectives:**
   The primary objectives of this course are:
   - to develop abstract and logical (probative) thinking
   - understanding how to set and solve problems
   - to acquire basic knowledge of advanced sections of mathematical analysis: Infinite Series and Ordinary Differential Equations
   - appreciating the value of continued mathematical education for the major
6. **Prerequisites:** MAT 227 or equivalent.
7. **Textbooks:**

Required:

1. Edwards C.H., Jr. David E. Penney "Calculus and analytic geometry", Prentice-Hall, Inc., 1986.
2. Tomas G.B., Jr. Ross L. Finney "Calculus and analytic geometry", Addison-Wesley Publishing Comp., 1988.

Additional:

3. Фихтенгольц Г.М. Основы математического анализа. Том 2. Санкт-Петербург,1999.
4. Фихтенгольц Г.М. Курс дифференциального и интегрального исчисления. Том 2. Москва, «Наука», 1970.
5. Смирнов В.И. Курс высшей математики. Том 2. Москва, 1962.
6. Edwards C.H., Jr. David E. Penney "Differential Equations and Boundary Value Problems", Prentice-Hall, Inc., 2000.

Additional theoretical material and respective problems will be presented by the instructor.

8. **Requirements and knowledge evaluation:**

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

Quiz 1	The instructor sets day and time	10 points
Midterm Exam	The instructor sets day and time	30 points
Quiz 2	The instructor sets day and time	10 points
Homework and class activity	Every class	10 points
Final Exam	Office of the Registrar sets day and time	40 points

The final grade of the student will calculated in conformity with a following scale:

0 ≤ F ≤ 40 < D ≤ 45 < C- ≤ 50 < C ≤60 < C+ ≤65

65< B- ≤70 < B ≤ 80 < B+ ≤ 85< A- ≤ 90 < A ≤100.

Make-up Exams and Quizzes

- 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.
- If a student misses both exams for any reasons, he/she will not be attested for the course.

- If the reason for missing the midterm exam is valid, the student's Final Exam will be worth up to 60 points. In this case extra tasks will be included in the Final Exam.
- If the reason for missing the Final Exam is valid, the student can apply for the grade of "I".

Attendance Requirements
It is important to attend classes to master the materials in the course. Attendance affects grades: students lose 1 point for any unexcused absence. Missing 10 or more classes for any reasons will result in a grade of "F" in the course.

Academic Honesty
The Applied Mathematics and Informatics Department has zero tolerance policy for cheating. Students who have questions or concerns about academic honesty should ask the instructor or refer to the University Catalog for more information.

Cell phones
We ask students to turn off their cell phones during math classes. Use of cell phones is entirely prohibited during the exams.

Syllabus change
Instructor reserve the right to change or modify this syllabus as needed; any changes will be announced in class.

9. Course content and tentative academic calendar:

Weeks 1-9

Introduction. Limit of a Sequence (review). [1]: p. 578-585; [2]: p. 625-645.

I. Infinite Series

Infinite Series with constant terms. [1]:p.578-616; [2]:p.626-699; [3]:p.11-43; [4]:p.257-327.

- The general concepts of the infinite series theory, Necessary Condition for convergence of a series.
- Positive-term series: Comparison Tests, the Integral Criteria of Maclaurin-Couchy for convergence, the Ratio Test (d'Alambert Test), the *n*th-Root Test (Couchy Test), Raabe Test.
- Alternating series: Leibniz's Theorem. Series with arbitrary constant terms: Absolute and Conditional convergence, the Absolute Convergence Theorem, Abel's and Dirihle's Tests. Properties of the convergent series.

Power Series. [1]:p.617-646; [2]:p.700-747; [3]:p.50-67, 87-109; [4]:p.298-301, 364-374.

- The Radius and Interval of convergence, the algebra of Power series, the term-by-term Differentiation and Integration Theorems.
- Taylor's Formula and Remainder Estimation Theorem, Taylor series. Taylor and Maclaurin series representation of the elementary functions, the binomial series.

Fourier Series. [3]:p.371-399.

- Properties of the trigonometric functions system.
- Fourier series of the even and odd functions.
- Convergence of the Fourier series.

Weeks 10-15

II. Introduction to Ordinary Differential Equations and Elements of Mathematical Modeling with Ordinary Differential Equations.

First-Order Differential Equations. [1]:p.952-970; [2]:p.1081-1094; [5]:p.11-41.

- Differential equations and mathematical models, basic concepts.
- Separable equations. Linear first-order equations (homogeneous and nonhomogeneous), the Method of Variation of Parameters for the nonhomogeneous equation.
- The equations transformed to linear: Bernoulli and Riccati equations.
- Initial value problem (Couchy Problem) for the first-order differential equations.
- A typical application of the first-order linear equations: Population Models, Cooling and Heating Models, Torricelli's Law, Geometrical applications.

Second-Order Linear Differential Equations. [1]:p.970-988; [2]:p.1094-1118; [5]:p.83-96.

- Homogeneous equation: Wronskian, general solutions.
- Homogeneous equation with constant coefficients: characteristic equation, general solutions in cases of distinct and repeated real roots, complex roots.
- Nonhomogeneous equation: the Method of Variation of Parameters and Method of Undetermined Coefficients.
- Boundary value problems for the second-order linear differential equations.
- A typical application of the second-order linear equations: Motion of a Particle, Mechanical Vibrations.