

**American University of Central Asia**  
**Applied Mathematics and Informatics Department**  
**Spring 2019**  
**Syllabus – Research Methods, MAT 370, ID 3864**

Instructor		Email	Office Hours	Phone	Office
Dr., Prof. Imanaliev Talaibek		imanaiev_t@auca.kg	Tu: 14.00-15.00	0(312) 915000, ext. 426	415
Course ID	Course Credits	Semester	Day and Time	Room	Lang.
3864	6	Spring	Tu:12.45-14.00 Th:12.45-14.00	G35	English

### **I. Course Description**

Students will develop skills required for mathematical research. The Main research methods will be introduced and applied in mathematical modeling of real life problems. This course will focus on communication in both written and oral form. Students will write documents and prepare presentations in a variety of formats for academic and non-academic purposes. The LaTeX document preparation system will be used. Since junior and senior level students may also think about applying for graduate school/internships/jobs there will be a block on "how to write a resume and cover letter".

This module is an introduction to methods often used in research in general, which will provide preparation for the BSc project. You will learn how to review critically and evaluate scientific writing, from books to research papers. You will receive training in writing academic reports in an appropriate style and structure, and will learn how to make and deliver oral presentations. Additional topics will be included so that you are prepared for project work at an advanced level. These will include literature search, computational mathematics tools and analysis packages, scientific word processing, publishing original results, research careers, project planning and teamwork.

### **II. Students Learning Objectives:**

This course covers:

A broad overview of research in mathematics

Gaining a more in-depth understanding of a specific research area

Critical reading of research literature

Overview of scientific writing and presentation techniques

Disciplinary Skills

At the end of this module, students should be able to:

Use library and web resources to review the state of current research in a chosen project area

Prepare and give a presentation (or use some other display format) describing a topic of current research, displaying critical examination of published work

Write a review of current research in a chosen area, using suitable style and with scientific word processing, which displays the ability to critically evaluate that research

### **Student Learning Outcomes**

Upon successful completion students should be able to:

At the end of this course, students should have developed with respect to the following attributes:

Critically evaluating scientific writing, from graduate textbooks to research papers, independently

Writing a coherent report and deliver a convincing presentation

Identifying and formulate a research question

Writing a coherent report

Delivering a convincing presentation

### **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	March, xx, 2019 (The lecturer sets day and time)	30 points
Quiz 2	The lecturer sets day and time	10 points

Final Exam	May, xx, 2019 (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:

**$0 \leq F \leq 40 < D \leq 45 < C- \leq 50 < C \leq 60 < C+ \leq 65 < B- \leq 70 < B \leq 80 < B+ \leq 85 < A- \leq 90 < A \leq 100$**

**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 cellphones**

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, ODE

**VI. Textbooks and References**

**a. Core Text (All the sources will be provided on e-course)**

1. Handbook of Writing for the Mathematical Sciences, N.J. Higham, SIAM, 1995
2. Kreyszig E. Advanced Engineering Mathematics. - John Wiley & Sons, 2006.
3. Strauss A. Walter. Partial Differential Equations. An Introduction. - John Wiley & Sons, 2008.
4. Boyce W., DiPrima R. *Elementary Differential Equations with Boundary Value Problems*. - John Wiley & Sons, 2005.

**b. Supplementary Texts**

5. Trench W. Elementary Differential Equations with Boundary Value Problems. - Free Edition, 2013.
6. Weiglhofer W., Lindsay K. Ordinary Differential Equations and Applications. - Woodhead Publishing, 2011.

**VII. Tentative Academic Calendar**

**Week 1.** In the first week, we will introduce our students to the exciting world of research in pure and applied mathematics. We will then introduce the students to efficient literature and bibliographic search, literature databases, search for particular results, etc

**Week 2.** In the second week, we first explain how to best read and understand applied maths literature. Then, we provide some useful guide to the intricate process of writing an (applied math) report or paper.

**Week 3.** In this third week, we continue our work on reading and writing scientific papers (focusing more on pure mathematics this week).

**Week 4.** In this fourth week, we will learn the basics of Latex, the most widely used document preparation system for the communication and publication of scientific documents in mathematics and several other fields of science.

**Week 5.** In week 5, we will make an overview of the use of several computational tools in mathematical research. We will see basic theoretical concepts such as algorithms & pseudocodes, and will learn how to implement algorithms with simple examples. We will also make an overview of different possible software utilities for practical aspects of research such as programming, plotting data, or symbolic computation. We will also finally learn how to make use of OEIS.

**Week 6.** In week 6, we will show how to make use of standard software such as powerpoint or beamer to work out scientific presentations and posters.

**Week 7.** Week 7 is a reading week, so no lectures will be delivered. You should use this time to work on the third marked assignment, and also to start working on your mini-project report and the presentations for it.

**Week 8-9.** In weeks 8 and 9, we will learn how to prepare and deliver a good scientific talks. We will focus on the essential ingredients to prepare a good ppt/beamer presentation and will explore different communication styles during a conference talk/seminar. We will pay special attention to the subtle differences between a pure maths and an applied maths talk, and will learn how to communicate efficiently. Week 8 will focus on applied subjects, and in week 9 we will cover the style typically used in pure maths talks.

**Week 10.** Week 10 is dedicated to several practical aspects on research, namely:

- research ethics & plagiarism: best practice
- the process of publishing original material: the overall intricate process of publishing a paper in a scientific journal, from submission to acceptance, including peer-refereeing and post-publication reviewing. We will also give an overview of the different scientific journals in pure and applied mathematics.
- an overview of the academic career: all that happens between starting a MSc until reaching tenure as an academic, and beyond.

**Week 11-12.** In week 11, we will start with students presentations of their mini-projects. You are required to attend this session even if you don't give a presentation.

**Week 13-15.** In this weeks we will continue with students presentations. You are required to attend this session even if you don't have to present. Here you can submit your miniproject report. Please submit two files:

- a pdf (result of compiling the .tex with the figures)
- the .tex file