Math 322
Mathematical Analysis for Engineers

Time and Location
Time: Tu and Th, 9:30AM - 10:45AM
Location: Psychology Rm. 305

Description of Course
Complex variables, linear algebra, Fourier series, partial differential equations. Examples will have a strong emphasis *on* optics, photonics, and engineering.

Course Prerequisites
Math 254 Introduction to Ordinary Differential Equations and Math 223 Vector Calculus
Enrollment into WileyPlus system. WileyPlus® course ID is TBD.

Instructor and Contact Information

Professor: Ildar Gabitov, PhD
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Office Hours: Tu 2:00PM-3:00PM, We 11:00AM-12:00PM, Th 2:00PM-3:00PM.

D2L and WileyPlus are primary reference for assignments, course announcements and grade postings.

Course Objectives and Expected Learning Outcomes

This course is designed to prepare students for the study of a wide class of linear systems arising in engineering applications. The mathematical methods covered by this course are the basis for the analysis of a broad range of engineering problems including stability, dynamics and thermodynamics of systems, signal processing, etc. The proposed material will enable students to understand, critically evaluate and use mathematical models and methods of modern engineering.

Students who successfully complete the course should:

- Know how to apply methods of applied mathematics to the problems of optics, photonics, biology and engineering
- Know the different ways of determining when a system of linear algebraic equations has a solution, and whether that solution is unique
- Know the geometric interpretation of the solution sets of linear algebraic equations
- Be able to solve systems of linear algebraic equations by gaussian elimination
- Be able to solve 2x2 and 3x3 homogeneous linear systems of ODEs by diagonalizing the matrix
- Be able to solve initial value problems for nonhomogeneous linear systems of ODEs, breaking the solution into homogeneous and particular solutions
- Be able to find particular solutions of nonhomogeneous equations using appropriate methods
- Know how to compute Fourier series expansions for general periodic functions
- Be able to solve basic linear PDEs like heat and wave equations on the interval (with Dirichlet or Neumann boundary conditions) using Fourier series
- Be comfortable computing the Fourier transforms of "signals" (time dependent functions) both by direct computation and by using properties of Fourier transform, in particular the convolution theorem.

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: http://policy.arizona.edu/human-resources/religious-accommodation-policy

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Students who miss class due to illness or emergency are required to bring documentation from their healthcare provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences.

Required Textbook: Advanced Engineering Mathematics by Erwin Kreyszig, Tenth Edition. ISBN: 978-8126554232

Assignments and Examinations: Schedule/Due Dates

Homework: Will be assigned regularly. *Homework* will be posted on WileyPlus® course ID is 801626, graded by computer. Homework is an essential component of the course, whether it is assigned for grading or not. *Homework* must be turned in before 4:30pm on Thursdays. All penalties for late *homework* are at the discretion of your instructor. *This* could depend on how late it is, whether

solutions are discussed in class before or not, etc. *Working together on homework problems is allowed, but the work you turn in must be your own. Homework will be assigned regularly.*

Grading: The total number of points available on tests, homework and quizzes is:

700 = 200 (homework (90%) + quizzes (10%)) + 3×100(midterms) + 200(final exam).

Three in-class midterms are scheduled for Tu, Feb 15, for Th, Mar 15, and Th, Apr 19. The final exam is on Tu, May 10, 8:00am–10:00am in the same room where the class met all semester. Final test will be available on D2L at 7:50am and work must be submitted by 10:15am. The University's Exam regulations for final exam week will be strictly followed, in particular those regarding students with multiple exams on a single day. Grades will be no lower than set forth in the following table:

$630 \leq$ points ≤ 700	90% to 100%	A
$560 \leq$ points ≤ 629	80% to 90%	B
$490 \leq$ points ≤ 559	70% to 80%	C
$420 \leq$ points ≤ 489	60% to 70%	D
$0 \leq$ points ≤ 419	0% to 60%	E

In general, there will be no make-up exams in the course and late work will not be accepted. However, in complex and unusual circumstances which are beyond your control, a make-up exam may be given on a case-by-case basis. This will require providing a detailed account of the situation and supporting documents.
Bonus points may be awarded for participation in various in-class activities and solving extra problems. These points will be added on top of your regular score in the "homework" category.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Dispute of Grade Policy: If you find an issue with how an assignment or exam has been graded, *you* must bring that to my attention within one week of that assignment being returned to the class.

Scheduled Topics/Activities by Week

Th Jan 13	Complex Numbers, Polar Form, Powers and Roots,	13.1, 13.2;	
Tu Jan 18	Powers and Roots, Derivative, Analytic Function	13.2, 13.3;	
Th Jan 20	Cauchy–Riemann Equations, Exponential Function	13.4, 13.5;	**HW1**
Tu Jan 25	Trig./Hyperb. Functions, Logarithm	13.6, 13.7;	
Th Jan 27	Matrices, Vectors: operations	7.1, 7.2;	**HW2**
Tu Feb 01	Linear Systems, Linear Independ., Rank, Vector Space	7.3, 7.4;	
Th Feb 03	Solutions, Existence, Uniqueness,	7.4, 7.5;	**HW3**
Tu Feb 08	Determinants, inverse matrix	7.6, 7.8;	
Th Feb 10	Vector Spaces, Linear Transformations,	7.8, 7.9;	**HW4**
Tu Feb 15	**Midterm 1**		
Th Feb 17	Review, Matrix Eigenvalues and Eigenvectors	8.1, 8.2;	**HW5**
Tu Feb 22	Eigenbasis similarity transformation	8.4;	
Th Feb 24	Diagonalization, 2-nd order Homogen. Lin.ODEs,	*8.4, 2.2;*	
Tu Mar 01	HLODEs with const. coef., Nonhomogen. ODEs	2.2, 2.7;	**HW6**;
Th Mar 03	Higher order HLODEs with const. coeff, systems of ODEs	3.2, 4.1;	
Tu Mar 15	**Midterm 2**		**HW7**

Th Mar 17	Theory of Systems of ODEs,	4.1, 4.2;	
Tu Mar 22	Review, Constant-Coefficient Systems,	4.2, 4.3;	
Tu Mar 29	Inhomogeneous Linear System of ODEs	4.6;	**HW8**
Th Mar 31	Fourier Series, properties	11.1, 11.2;	
Tu Apr 05	Approximation by Trigonometric Polynomials, $\varsigma(2) = \pi^2/62$,	11.4;	**HW9**
Th Apr 07	Fourier Integral and Fourier transform	11.7, 11.9;	
Tu Apr 12	PDEs, Vibrating String, Wave Equation,	12.1, 12.2;	**HW10**
Th Apr 14	Solution by Separating Variables,	12.2, 12.3;	
Tu Apr 19	**Midterm 3**		
Th Apr 21	Solution by Separating Variables, Heat equation	12.3, 12.5;	
Tu Apr 26	Solution by Separating Variables, examples	12.5, 12.6;	**HW11**
Th Apr 28	Solution of HE by Fourier Integrals and Transforms,	12.6, 12.7	
Tu May 03	Review of PDF solution techniques.		
Tu May 05	Reading Day		
Tu May 10	**Final Exam** 08:00am–10:00pm. Test will be displayed on D2L at 7:50am and collected by 10:15am (single file in PDF format)		

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations

As we enter the Spring semester, the health and well-being of everyone in this class is the highest priority. Accordingly, we are all required to follow the university guidelineson COVID-19 mitigation. Please visit www.covid19.arizona.edu for the latest guidance.At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

If our class meets at a campus location: Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity. The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Additional University-wide policies are available here:
https://academicaffairs.arizona.edu/syllabus-policies

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.