ELEMENTARY FOURIER ANALYSIS:
MATH 396 T: SECTION 001
SYLLABUS

SPRING 2020

Instructor:	**Office:**	**Office Hours:**	**Phone:**
Robert Sims	ENR2 S346	Tuesdays from 10:00 - 10:50am	626-1990

My preferred method of contact is by e-mail: `rsims@math.arizona.edu` and I typically respond within 24 hours.

I will also be in the tutoring room (Math 220) on Thursdays from 1:00 to 1:50pm. If you have conflicts with these tutoring hours, or would just like more time, please email me directly and we can make an appointment.

I will keep course information on our course website:

`https://www.math.arizona.edu/~rsims/ma396t/ma396t.html`

I will keep up-to-date grades for homework and tests online in D2L.

About the Course: In mathematics, we can often solve hard problems by breaking them up into a sum of much easier ones. Fourier Series were invented to solve important problems like the measuring of heat as a function of time and position, the propagation of waves (light or sound), and the behavior of electrical signals pulsing through circuits or wave-guides. It is remarkable that we can decompose nearly arbitrary signals as the sum of sines and cosines at different frequencies, although we may need to make these sums infinite. In this course we will learn how and when these decompositions can be made. Students need only have a good background in calculus in order to enroll in this course.

Course Prerequisites: The pre-requisites for this course are Calculus through Math 129.

Course Format and Teaching Methods: This course consists of regular lectures with in-class discussions.

Course Objectives: The aim of this course is to provide a gentle introduction to harmonic analysis which begins with various facts about complex numbers and proceeds to develop Fourier analysis touching on a wealth of applications. Students will learn more about the machinery developed in calculus and hopefully better appreciate how notions of convergence arise in

problem solving. The course will focus on calculations, understanding and applying theorems, and elementary proof writing.

Expected Learning Outcomes:

- Be able to present and discuss basic notions of analysis in a clear way with careful definitions and some proofs.
- Be able to describe several theorems on convergence of Fourier series especially in reference to smooth functions.

Course text: For this course, I will be using:
Early Fourier Analysis by Hugh L. Montgomery. Volume 22 in *Pure and Applied Undergraduate Texts: The Sally Series*. American Mathematical Society 2014.
Another good undergraduate text on Fourier analysis is:
Fourier Analysis and Its Applications by Gerald B. Folland. Volume 4 in *Pure and Applied Undergraduate Texts: The Sally Series*. American Mathematical Society 1992.

Calculation of Course Grades: The course grade will be determined from homework, two midterms, and a final exam. A chart describing the point allocation follows.

Homework	100 pts
Midterm 1	100 pts
Midterm 2	100 pts
Final Exam	200 pts
Total	500 pts

Course grades will be no lower than the following scale:

90-100% A; 80-89% B; 70-79% C; 60-69% D; Below 60% E

Dates for the Midterms (which are tentative) and Final are as follows:

Midterm 1	Friday, February 21
Midterm 2	Friday, April 10
Final Exam	Friday, May 8

University rules relating to final examinations, and the university final exam schedule may be found at:

`http://www.registrar.arizona.edu/schedules/finals.htm`

Missed Exam Policy: Students who are unable to attend an exam should notify their instructor as soon as possible. Arrangements for a make-up test will be considered on a case-by-case basis. Make-up exams will be administered only at the discretion of the instructor. If a student is allowed to make up a missed exam, the student must take it at a mutually arranged time. No further opportunities will be extended. Failure to contact the

instructor within one week of the missed exam will result in a grade of zero on that exam.

Homework: Homework will be assigned roughly once a week. There will be suggested problems and problems to be turned-in for grading. Each homework assignment will be graded out of ten points. Five points are available for completeness and five points are available for correctness. Although discussion of homework problems with other students and with the instructor is encouraged, students should write up their own answers. Homework submitted must be a reflection of the student's own knowledge, not another student's knowledge or the knowledge of someone who posted a solution online. Homework should be typed or written in legible, complete sentences, showing calculations and reasoning in a clear, logical order. Homework is due at the beginning of class. When averaging to produce the final homework score of 100 points, your lowest two homework score will be dropped. For this reason, no late homework will be accepted.

Grading Disputes: Any grading disputes must be addressed within one week after an exam or homework has been returned.

Withdrawal and Incompletes: A student may withdraw from the course with a deletion from record through January 28th, using UAccess. A student may withdraw with a grade of **W** through March 31, using UAccess. A grade of **I** (Incomplete) will be given only at the instructors discretion and according to University Policy as described:

`http://www.registrar.arizona.edu/gradepolicy/incomplete.htm`

Attendance and Class Participation Policy: Participating in the course and attending lectures are vital to the learning process. As such, attendance is required at all lectures. For information on the Administrative Drop Policy, see

`http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative`

If you need to miss class for unavoidable circumstances, contact your instructor as soon as possible. Please note the following: All holidays or special events observed by organized religions will be honored for those students who indicate affiliation with that particular religion.

`http://policy.arizona.edu/human-resources/religious-accommodation-policy`

Absences pre-approved by the UA Dean of Students (or Deans designee) will be honored.

`https://deanofstudents.arizona.edu/policies/attendance-policies-and-practices`

It is the student's responsibility to notify the instructor in advance of an absence related to religious observation or an activity for which a Dean's excuse has been granted, and to arrange for how any missed work will be handled.

Communication with Students: Announcements and important course information will be discussed in class, indicated on our course website, and announces on D2L. It is the student's responsibility to check for messages and announcements regularly.

Accessibility and Accommodations: It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations.

`https://drc.arizona.edu/instructors/syllabus-statement`

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.

Academic Integrity: Students are responsible to inform themselves of University policies regarding the Code of Academic Integrity. Students found to be in violation of the Code are subject to penalties ranging from a loss of credit for work involved to a grade of E in the course, and risk possible suspension or probation. The Code of Academic Integrity will be enforced in all areas of the course, including, but not limited to homework and tests. For more information about the Code of Academic Integrity policies and procedures, including information about your rights and responsibilities as a student, see the following website:

`http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity`

Student Code of Conduct: Students at The University of Arizona are expected to conform to the standards of conduct established in the Student Code of Conduct. Prohibited conduct includes: All forms of student academic dishonesty, including cheating, fabrication, facilitating academic dishonesty, and plagiarism. Interfering with University or University-sponsored activities, including but not limited to classroom related activities, studying, teaching, research, intellectual or creative endeavor, administration, service or the provision of communication, computing or emergency services. Endangering, threatening, or causing physical harm to any member of the University community or to oneself or causing reasonable apprehension of such harm. Engaging in harassment or unlawful discriminatory activities on the basis of age, ethnicity, gender, handicapping condition, national origin, race, religion, sexual orientation, or veteran status, or violating University rules governing harassment or discrimination. Students found to be in violation of the Student Code of Conduct are subject to disciplinary action. For more information about the Student Code of Conduct, including a complete list of prohibited conduct, see the following website:

http://deanofstudents.arizona.edu/accountability/students/student-accountability

Other Relevant University Policies Relating to Conduct: Please take note of the following University policies:

- Policy on Threatening Behavior by Students:
  http://policy.web.arizona.edu/education-and-student-affairs/threatening-behavior-students
- Nondiscrimination and Anti-Harassment Policy:
  http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassm

Expected Classroom Behavior: Students should turn off all electronic devices during class unless the device is deemed necessary for the class by the instructor. This includes, but is not limited to cell phones, mp3 players, and laptops. If you have a disability-related accommodation that involves the use of a computer during class, please discuss this with your instructor in advance.

Changes to the Course Syllabus: The information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Scheduled Topics/Activities:

Below is a tentative list of topics and activities per week. More information can be found on the course calendar which is available on the course website.

Week:	**Topics:**	**Sections:**	**HW/Midterms:**
Jan. 15 - Jan. 17	Complex Numbers	1.1	
Jan. 20 - Jan. 24	Polynomials	1.2, 1.3	HW1
Jan. 27 - Jan. 31	Power Series and Discrete F.T.	1.4, 2.1, 2.2	
Feb. 3 - Feb. 7	Fast F.T. and F. Coefficients	2.3, 3.1, 3.2	HW2
Feb. 10 - Feb. 14	Convolutions and Convergence	3.3, 3.4, 4.1	
Feb. 17 - Feb. 21	Summability	4.2, 4.3	HW3, M1
Feb. 24 - Feb. 28	Vector Spaces and Parseval	4.4, 5.1, 5.2	
Mar. 2 - Mar. 6	Trig. Polynomials	6.1, 6.2, 6.3	HW4
Mar. 9 - Mar. 13	Spring Break		
Mar. 16 - Mar. 20	Approximations	6.4, 6.5, 7.1	HW5
Mar. 23 - Mar. 27	Wiener's Theorem	7.2, 8.1, 8.2	HW 6
Mar. 30 - Apr. 3	The Heat Equation	8.3, 9.1	M2
Apr. 6 - Apr. 10	The Wave Equation	9.2, 9.3, 9.4	
Apr. 13 - Apr. 17	Uniform Distributions	9.5, 9.6, 9.7	HW7
Apr. 20 - Apr. 24	The Fourier Transform	9.8, 10.1, 10.2	
Apr. 27 - May 1	Poisson Summation Formula	10.3, 10.4, 10. 5	HW8
May 4 - May 8	Multiple F.T.s	11.1, 11.2	HW8