MTH 5316: Fourier Series and Orthogonal Functions

Sul Ross State University Rio Grande College

Fall 2023

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Course Description	MTH 5303 is intended as an introduction to function spaces, orthogonal functions, Fourier series, Legendre polynomials, spherical harmonics, heat and temperature, and waves and vibrations.
Class Time	Thursday, 6:00 – 8:45 p.m., or as announced (web-based class)
Required Text	Harry F. Davis, *Fourier Series and Orthogonal Functions*, ISBN 9780486659732

Course Policies

Attendance Policy

Attendance is mandatory. Students are expected to attend class in person in their classroom of registration unless permission is given for extenuating circumstances. You will be held responsible for all material covered in class or in the reading assignments. If you have to miss a class, it is your responsibility to obtain all notes, assignments, and announcements from someone else in the class. Make-up exams will be given only in the event of an emergency, in which case written justification and/or documentation must be provided and approved.

Communication

The Blackboard system will be used to provide course materials, submit assignments, and post grades. You are welcome to e-mail, call, or text me at any time. My cell number is **(830) 333-0164**. Please identify yourself in your text or voicemail. Please make sure to check the e-mail address associated with Blackboard on a regular basis.

Grading Policy

Your grades will be weighted as follows:

Homework	40%
Midterm Exam	25%
Final Exam	35%

A student who averages at least 90% will receive an A; at least 80% will receive at least a B; at least 70% will receive at least a C; at least 60% will receive at least a D.

Homework

For each section you will be asked to complete an assignment. Assignments will be made available on Blackboard. Homework can be submitted in a variety of formats, but each assignment must be submitted as a single file that I can view and grade on Blackboard.

One possibility would be to type up your homework using the Equation Editor on Microsoft Word and save it as a PDF. Another would be to capture high-quality images of your homework using a phone or other device and combine into a single file, e.g. by pasting each image into a word processor file. Feedback will be provided in the form of comments your Blackboard file.

All work must be shown for full credit. Try to be as tidy as possible so that I can understand your work. I'm flexible as to file format provided I can view your submission on Blackboard. Submissions consisting of multiple image files will not be graded as it's too easy for me to lose my place and miss something. If I have trouble seeing your file, I will let you know and give you a chance to resubmit.

Each problem will be worth 4 points unless otherwise noted.

ALWAYS TURN IN THE HOMEWORK, EVEN IF IT'S INCOMPLETE.

YOU WILL NOT PASS THE CLASS IF YOU DON'T SUBMIT HOMEWORK.

I'm flexible about due dates if something comes up, but unexcused late work may receive a zero.

Feedback will be provided in the form of notes on your submitted file. It is your responsibility to carefully view all feedback and contact me if you have any questions or concerns.

In addition, you will complete a number of small projects on GeoGebra. To obtain GeoGebra, navigate to

https://www.geogebra.org

Exams

There will be one midterm exam. It is tentatively scheduled to take place close to spring break. There is some flexibility as to scheduling. The final exam will take place during final exam week. It will be comprehensive.

Subject Outline

I. Linear Spaces: *functions – vectors – linear spaces – finite-dimensional linear spaces – infinite dimensional linear spaces*

II. Orthogonal Functions: *inner products – orthogonal functions and vectors – orthogonal sequences – differential operators – integral operators – convolution and the Dirichlet kernel*

III. Fourier Series: *definitions – examples – sine and cosine series – the Gibbs phenomenon – uniform convergence*

IV. Legendre Polynomials and Bessel Functions: *PDEs – the Laplacian – Legendre polynomials – Laplace's equation in spherical coordinates – spherical harmonics – Bessel functions*

V. Waves and Vibrations; Quantum Theory: *the vibrating string – the one-dimensional wave equation – vibrating membranes – waves in two and three dimensions – the hydrogen atom*

VI. Heat and Temperature: *the theory of heat conduction – the temperature of plates – the temperature of solids*

Schedule

This schedule is tentative only. The unit numbers refer to the above outline.

January 18 – February 2	Unit I
February 2 – February 23	Unit II
February 23 – March 9	Unit III
March 9 (approximately)	Midterm Exam
March 13 – 17	*Spring Break*
March 20 – April 6	Unit IV
April 6 – 20	Unit V
April 20 – May 10	Unit VI
May 12 – 17 (approximately)	Final Exam

University Statements

Distance Education Statement: *Students enrolled in distance education courses have equal access to the university's academic support services, such as Smarthinking, library resources, online databases, and instructional technology support. For more information about accessing these resources, visit the SRSU website. Students should correspond using Sul Ross email accounts and submit online assignments through Blackboard, which requires secure login information to verify students' identities and to protect students' information. The procedures for filing a student complaint are included in the student handbook. Students enrolled in distance education courses at Sul Ross are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook. Students in web-based courses must maintain appropriate equipment and software, according to the needs and requirements of the course, as outlined on the SRSU website.*

Americans with Disabilities Act: *Sul Ross State University is committed to equal access in compliance with the Americans with Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Kathy Biddick in Student Services, Room C-102, Uvalde campus. The mailing address is 2623 Garner Field Road, Rio Grande College-Sul Ross State University, Uvalde, Texas 78801. Telephone: 830-279-3003. Email: kbiddick@sulross.edu.*

University Libraries: *The Sul Ross Library offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, library.sulross.edu. SRSU RGC students may request InterLibrary Loans (ILLs) and book check outs from the Sul Ross Library to be picked up at the SWTJC library that is most convenient. Access requires your LoboID and password. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).*

The Southwest Texas Junior College (SWTJC) Library is also available on each campus for your physical use of the space or checking out books. Del Rio, Eagle Pass, and Uvalde students may use online resources available through SWTJC website, library.swtjc.edu. These libraries serve as pickup locations for your ILL or Document Delivery or book requests; to do so, choose the appropriate pick-up location when requesting materials from the Alpine campus.