Math 5302, Spring 2021
Elementary Analysis II

Course Information

20326 Math 5302.001 MW 11:30-12:45 Virtual/Remote Learning

Professor Contact Information

Instructor: John Zweck

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Phone: (972) 883-6699 (Do not leave a message. Email me instead.)

Office Hours: W 3:50-4:50 via MS Teams *and by appointment*. If you cannot attend office hours *please* contact me in class or by email to set up a time to meet. Also, you are encouraged to ask me questions by email.

Other Info: All email correspondence with your instructor must be sent to the email address above from your utdallas.edu account.

Course Modality and Expectations

Instructional Mode: Remote synchronous online learning at the day and time of the class.

Course Platform: Students will participate in the online lectures using **MS Teams**. General instructions for accessing a course meeting in Teams are here. Online lectures will be recorded for later viewing in **MS Streams**. These recordings will be particularly important to students participating asynchronously. General instructions for accessing lecture recordings in MS Streams are here. Students needing *closed captioning* can turn them on within Teams. Captions will also be available in the Streams videos.

Students will receive an email prior to the first lecture with specific instructions for how to join. A basic introduction to eLearning for students is here. We recommend you use a *Chrome or Firefox browser* to access eLearning.

Expectations:

1. You are expected to adhere to the **weekly schedule** described later in this syllabus.
2. To gain proficiency in this subject you will need to develop a **conceptual understanding** of the course material in order to solve problems. Therefore you are expected to **actively engage with the lecture material** as presented by the instructor. Each week you will take a quiz designed to assess your conceptual understanding.

3. To submit written assignments and communicate mathematical ideas with your instructor and fellow students, at a minimum you will need to create scanned pdfs of handwritten documents that can be uploaded or emailed. For that, we strongly recommend the methods described here.

4. Although the midterm exams and the final exam are open book, open notes, open internet, you are expected to **prepare for them just as rigorously as if the exams were closed**. See Study Tips at the end of this syllabus for more information.

5. *The course instructor understands that we are living in an exceptional time and that during the semester you may encounter challenges that prevent you from performing at your best. I will endeavor to adjust assessment due dates for individual students in as flexible and equitable manner as possible. Nevertheless, all students are expected to complete all assigned work.*

Asynchronous Learning Guidelines: Asynchronous participation means that you are not participating in the course at the same time as the instruction of the course.

1. Students who choose the asynchronous option must still meet the expectations described above and must adhere to the weekly schedule and the exam policies for the course.

2. At any time in the semester you may elect to switch from a synchronous to an asynchronous mode of participation, or vice-a-versa. Students **must immediately inform the instructor when they switch.**

3. The synchronous lectures will be recorded and posted in the eLearning Course, MATH 5302.001. Students participating asynchronously are expected to view these lectures and ask clarifying questions of the instructor by email and in scheduled/by appointment office hours.

4. While the course is designed under the assumption that students may need to participate asynchronously, the synchronous option will provide you with additional enrichment opportunities. Students who participate in the lectures synchronously can ask/answer questions and obtain **immediate feedback** from the instructor **in real time**.

COVID-19 Guidelines and Resources

The UT Dallas Syllabus Policies and Procedures for Spring 2021 include COVID-19 resources for students. In particular, we emphasize the following items from these policies.

Class Participation: Regular class participation is expected regardless of course modality. Students who fail to participate in class regularly are inviting scholastic difficulty. A portion of the grade in the course is

directly tied to class participation. It also includes students engagement in group or other activities during class that solicit feedback on homework assignments, readings, and/or materials covered in the lectures and/or labs. Class participation is documented by faculty. Successful class participation is defined as consistently adhering to University requirements, as presented in the syllabus. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Class Recordings: The instructor may record meetings of this course. Any recordings will be available to all students registered for this class as they are intended to supplement the classroom experience. Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. If the instructor or a UTD school/department/office plans any other uses for the recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Course Materials

Announcements: The instructor will communicate with you regularly using a class email list and the announcements section of the **MATH 5302.001** eLearning Course.

Webpage: I will maintain a web page for the course, linked from my web page https://personal.utdallas.edu/~jwz120030/. *Bookmark it!* All course materials (except quizzes and exams) will be posted on this web page, and are publicly available.

eLearning: The eLearning Course **MATH 5302.001** will be used to access synchronous lectures, and to post recordings of lectures. It will also be used to administer quizzes and exams and post grades. The course material housed solely on eLearning is not publicly available.

Course Pre-requisites

MATH 5301 (Elementary Analysis I) or MATH 4301 (Mathematical Analysis I)

Course Description

Catalogue Entry for MATH 5302: Riemann and Darboux integrals, functions of bounded variation, Riemann-Stieltjes integration, Lebesgue measure, Introduction to Lebesgue integral.

More specifically, topics to be covered in MATH 5302 will include:

1. Riemann Integration
   (a) Riemann Integral and Conditions for Integrability

(b) Lower and Upper Darboux Integrals

(c) Properties of Definite Integrals and the Fundamental Theorem of Calculus

(d) Improper Integrals

2. Riemann-Stieltjes Integrals

(a) Definition of Riemann-Stieltjes Integrals

(b) Functions of Bounded Variation

(c) Necessary Conditions for the Existence of the Riemann-Stieltjes Integral

(d) Properties of the Riemann-Stieltjes Integral

(e) Computation of the Riemann-Stieltjes Integral

3. Lebesgue Measure and Integration

(a) Construction of Lebesgue Measure

(b) Properties of Lebesgue Measure

(c) The Middle-Third Cantor Set

(d) σ-Algebras and Borel Sets

(e) Measurable Functions

(f) The Lebesgue Integral

(g) Convergence Theorems [*if time permits*]

Student Learning Outcomes

This course concerns three complementary theories of integration due to Riemann, Riemann-Stieltjes and Lebesgue. The student learning outcomes for the course are:

1. State the definitions of fundamental concepts in each integration theory
2. State fundamental theorems on the existence and properties of each of these integrals
3. Calculate concrete integrals, rigorously justifying each step using the theory
4. Apply integration theory to prove results about specific classes of functions
5. Construct examples that illustrate aspects of the theory
6. Reproduce proofs of major results in the theory
7. Construct proofs of known results that expand upon the theory discussed in lectures
8. Explain the advantages and limitations of each of the three theories of integration

Textbooks

No textbook is required. The following texts are recommended and represent a range of perspectives and levels of sophistication.

[WK] "Introduction to Mathematical Analysis", Edited by W. Krawcewicz, UT Dallas, 2013. *These lecture notes will be provided to students.*

[J] "Lebesgue Integration on Euclidean Space", F. Jones, Jones and Bartlett, 1993

[W] "An Introduction to Analysis", W.R. Wade, Pearson, 2010

[R] "Principles of Mathematical Analysis", W. Rudin, McGraw-Hill, 1978

[S] "Essentials of Integration Theory for Analysis", D.W. Stroock, Springer, Graduate Texts in Mathematics, 262, 2010

[TK] "A Companion to Analysis: A Second First and First Second Course in Analysis", T. W. Körner, Graduate Studies in Mathematics, Volume 62, American Mathematical Society, 2003

[WZ] "Measure and Integral: An Introduction to Real Analysis", R.L. Wheeden and A. Zygmund, Marcel Dekker, Inc. 1977

Technical Requirements: In addition to a confident level of computer and Internet literacy, certain minimum technical requirements must be met to enable a successful learning experience. Please review the important technical requirements on the Getting Started with eLearning webpage.

Course Access and Navigation: This course can be accessed using your UT Dallas NetID account on the eLearning website. Please see the course access and navigation section of the Getting Started with eLearning webpage for more information. To become familiar with the eLearning tool, please see the Student eLearning Tutorials webpage.

Technical Support: UT Dallas provides eLearning technical support 24 hours a day, 7 days a week. The eLearning Support Center includes a toll-free telephone number for immediate assistance (1-866-588-3192), email request service, and an online chat service.

Communication: This course utilizes online tools for interaction and communication. Some external communication tools such as regular email and a web conferencing tool may also be used during the semester. For more details, please visit the Student eLearning Tutorials webpage for video demonstrations on eLearning tools. Student emails will be answered within 1 working day under normal circumstances.

Distance Learning Student Resources: Online students have access to resources including the McDermott Library, Academic Advising, The Office of Student AccessAbility, and many others. Please see the eLearning Current Students webpage for more information.

Server Unavailability or Other Technical Difficulties: The University is committed to providing a reliable learning management system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will provide an appropriate accommodation based on the situation. Students should immediately report any problems to the instructor and also contact the online eLearning Help Desk. The instructor and the eLearning Help Desk will work with the student to resolve any issues at the earliest possible time.

Academic Calendar and Assignments

The Lecture Notes and Homework Assignments will be posted on the publicly accessible course web page. Most of the homework problems will be graded. The course web page also includes some past exams. All quizzes and exams must be accessed via the eLearning Course MATH 5302.001.

Grading Policy

Grades: Quizzes 15%, Homework 45%, Midterm Exam 20%, Final Exam 20%

Quizzes: Each week you will do an online, automatically graded concept quiz (**CQ**). You will be allowed two attempts at each quiz with a time limit of 30 minutes per attempt. The quizzes will be available in eLearning by 11pm each Friday and are due the following Monday at 10am. Each quiz will cover the lecture material from the previous week. The first quiz is due Monday Feb 1st. There will be no quiz due March 8th.

The questions will not involve detailed calculations of an algorithmic, "apply this method" nature. Rather they will be designed to test the degree to which you have engaged with the *conceptual material discussed in the lectures*. There will be about 4 questions per week, which will typically be T/F, multiple answer, or multiple choice. The purpose of the quizzes is to make sure you have understood the concepts discussed in class before applying them to solve problems.

Solutions to the quiz will be discussed in the first 10-15 minutes of the lecture each Monday. *Students are encouraged to actively participate in these discussions.* To ensure we stay on schedule, each week there may be a roughly 10-15 minute recorded additional video lecture posted in eLearning.

Homework: Due each Thursday at 7pm. Problem sets will be available at least a week before the due on the course web page.

Exams: The exams will be open book, open notes, open internet. Prior to the due date you may not discuss the exam questions with any other person except the course instructor. Students will access the exams and submit their solutions from within eLearning.

Midterm Exam: Wednesday March 9th to Friday March 11th.

Final Exam: Monday May 10th to Tuesday May 12th. **The final exam will be based on the whole course.**

Course Policies

Attendance

Regular and punctual attendance in Lectures is strongly encouraged for those participating synchronously. An informal study by the UTD Department of Mathematical Sciences has shown that there is a very strong correlation between attendance at lectures and course grade.

Homework

You may ask me questions about the homework and you may discuss a first draft of your solutions with another student in the class. However the final version must be your own. *After your homework has been graded for the first time, you may be given the opportunity to resubmit selected questions to be graded a second time.*

Late Submissions

There will be no late submissions or makeups allowed for the quizzes. Extensions for homework will only be granted in exceptional circumstances with appropriate documentation.

Extra Credit

There will be no opportunity for students to earn extra credit.

Make ups for exams that you cannot attend or miss

If you know ahead of time that you cannot take an exam you must contact the instructor by email at least 4 days in advance of the scheduled exam requesting to take the exam at an alternate time. If an emergency arises that prevents you from taking the exam at the scheduled time you must contact your instructor by email no later than 48 hours after the exam time. Be prepared to provide appropriate evidence in support of your request. Reasonable requests for make up exams will be approved.

Regrades

Requests for regrades on homework or the midterm exam must be made no later than 7 days after the work has been returned to the class. There will be no regrades allowed for the final exam. Once posted, the only reason a course grade will be changed is because of a clerical error.

Academic Integrity

All instances of cheating will be reported to the University administration. See http://www.utdallas.edu/deanofstudents/dishonesty/

Study Tips

1. On the course web page I will post the sections that we will cover each day. You are expected to read the section ahead of time, so as to be familiar with the material.
2. It is very important to keep the main definitions, statements of theorems, and simpler examples in the forefront of your mind throughout the course, since we will refer back to them many times. You will need to digest the material several times to master it—before class, in class, reading through material after class, rederiving for yourself without any aid results discussed in class, and doing the assigned problems.
3. This is a fast paced course. Do not get behind. Do not miss class. Ask for help well before you are totally lost.
4. Ask questions. If you are dazed and confused your class mates will be too!
5. In class I sometimes call on people by name to answer questions mostly to help me find out whether you are understanding what's going on. If you do not feel comfortable being called on in class, please let me know.
6. Attend office hours and/or make separate appointments to speak with the course instructor. Before coming to office hours prepare a list of questions and/or email a scan of your attempt at a problem to me. Talk math with your fellow students, don't work in isolation.
7. Learn the art of taking good notes. My lectures will often present a somewhat complementary perspective on the subject to that in the textbook. Scans of my handwritten lecture notes are available on the course web page, but they are a bit messy and are best used to check details you missed in lectures. To increase your comprehension of the course material it is better for you to take and revise your own set of notes.
8. Do all the hwk problems. Work out what your mistakes are on the graded hwk and learn from them.

Advice for Homework

1. Never start your homework the day (before) it is due!
2. Begin each hwk assignment the same day that we cover the material in class.
3. Write up your homework so that you will easily understand it in a month's time when you are studying for the exam!
4. The only way to learn math is to do it: Struggle to solve problems for yourself.
5. However, if you get stuck on a problem for too long get help and get it before you waste too much time! Here are some places you can go for help.
    - Carefully read your notes from lectures and the book (again!).
    - Draw a schematic picture to help you think about the problem.
    - Ask me for help by email or in person.
    - Ask a fellow class member—often two heads are better than one! I encourage you to find a study partner for this class. First attempt the hwk yourself, then discuss them with your study partner, and finally carefully write the solutions up in your own words.
    - Sleep on it. Some of my best ideas come when I wake up in the morning.
6. Some of the homework problems will be harder than others. Don't expect to solve them all on the first try.

Advice for Exams

Exams will include problems similar to those in the homework and in lectures, as well as examining theory covered in class (definitions, theorems, *proofs!*, concepts, examples). Some past exams will be posted on the course web page.

Even though the exams are open book, I encourage you to first master the theory and memorize calculation methods and formulae you need to know and then use this knowledge to work a range of problems *without looking at your notes*. To learn theory, calculation methods, and formulae with your lecture notes employ a method as rigorous as the following. First go through your notes and compile a list of questions/prompts. Then with your notes closed write down what you know about each item on the list, as precisely and succinctly as you can. Only when you get stuck should you look at your lecture notes. If you do this about 4 times in the 10 days prior to the exam you should be in good shape. Don't forget to work past exam problems as well!

You should also spend *some but not all* of your preparation time studying in small groups to learn from each other. Presenting material to someone else is often the best way to work out whether you really know it yourself.

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

> "As a Comet, I pledge honesty, integrity, and service in all that I do."

Academic Support Resources

The information contained in the following link lists the Universitys academic support resources for all students. Please go to Academic Support Resources webpage for these policies.

UT Dallas Syllabus Policies and Procedures

The information at `http://go.utdallas.edu/syllabus-policies` constitutes the University's policy and procedures segment of the course syllabus.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the instructor.