MATH 4245: Fundamental Concepts of Analysis I

2022 Fall Session	
Total Class Sessions: 25	**Instructor: Staff**
Class Sessions Per Week: 5	**Classroom: TBA**
Total Weeks: 5	**Office Hours: TBA**
Class Session Length (Minutes): 145	**Language: English**
Credit Hours: 4	

Course Description:

This course aims to introduce the student to fundamental concepts of analysis that underpins a large number of areas of mathematics, both pure and applied. This course deals with functions of a real variable, including limits of functions, continuity, differentiation, Riemann-Stieltjes integrals, and uniform convergence and power series. The student should be adequately prepared by this course to continue with other branches of analysis.

Learning Objectives:

By the end of the course, students should be able to:

- Apply the definition of limits of functions and solve problems
- Use the definition of limits to determine continuity of a function
- Determine the continuity, differentiability, and inerrability of functions defined some domains
- Apply the Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis
- Write solutions to problems and proofs of theorems that meet rigorous standards based on content, organization and coherence, argument and support
- Determine the Riemann- Stieltjes integrals and integrability of a bounded function and prove a selected theorems
- Apply Taylors theorem to determine convergence of a series of functions
- Recognize the difference between point wise and uniform convergence of a sequence of functions
- Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.

Course Materials:

1. Introduction to Real Analysis by William F. Trench, *Library of Congress Cataloging-in-Publication Data*
2. Introduction to Real analysis, Pearson Education, 2003. (Freely downloadable at http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_REAL_ANALYSIS.PDF.

3. Walter Rudin, Principles of mathematical analysis, 3rd ed., McGraw-Hill Book Co., New York, 1976. International Series in Pure and Applied Mathematics.
4. Patrick M. Fitzpatrick: *Advanced Calculus*. Second edition.

Course Format and Requirements:

This course has 25 class sessions in total. Each class session is 145 minutes in length. Pre-reading the relevant lesson and attempting the assigned exercise problems prior to each class is strongly recommended. Familiarizing with the course material before class, you will gain a better understanding of the information presented during the class. Students are strongly encouraged to ask questions on things they do not understand. Main learning points will be highlighted from the relevant textbook chapters.

Attendance:

Students are expected to attend and participate in class. Strong attendance and participation are good indicators of success. Each student is responsible for all course material, announcements, quizzes and exams made in class, whether or not the student attended that day's class.

Course Assignments:

Homework Assignment:

There will be five weekly homework assignments. Assignments will count for 20% of the final grade. The questions for a homework assignment will be posted on the platform. The due date for each homework assignment will be announced. Late homework submission won't be accepted.

Quizzes:

Quizzes will count for 20% of the final grade. 5 quizzes will be given through the whole lecture. The quizzes questions will be quite similar to homework questions. No make-up quizzes will be given.

Exams:

Mid Exams

There will be two mid exams in this course. The Mid Exams will count for 30% of the final grade. The mid exams will be based onconcepts covered in class. They will be in-class, close-book and non-cumulative.

Final Exam

The final will be **cumulative** and **close-book**. Note that the final will not be taken during the normal class times. Exact time for final will be announced later.

Course Assessment:

Homework Assignment	20%
Quizzes (5)	20%

Midterm Exams 1	15%
Midterm Exams 2	15%
Final Exam	30%
Total	**100%**

Grading Scale (percentage):

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
98-100	**93-97**	**90-92**	**88-89**	**83-87**	**80-82**	**78-79**	**73-77**	**70-72**	**68-69**	**63-67**	**60-62**	**<60**

Academic Integrity:

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Chengdu University of Technology's *Academic Conduct Code.* Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code*.

Special Needs or Assistance:

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.

Course Schedule:

Week	Topics	Assessments
1	**Go Through Course Syllabus** **Functions and Limits** • Functions and Operations • Definition and Examples on limits of Functions • Theorems on Limits of Functions • Limit at infinity and Infinite limits • Monotonic Functions • Limits Inferior and Superior	• Homework Assignment 1 • Quiz 1
	Continuous functions • Continuous functions - Definition and examples	• Homework Assignment 2 • Quiz 2

2	• Bounded Functions • Intermediate Value Theorem • Uniform continuity	• Mid I
3	**Differentiation** • Definition of the Derivative • Interpretations and Theorems of the Derivative • Rules of Differentiation • One Sided Derivatives • Rolles's Theorem • Intermediate Value Theorem • Mean Value Theorem • Taylor's Theorem	• Homework Assignment 3 • Quiz 3
4	**Integration** • Definition of The Integral • The Integral as area under curve • Upper and Lower Integrals • The Riemann–Stieltjes Integral • Existence of the Integral • Properties of the Integral • First mean Value theorem for Integrals • Fundamental Theorem of Calculus	• Homework Assignment 4 • Quiz 4 • Mid 2
5	**Integration** • Integration by Parts • Second Mean Value Theorem for Integrals • Change of Variable **Sequence and Series Functions** • Sequence of Functions • Infinite Series of Functions • Uniform Convergence • Power Series **Course Summary** **Review of Final Exam**	• Homework Assignment 5 • Quiz 5 • Final Exam