

**STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK**



MASTER SYLLABUS

MATH 401 – REAL ANALYSIS

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Canino School of Engineering Technology

Mathematics

FALL 2019

- A. **TITLE:** Real Analysis
- B. **COURSE NUMBER:** MATH 401
- C. **CREDIT HOURS:** (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)

Credit Hours: 4
Lecture Hours: 4 per week
Lab Hours: 0 per week
Other: 0 per week

Course Length: 15 weeks

- D. **WRITING INTENSIVE COURSE:** Yes No
- E. **GER CATEGORY:** None: Yes:
If course satisfies more than one:
- F. **SEMESTER(S) OFFERED:** Fall Spring Fall & Spring

G. **COURSE DESCRIPTION:**

This course is a proof-based course that covers the fundamentals of mathematical analysis: definitions and theorems regarding point set topology (applied to the real numbers), convergence of sequences, subsequences and series of numbers, continuity and differentiability of functions, the theory and practice of the Riemann integral, the theoretical rationale regarding convergence or divergence of sequences and series, and Fourier series. Also covered are uniform continuity and uniform convergence, specifically when it relates to the change in the order of limit operations.

H. **PRE-REQUISITES:** None Yes If yes, list below:

Calculus III (MATH 263) and Linear Algebra (Math 361) with a grade of C or better or permission of the instructor.

CO-REQUISITES: None Yes If yes, list below:

I. STUDENT LEARNING OUTCOMES: (see key below)

By the end of this course, the student will be able to:

<i>Course Student Learning Outcome [SLO]</i>	<i>Program Student Learning Outcome [PSLO]</i>	<i>GER [If Applicable]</i>	<i>ISLO & SUBSETS</i>	
Prove elementary facts regarding point set topology using the appropriate definitions and applicable theorems.				Subsets
Define and recognize whether the series of real numbers is convergent or divergent			ISLO	Subsets
Identify Cauchy sequences and subsequences and be able to distinguish when a given sequence of functions is convergent or divergent.			ISLO	Subsets
Identify and prove that a function has a limit as x approaches infinity.			ISLO	Subsets
Define what it means for a function to have a Riemann Integral and describe its properties.			ISLO	Subsets
Compute the Taylor series and Power series for given functions.			ISLO	Subsets
Define and recognize the continuity of real functions				

KEY	Institutional Student Learning Outcomes [ISLO 1 – 5]
ISLO #	ISLO & Subsets
1	Communication Skills Oral [O], Written [W]
2	Critical Thinking <i>Critical Analysis [CA], Inquiry & Analysis [IA], Problem Solving [PS]</i>
3	Foundational Skills <i>Information Management [IM], Quantitative Lit./Reasoning [QTR]</i>
4	Social Responsibility <i>Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</i>
5	Industry, Professional, Discipline Specific Knowledge and Skills

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes No

If YES, select one or more of the following categories:

- | | |
|---|--|
| <input type="checkbox"/> Classroom/Lab | <input type="checkbox"/> Civic Engagement |
| <input type="checkbox"/> Internship | <input type="checkbox"/> Creative Works/Senior Project |
| <input type="checkbox"/> Clinical Placement | <input type="checkbox"/> Research |
| <input type="checkbox"/> Practicum | <input type="checkbox"/> Entrepreneurship |
| <input type="checkbox"/> Service Learning | (program, class, project) |
| <input type="checkbox"/> Community Service | |

K. TEXTS:

A Friendly Introduction To Real Analysis by Wiltold Kosmala, ISBN: 013045796, Pearson

L. REFERENCES:

- 1) Advanced Calculus: A Geometric View, by James J. Callahan, Springer 2010,
- 2) Advanced Calculus 5th ed. by Wilfred Kaplan, Pearson, 2002
- 3) Div, Grad, Curl, and All That 4th ed. By H.M. Schey, W.W. Norton and Company, 2005.

M. EQUIPMENT: None Needed:

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Homework
Quizzes
Tests
Projects

P. DETAILED COURSE OUTLINE:

- I) Introduction
 - A) Mathematical Induction
 - B) Proof Techniques
 - C) Finite and Infinite Sets
 - D) Ordered Fields, Real Numbers and the Completeness Axiom
- II) Limits
 - A) Definition of a Sequence and Convergence
 - B) Limit Theorems
 - C) Infinite Limits
 - D) Monotone Sequences
 - E) Cauchy Sequences

F) Subsequences

III) Limits of Functions

- G) Limit at Infinity
- H) Limit at a Real Number
- I) Monotone Functions

IV) Continuity

- A) Continuity of a Function
- B) Properties of Continuous Function
- C) Uniform Continuity

V) Integration

- A) Riemann Integral
- B) Integrable Functions
- C) Properties of the Riemann Integral
- D) Improper Integrals

VI) Infinite Series

- A) Convergence
- B) Tests for Convergence
- C) Ratio and Root Tests
- D) Absolute and Conditional Convergence

VII) Sequences and Series of Functions

- A) Pointwise Convergence
- B) Uniform Convergence
- C) Properties and Uniform Convergence
- D) Power Series and Taylor Series

Q. LABORATORY OUTLINE: None Yes