Course Objectives
Calculus I
Dr. M. P. M. M. M^{c}Loughlin
Fall 2015

Length of Course: One semester

Pre-requisite: High School Algebra; Geometry; Trigonometry; Functions & Graphs; and, a satisfactory Mathematics placement.

Text (required but rarely used in this class):
Calculus: with Early Transcendentals Briggs, Cochran, & Gillette, Pearson. ISBN: 9780321785374

Handouts, Worksheets, Open Questions, etc.(required to be downloaded each class):
http://faculty.kutztown.edu/mcloughl/Math181.html

Texts (supplemental):
The instructor may suggest supplemental exercises or reading from a number of sources; including, but not limited to:
University Calculus: Elements with Early Transcendentals Haas, Weir, & Thomas, (Any edition) Pearson. *Calculus,*Riddle (Any edition). Wadsworth.
Calculus, Hunt (Any edition). Harper-Collins.
Calculus, Grossman (Any edition). Harcourt.
Schaum Outline Series: Calculus , Mendelson & Ayres (any edition). McGraw - Hill.

Course Objective:
This course prepares students who major in mathematics, the sciences, or engineering with the mathematical background they need to address problems that arise in those majors. It could be counted in Category IV-A, IV-D, or V of General Education. The course addresses General Education Goal #3: "Students will apply mathematical functions and numeric data interpretation to problem solving."
A student should have mastered and demonstrated the following skills after completing Math 181:
• the student is able to think logically
• the student is able to reason and recognise patterns and be able to make conjectures
• the student is able to use mathematical symbols
• the student understands the basic concepts of analysis; limit, continuity and the derivative
• the student is able to strike a judicious balance between theory and application, between computational skills and mathematical sophistication and between intuition and rigour.
• the student is able to do applications of derivatives.
• the student is able to explain what a proof is and discern between a valid proof and claim that a proof has been performed, but in reality has not.
• the student is able to read a proof of a statement.
• the student is able to construct a valid examples of true claims.
• the student is able to construct valid counterexamples to propositions which are false.
• the student is able to recognise and avoid common fallacies in arguments including begging the question, circular reasoning, affirming the conclusion, and denying the hypothesis.
• the student is able to take a derivative by the definition of the derivative.
• the student is able to take derivatives by the power, sum, product, quotient, or chain rule (and combinations of said).
• the student is able to take derivatives by the polynomial, trigonometric, transcendental, algebraic, logarithmic, exponential, or rational functions (and combinations of said).

A brief overview of some (but not all of) the Course Content:

A. Limits and Continuity

1. Rates of Change and Tangents to Curves
2. Limit of a Function and Limit Laws
3. Intuitive concept of limit
4. Precise Definition of a Limit
5. One-Sided Limits
6. Continuity
7. The squeeze theorem
8. Limits Involving "Infinity"

B. Differentiation

1. Tangents and Derivatives at a Point
2. The Derivative as a Function
3. Differentiation Rules
4. The Derivative as a Rate of Change
5. Derivatives of Trigonometric Functions
6. Derivatives of Exponential Functions
7. The Chain Rule
8. Instantaneous velocity, speed, and acceleration
9. Implicit Differentiation
10. Inverse Functions and Their Derivatives
11. Derivatives of Logarithmic Functions
12. Derivatives of Inverse Trigonometric Functions
13. Related Rates
14. Differentials and approximations

C. Applications of the Derivative

1. Extreme Values of Functions
2. The Mean Value Theorem
3. Monotonic Functions and the First Derivative Test
4. Concavity, the Second Derivative Test, and Curve Sketching
5. Applied Optimization
6. Indeterminate Forms and L'Hôpital's Rule
7. Hyperbolic Functions
8. Parameterizations of Plane Curves (optional)
9. Newton's Method (optional)

Antiderivatives and Differential Equations

D. Introduction to Integrals

1. Antiderivatives and indefinite integration
2. The definite integral
3. Change of variables
4. Summation notation, Riemann Sums, and area
5. Properties of the definite integral
6. The Fundamental Theorem of Calculus, Part I
7. The Fundamental Theorem of Calculus, Part II

E. Applications of the Integrals

1. Area between curves
2. Volume, density, and average value
3. Solids of revoultion, shells, discs, and surface areas
4. Work, force, and pressure
5. Linear Differential Equations

Outline of the Course (with suggested pace):

§	**Title**	**Sections**	**Pace**
I	Preliminaries & Review of Pre-calculus	Handouts & Worksheets	$\frac{1}{2} - 1$ week
II	Limits and Continuity	Chapter 1	$2\frac{1}{2}$ weeks
III	The Derivative	Chapter 2 § 1 – 5 & 7	$2\frac{1}{2}$ weeks
IV	Applications of the Derivative	Chapter 3	$2\frac{1}{2}$ weeks
V	The Anti-derivative and the Integral	Chapter 4	$2\frac{1}{2}$ weeks
VI	Applications of the Integral	Chapter 6	$3\frac{1}{2}$ weeks