

Spring 2016

**DEPARTMENTAL SYLLABUS  
MATH 241/251A (4) – CALCULUS I**

**Course Description:** Basic concepts, differentiation with applications, integration.

**Prerequisite for Math 241:** Math 140 or Math 215 or placement exam.

**Prerequisite for Math 251A:** Math department consent plus one of the following: A in Math 140, high score on the placement exam, high SAT or ACT score.

**Text:** *University Calculus (Alternate or Custom Edition)* by J. Hass, M. Weir, and G. Thomas, Addison Wesley.

**Format:** This four credit class meets for 150 minutes of lecture and 50 minute of recitation per week.

**Final Exam:** There will be a common final exam for all sections of 241 and 251A.

**Course objectives:** Upon successful completion of Math 241 the student will have an understanding topics listed below, be able to solve routine problems, and be able to apply the ideas. A successful Math 251A student will have an in-depth understanding of the topics, be able to solve routine and challenging problems, and be able to apply the ideas creatively.

**Program objectives:** In this introductory level course students learn the basics about differentiation and integration of functions in one variable. The approach emphasizes computation and application over theory. The course material is fundamental for majors in mathematics, the physical sciences, and engineering. The course is the first in a four (three) semester sequence.

**Approximate Timeline:****Weeks 1–3: Tangent lines, limits, and continuity.**

- (1) Review as determined by lecturer.
- (2) Section 2.1: Tangent lines to curves.
- (3) Section 2.2: Limits of functions and limit laws (algebra and pinching).
- (4) Section 2.3: The precise definition of a limit.
- (5) Section 2.4: One-sided limits and limits at infinity.
- (6) Section 2.5: Infinite limits and asymptotes.
- (7) Section 2.6: Continuity and Intermediate Value Theorem.

**Weeks 3–6: Derivatives.**

- (1) Section 3.1: Definition of the derivative, calculation of derivatives using first principles, and differentiability on an open interval.
- (2) Section 3.2: Calculate derivatives, linearity, product and quotient rule. Higher order derivatives.
- (3) Section 3.3: Applications and interpretation of the derivative as rate of change.
- (4) Section 3.4: Derivatives of trigonometric functions.
- (5) Section 3.5: Chain Rule.
- (6) Section 3.6: Implicit differentiation.
- (7) Section 3.7: Related rates.
- (8) Section 3.8: Differentials and linear approximation.

**Weeks 7–10: Applications of differentiation.**

- (1) Section 4.1: Absolute and local extrema and critical points.
- (2) Section 4.2: Mean Value Theorem and some of its corollaries.
- (3) Section 4.3 & 4.4: Monotonicity, concavity, and sketching of curves (more than one lecture).
- (4) Section 4.5: Applied optimization problems (up to one week).
- (5) Section 4.6: Newton's method.
- (6) Section 4.7: Antiderivatives and differential equations.

**Weeks 11–15: Integration and basic applications**

- (1) Section 5.1: Area estimates with finite sums.
- (2) Section 5.2: Sigma Notation and Riemann sums.
- (3) Section 5.3: The definite integral and its basic properties
- (4) Section 5.4: The Fundamental Theorem of Calculus.
- (5) Section 5.5: Indefinite integrals and substitution.
- (6) Section 5.6: Areas between curves.
- (7) Section 6.1: Volumes by slicing and rotation about axes.
- (8) Section 6.2: Volumes via shells.