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

Course Description: Basic concepts, differentiation with applications, integration.
Prerequisite: A grade of C or better in Math 140 or Math 215 or precalculus assessment as specified by the department.
Text: *University Calculus (Alternate Edition)* by J. Haas, M. Weir, and G. Thomas, Addison Wesley, current edition.
Format: This four credit class meets for 150 minutes of lecture and 50 minute of recitation/lab (scheduled in the computer lab, PSB 208) per week.
Gateway Exam: All instructors are encouraged to participate in the differentiation gateway exam. Students shall receive a grade C or better for the course only if they pass the exam.
Timeline: Week 1: Getting started:

(1) Discuss instructor's syllabus, academic expectations from the department website, preview.
(2) Review of precalculus material. Many students are not settled during the first week, so it is best to spend time on important material, without making it too difficult for students to catch up.

Week 2–3: Tangent lines, limits, and continuity. The precise definition of a limit (Section 2.3) may be incorporated throughout.

(1) Section 2.1: Tangent lines to curves.
(2) Section 2.2: Limits of functions and limit laws (algebra and pinching).
(3) Section 2.4: One–sided limits and limits at infinity.
(4) Section 2.5: Infinite limits and asymptotes.
(5) Section 2.6: Continuity.

Week 4–6: 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.

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(3) Section 3.3: Applications and interpretation of the derivative as rate of change (cut short).
(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.
(9) Section 3.9: Parametrization of plane curves.

Week 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.

Week 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.

Course objectives: Upon successful completion of Math 241 the student will have an understanding of the above listed topics, 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 is more computational than theoretical. 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.