COMMON COURSE OUTLINE: Course discipline/number/title: MATH 1127: Calculus I

A. CATALOG DESCRIPTION
1. Credits: 5
2. Hours/Week: 5
3. Prerequisites (Course discipline/number): 4 years of high school mathematics including trigonometric functions with a grade of "B" or higher or MATH 1117 (Pre-Calculus) and/or appropriate placement from the current placement test; College level reading
4. Co-requisites (Course discipline/number): None
5. MnTC Goals (if any): Goal 2/Critical Thinking, Goal 4/Mathematics/Logical Reasoning

This mathematics course is a first semester calculus course including topics: limits, continuity, differentiability, applications of differentiation including related rates, optimization, linear approximation and Newton’s method, function sketching, integration with applications including area, volumes of rotation, and work, introduction to the calculus of inverse functions including exponential, logarithmic, and trigonometric functions.

B. DATE LAST REVISED (Month, year): February, 2014

C. OUTLINE OF MAJOR CONTENT AREAS: Major topics including:
1. Evaluation of limits including the precise definition of limits by delta-epsilon
2. Continuity
3. Differentiability of functions and relations by the limit definition
4. Evaluation of derivatives by differentiation formulas including the product, quotient, power and chain rules
5. Implicit differentiation
6. Sketching of functions including regions of increasing/decreasing, extrema, concavity, and inflection points
7. Applications such as related rates, optimization, areas by integration and by Riemann sum
8. Integration by memory forms and substitution
9. Applications of integration including area under a curve
10. Volumes of rotation by disk, washer, shell, volumes by parallel planes or cross-sectional area
11. Calculus of inverse functions including transcendental functions of exponential and logarithmic including derivatives and integrals
12. Calculus of inverse trigonometric including derivatives and integrals

D. LEARNING OUTCOMES (GENERAL): The student will be able to:
1. Understand and complete inductive and deductive type proofs.
2. Reason out and solve equations and inequalities including polynomial, single and multiple absolute value, and trigonometric and apply these concepts to calculus.
3. Understand the concept and existence of a limit.
4. Evaluate limits as possible at a point, determinate and indeterminate forms, and evaluate limits at infinity with relation to asymptotic behavior.
5. Relate limits to continuity and discontinuity
6. Understand various notations of derivatives.
7. Use the definition of the limit of the difference quotient and derivative rules including: memory forms, product rule, quotient rule, power rule, chain rule, and implicit differentiation to evaluate derivatives.
8. Understand the concept of differential and apply to approximation.
10. Sketch functions and relations using concepts from algebra as well as continuity, asymptotic and end behavior, increasing/decreasing, extrema, concavity, and inflections.
11. Set up and solve related rate problems.
12. Set up and solve optimization problems.
13. Understand the concepts of definite and indefinite integrals.
14. Know exact integrals, apply substitution to evaluate some integrals.
15. Set up and evaluate areas using Riemann sums and definite integrals.
16. Set up and evaluate applied problems such as volumes of rotation by disks, washers, and shells and volumes by cross sections, work problems involving spring motion and fluid motion.
17. Know average value of a function.
LEARNING OUTCOMES (GENERAL): Continued . .
18. Understand the calculus of exponential and logarithmic functions with applications to growth and decay problems.
19. Understand derivatives as applied to inverse functions.
20. Apply inverse techniques to trigonometric, inverse trigonometric functions and their derivatives and their integrals.

E. LEARNING OUTCOMES (MNTC):
Goal 2/Critical Thinking: The student will be able to:
1. Gather factual information and apply it to a given problem in a manner that is relevant, clear, comprehensive, and conscious of possible bias in the information selected.
2. Imagine and seek out a variety of possible goals, assumptions, interpretations, or perspectives, which can give alternative meanings or solutions to given situations or problems.
3. Analyze the logical connections among the facts, goals, and implicit assumptions relevant to a problem or claim; generate and evaluate implications that follow from them.
4. Recognize and articulate the value assumptions, which underlie and affect decisions, interpretations, analyses, and evaluations made by ourselves and others.

Goal 4/Mathematics/Symbolic Systems: The student will be able to:
1. Illustrate historical and contemporary applications of mathematics/logical systems.
2. Clearly express mathematical/logical ideas in writing.
3. Explain what constitutes a valid mathematical/logical argument (proof).
4. Apply higher-order problem solving and/or modeling strategies.

F. METHODS FOR EVALUATION OF STUDENT LEARNING:
1. Objective and short answer tests
2. Quizzes
3. Homework
4. Projects
5. Papers
6. Group work

G. RCTC CORE OUTCOME(S) ADDRESSED:
☐ Communication ☐ Civic Responsibility
☒ Critical Thinking ☐ Personal/Professional Accountability
☐ Global Awareness/Diversity ☒ Aesthetic Response

H. SPECIAL INFORMATION (if any):
1. Additional fees may be required for field trips.
2. A graphics calculator is required for the class.