ESSEX COUNTY COLLEGE
Mathematics and Physics Division
MTH 114 – Unified Calculus I
Course Outline

Course Number & Name: MTH 114 Unified Calculus I

Credit Hours: 3.0   **Contact Hours:** 3.0   **Lecture:** 3.0   **Lab:** N/A   **Other:** N/A

Prerequisites: Grade of "C" or better in MTH 113 or placement

Co-requisites: None   **Concurrent Courses:** None

Course Outline Revision Date: Fall 2010

Catalog Description: This course provides an introduction to one variable differential and integral calculus, emphasizing methods and applications. Topics include limits, continuity, the derivative, differentiation formulas for algebraic functions, anti-differentiation, the Fundamental Theorem of Calculus, and an introduction to the techniques of integration.

General Education Goals: The aggregate of the core courses required for any major at ECC have the following goals:

1. **Written and Oral Communication**: Students will communicate effectively in both speech and writing.

2. **Quantitative Knowledge and Skills**: Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

3. **Scientific Knowledge and Reasoning**: Students will use the scientific method of inquiry through the acquisition of scientific knowledge.

4. **Technological Competency/Information Literacy**: Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

5. **Society and Human Behavior**: Students will use social science theories and concepts to analyze human behavior and social and political institutions and to act as responsible citizens.

6. **Humanistic Perspective**: Students will analyze works in the field of art, music, or theater; literature; and philosophy and/or religious studies; and will gain competence in the use of a foreign language.

7. **Historical Perspective**: Students will understand historical events and movements in World, Western, non-Western, or American societies and assess their subsequent significance.

8. **Global and Cultural Awareness of Diversity**: Students will understand the importance of global perspective and culturally diverse peoples.

9. **Ethics**: Students will understand ethical issues and situations.

Course Goals: Upon successful completion of this course, students should be able to do the following:

1. demonstrate knowledge of the fundamental concepts and theories from algebra and calculus; (GEG2)

2. utilize various pre-calculus and calculus problem-solving and critical-thinking techniques to set up and solve applied problems in geometry, sciences, and other fields; (GEG 2)

3. communicate accurate mathematical terminology and notation in written and/or oral form in order to explain strategies to solve problems as well as to interpret found solutions; (GEG 1, GEG 2) and

4. use calculators effectively as a tool to solve such problems as those described above. (GEG 2)

Measurable Course Performance Objectives (MPOs): Upon successful completion of this course, students should specifically be able to do the following:

1. Demonstrate knowledge of the fundamental concepts and theories from algebra and calculus:

    1.1 *use the concepts of continuity and limits to analyze and graph functions;*
    1.2 *use the definition of derivative to determine the derivative of explicit polynomial and rational functions;*
    1.3 *apply the rules of differentiation to determine the derivative of explicit and implicit polynomial and rational functions;*
    1.4 *apply the rules of anti-differentiation to find the anti-derivative of polynomial and rational functions;* and
    1.5 *use the first and second derivative tests to sketch a curve by identifying maxima and minima points and concavity*

2. Utilize various pre-calculus and calculus problem-solving and critical-thinking techniques to set up and solve applied problems in geometry, sciences, and other fields:

    2.1 *calculate the slope of a tangent or normal line to a curve, as well as find the equation of the tangent or normal line;*
    2.2 *determine the instantaneous rate of change of a function including applications involving velocity or acceleration of an object undergoing rectilinear motion;* and
    2.3 *use appropriate parametric equations and differentiation to find the velocity or acceleration of an object undergoing curvilinear motion*
    2.4 *solve optimization application problems taken from a variety of fields;*
    2.5 *use anti-differentiation to calculate the area under a curve;* and
    2.6 *apply the Trapezoidal Rule and Simpson's Rule to approximate the area under a curve*

3. Communicate accurate mathematical terminology and notation in written and/or oral form in order to explain strategies to solve problems as well as to interpret found solutions:

    3.1 *write and explain solutions to application problems including related rates, instantaneous velocity and acceleration, and optimization*

Measurable Course Performance Objectives (MPOs) (continued):

4. Use graphing calculators effectively as a tool to solve such problems as those described above:

    4.1 *use the GRAPH feature to display polynomial functions*; and
    4.2 *use the TANGENT feature to display polynomial functions and the corresponding tangent line to the curve at a particular point*

Methods of Instruction: Instruction will consist of a combination of lectures, presentation of sample problems, clarification of homework problems/textbook material, and general class discussion.

Outcomes Assessment: Test and exam questions are blueprinted to course objectives. Data is collected and analyzed to determine the level of student performance on these assessment instruments in regards to meeting course objectives. The results of this data analysis are used to guide necessary pedagogical and/or curricular revisions.

Course Requirements: All students are required to:

1. Maintain regular attendance; excessive absences will negatively affect student understanding and performance.

2. Complete reading and problem solving homework in a timely manner and contribute to class discussions. Mathematics cannot be understood without doing a significant amount of outside study.

3. Take tests and exams when scheduled. **No make-ups will be permitted**. The first missed test will be recorded as a zero until the end of the semester, at which time the **final exam grade will also be used to replace the missing test grade. Grades from any other missed tests will be recorded as irreplaceable zeros**. The Comprehensive Final Exam is required and cannot be rescheduled unless some **extraordinary** event occurs and prior arrangement is made with the instructor.

Methods of Evaluation: Final course grades will be computed as follows:

Grading Components	% of final course grade
• **Homework** Assignments may be from the suggested textbook homework list or through an online homework package.	**10 – 15%**
• **Quizzes** Quizzes will be examined to determine the extent to which students meet course objectives.	**15 – 20%**
• **2 or more Tests** (dates specified by the instructor) Tests will show evidence of the extent to which students meet course objectives, including, but not limited to, identifying and applying concepts, analyzing and solving problems, estimating and interpreting results, and stating appropriate conclusions using correct terminology.	**30 – 45%**
• **Final Exam** The **comprehensive** final exam will examine the extent to which students have understood and synthesized all course content and achieved all course objectives.	**30 – 35%**

NOTE: The instructor will provide specific weights, which lie in the above-given ranges, for each of the grading components at the beginning of the semester.

Academic Integrity: Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

- plagiarism – the failure to acknowledge another writer's words or ideas or to give proper credit to sources of information;

- cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;

- interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and

- fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

Student Code of Conduct: All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, *Lifeline*, for more specific information about the College's Code of Conduct and attendance requirements.

Course Content Outline: based on the text **Basic Technical Mathematics with Calculus**, 9th edition, by Allyn J. Washington; published by Pearson Prentice Hall, New Jersey, 2008. ISBN# 13: 978-0-13-8142261

Class Meeting (105 minutes)	Chapter/Section	
	CHAPTER 23 THE DERIVATIVE	
1	23.1	Limits
2	23.2	Slope of a Tangent to a Curve
3	23.3	The Derivative
4	23.4	The Derivative as an Instantaneous Rate of Change
5	23.5	Derivatives of Polynomials
6	23.6	Derivatives of Products and Quotients of Functions
7	23.7	The Derivatives of a Power of a Function
8	23.8	Differentiation of Implicit Functions
9	23.9	Higher Derivatives
10	Review for Test #1	
11	**Test #1** on Chapter 23	
	CHAPTER 24 APPLICATIONS OF THE DERIVATIVE	
12	24.1	Tangents and Normals
	24.2	Newton's Method for Solving Equations (optional)
13	24.3	Curvilinear Motion
14	24.4	Related Rates
15	24.5	Using Derivatives in Curve Sketching
16	24.6	More on Curve Sketching
17	24.7	Applied Maximum and Minimum
18	Review for Test #2	
19	**Test #2** on Chapter 24	
	CHAPTER 25 INTEGRATION	
20	25.1	Antiderivatives
21	25.2	The Indefinite Integral
	25.3	The Area Under the Curve
22	25.4	The Definite Integral
23	25.5	Numerical Integration: The Trapezoidal Rule
24	25.6	Simpson's Rule
	CHAPTER 26 APPLICATIONS OF INTEGRATION	
25	26.1	Applications of the Indefinite Integral
26	26.2	Areas by Integration
27	Review for Final Exam	
28	Comprehensive **Final Exam** on all course material covered	