ESSEX COUNTY COLLEGE
Mathematics and Physics Division
MTH 121 – Calculus with Analytic Geometry I
Course Outline

Course Number & Name: MTH 121 Calculus with Analytic Geometry I

Credit Hours: 4.0 **Contact Hours:** 4.0 **Lecture:** 4.0 **Lab:** N/A **Other:** N/A

Prerequisites: Grade of "C" or better in MTH 120 or placement

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

Course Outline Revision Date: Fall 2010

Course Description: This is the first course covering a rigorous sequence in early transcendental calculus. Topics covered include the theory and application of limits, continuity, differentiation, anti-differentiation and the Fundamental Theorem of Calculus. Methods and applications include related rates, implicit differentiation, indeterminate forms, Newton's method, the Mean Value theorems, and volumes.

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 calculus; (GEG 2)
2. utilize various problem-solving and critical-thinking techniques to set up and solve applied problems in engineering, sciences, business and technology 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 appropriate technology, such as graphing calculators and computer software, 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 calculus:
   - 1.1 *define limits, continuity and derivatives*;
   - 1.2 e*valuate limits by using the limit laws*;
   - 1.3 e*valuate derivatives by using various rules such as sum, product, quotient, chain, and l`Hospital's rules as well as implicit differentiation with applications in the tangent lines, extreme values and local linearity*;
   - 1.4 a*pproximate definite integrals by calculating the limit of Riemann sums and exactly evaluate definite and indefinite integrals using the Fundamental Theorem in Calculus*;
   - 1.5 a*pply the derivative of functions to find critical points and extreme values, and to graphs functions*; and
   - 1.6 a*pply differentials to approximate the function values*

2. Utilize various problem-solving and critical-thinking techniques to set up and solve applied problems in engineering, sciences, business and technology fields:
   - 2.1 a*pply integrals to calculate areas, work and volumes of revolution*; and
   - 2.2 *apply derivatives to solve the relative rates and optimization problems in business and engineering*

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 related rates, optimization, and work and other application problems*

4. Use appropriate technology, such as graphing calculators and computer software, effectively as a tool to solve such problems as those described above:
   - 4.1 *use a graphing calculator and/or web-based application programs such as Applet to visualize graphs of functions. Identify limits, and calculate definite integrals*; and
   - 4.2 *use mathematical software such as Mathematica and Maple to calculate derivatives and integrals*

Methods of Instruction: Instruction will consist of a combination of lectures, class discussion, individual study, and computer lab work.

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. Read the textbook and do the suggested review problems in a timely manner.
2. Be an active participant in all classes.
3. Complete all written and/or electronic homework and adhere to assignment deadlines.
4. Take exams/quizzes in class and adhere to the exam/quiz schedule.

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

Grading Components	% of final course grade
• **Optional assignments** e.g., problem sets, research projects, etc., designed to enhance understanding of applications of calculus in engineering and related disciplines.	**0 – 10%**
• **3 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.	**60 – 70%**
• **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. Also, students may use a scientific or graphing calculator or laptop computer to enhance understanding during class or while doing homework. However, no form of technological aid can be used on tests/exams.

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 **Calculus: Early Transcendentals**, 6th edition, by Stewart; published by Cengage/Brooks/Cole, 2008; ISBN #: 0-53878256-0

Class Meeting (80 minutes)	Chapter/Section
	CHAPTER 2 LIMITS AND DERIVATIVES
1	2.1 The Tangent and Velocity Problems
2	2.2 The Limit of a Function
3	2.3 Calculating Limits Using the Limit Laws
4	2.4 The Precise Definition of a Limit: *This is optional material.*
5	2.5 Continuity
6	2.6 Limits at Infinity, Horizontal Asymptotes
7	2.7 Derivatives and Rates of Change
8	2.7 Derivatives and Rates of Change (continued)
9	2.8 The Derivative as a Function
	CHAPTER 3 DIFFERENTIATION RULES
10	3.1 Derivatives of Polynomials and Exponential Functions
11	3.2 The Product and Quotient Rules
12	3.3 Derivatives of Trigonometric Functions
13	3.4 The Chain Rule
14	3.4 The Chain Rule (continued)
15	**Test #1** on Chapter 2 & Sections 3.1 – 3.4
16	3.5 Implicit Differentiation
17	3.6 The Derivatives of Logarithmic Functions
18	3.9 Related Rates
19	3.9 Related Rates (continued)
20	3.10 Linear Approximations and Differentials
	CHAPTER 4 APPLICATIONS OF DIFFERENTIATION
21	4.1 Maximum and Minimum Values
22	4.2 The Mean Value Theorem
23	4.3 How Derivatives Affect the Shape of a Graph
24	4.4 Indeterminate Forms and l`Hospital's Rule
25	4.5 Summary of Curve Sketching
26	4.6 Graphing with Calculus and Calculators
27	4.7 Optimization Problems
28	4.9 Antiderivatives
29	**Test #2** on Sections 3.5 – 3.6, 3.9 – 3.10 & Chapter 4
	CHAPTER 5 INTEGRALS
30	5.1 Areas and Distances
31	5.2 The Definite Integral
32	5.3 The Fundamental Theorem of Calculus

Class Meeting (80 minutes)	Chapter/Section
33	5.4 Indefinite Integrals and the Total Change Theorem
34	5.5 The Substitution Rule
	CHAPTER 6 APPLICATIONS OF INTEGRATION
35	6.1 Areas Between Curves
36	6.2 Volume
37	**Test #3** on Chapter 5 & Sections 6.1 & 6.2
38	6.3 Volumes by Cylindrical Shells
39	6.4 Work
40	6.5 Average Value of a Function
41	Review for Final Exam
42	Comprehensive **Final Exam** on all course material covered