

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 2011

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: MTH 121 is affirmed in the following General Education Foundation Category: **Quantitative Knowledge and Skills.** The corresponding General Education Goal is as follows: Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

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;
2. utilize various problem-solving and critical-thinking techniques to set up and solve applied problems in engineering, sciences, business and technology fields;
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; and
4. use appropriate technology, such as graphing calculators and computer software, effectively as a tool to solve such problems as those described above.

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 *evaluate limits by using the limit laws;*
 - 1.3 *evaluate 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 *approximate definite integrals by calculating the limit of Riemann sums and exactly evaluate definite and indefinite integrals using the Fundamental Theorem in Calculus;*
 - 1.5 *apply the derivative of functions to find critical points and extreme values, and to graphs functions; and*
 - 1.6 *apply 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 *apply 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
♦ Homework 10 – 20% e.g., problem sets, research projects, etc., designed to enhance understanding of applications of calculus in engineering and related disciplines.	
♦ 3 or more Exams/Quizzes (dates specified by the instructor) Exams/quizzes 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.	50 – 60%
♦ 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.	20 – 30%

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, technological aids may only be used on select assessments (exams, quizzes, etc.) – instructors will inform students in advance when these technological aids are needed and may be used.

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**, 2nd edition, by Rogawski; published by Freeman, 2012; ISBN-10 #: 1-4292-0838-4; ISBN-13 #: 978-1-4292-0838-3

Class Meeting (80 minutes)	Chapter/Section
	CHAPTER 2 LIMITS
1	2.1 Limits, Rates of Change, and Tangent Lines
2	2.2 Limits: A Numerical and Graphing Approach
3	2.3 Basic Limit Laws
4	2.4 Limits and Continuity
5	2.5 Evaluating Limits Algebraically
6	2.6 Trigonometric Limits
7	2.7 Limits at Infinity
8	2.8 Intermediate Value Theorem
	CHAPTER 3 DIFFERENTIATION
9	3.1 Definition of the Derivative
10	3.2 The Derivative as a Function
11	3.3 Product and Quotient Rules
12	3.4 Rates of Change
13	3.5 Higher Derivatives
14	Test #1 on Chapters 2 & Sections 3.1 – 3.5
15	3.6 Trigonometric Functions
16	3.7 The Chain Rule
17	3.8 Derivatives of Inverse Functions
18	3.9 Derivatives of General Exponential and Logarithmic Functions
19	3.10 Implicit Differentiation
20	3.11 Related Rates
	CHAPTER 4 APPLICATIONS OF THE DERIVATIVE
21	4.1 Linear Approximation and Applications
22	4.2 Extreme Values
23	4.3 The Mean Value Theorem and Monotonicity
24	4.4 The Shape of a Graph
25	4.5 L'Hopital's Rule
26	4.6 Graph Sketching and Asymptotes
27	4.7 Applied Optimization
28	4.8 Newton's Method
29	4.9 Antiderivatives
30	Test #2 on Sections 3.6 – 3.11 & Chapter 4

**Class Meeting
(80 minutes)**

Chapter/Section

	CHAPTER 5 THE INTEGRAL
31	5.1 Approximating and Computing Area
32	5.2 The Definite Integral
33	5.3 The Fundamental Theorem of Calculus, Part I
34	5.4 The Fundamental Theorem of Calculus, Part II
35	5.5 Net Change as the Integral of a Rate
36	5.6 Substitution Method
	CHAPTER 6 APPLICATIONS OF THE INTEGRAL
37	6.1 Area Between Two Curves
38	6.2 Setting Up Integrals: Volume, Density, Average Value
39	<u>Test #3</u> on Chapter 5 & Sections 6.1 & 6.2
40	6.3 Volumes of Revolution
41	6.4 The Method of Cylindrical Shells
42	Review for Final Exam
43	Comprehensive <u>Final Exam</u> on all course material covered

MTH 121 Suggested Homework/Review Problems

NOTE: The format used below is **assignment # chapter.section.exercise number**.

1. 1.1.11, 1.1.19, 1.1.24, 1.1.33, 1.1.37, 1.1.46, 1.1.55, 1.2.1, 1.2.9, 1.2.22, 1.2.29, 1.2.33, 1.2.37, 1.3.1, 1.3.3, 1.3.5, 1.3.12, 1.3.26, 1.3.27, 1.3.36, 1.4.42, 1.4.57, 1.5.2, 1.5.4, 1.5.27, 1.5.28, 1.5.30, 1.5.39, 1.6.3, 1.6.5, 1.6.11, 1.6.18, 1.6.20, 1.6.28
2. 2.1.2, 2.1.4, 2.1.5, 2.1.7, 2.1.11, 2.1.14, 2.1.16, 2.1.17, 2.1.18, 2.1.22, 2.1.25, 2.1.30
3. 2.2.1, 2.2.4, 2.2.8, 2.2.9, 2.2.11, 2.2.12, 2.2.14, 2.2.17.T, 2.2.18, 2.2.20, 2.2.21, 2.2.23, 2.2.26, 2.2.28, 2.2.32, 2.2.34, 2.2.38, 2.2.53, 2.2.55, 2.2.56
4. 2.3.5.T, 2.3.9, 2.3.12, 2.3.13, 2.3.14, 2.3.27, 2.3.30, 2.3.31, 2.3.32
5. 2.4.1, 2.4.6, 2.4.9, 2.4.11, 2.4.13, 2.4.17, 2.4.22, 2.4.25, 2.4.27, 2.4.28, 2.4.33, 2.4.36, 2.4.38, 2.4.51, 2.4.57, 2.4.80, 2.4.84
6. 2.5.1, 2.5.3, 2.5.6, 2.5.9, 2.5.10, 2.5.12, 2.5.15, 2.5.18, 2.5.21, 2.5.24, 2.5.25, 2.5.27, 2.5.28, 2.5.30, 2.5.45, 2.5.49, 2.5.54
7. 2.6.2, 2.6.3, 2.6.6, 2.6.7, 2.6.10, 2.6.18, 2.6.20, 2.6.21, 2.6.22, 2.6.27, 2.6.28, 2.6.34, 2.6.49, 2.6.53, 2.6.55
8. 2.7.7, 2.7.9, 2.7.10, 2.7.12, 2.7.19, 2.7.21, 2.7.22, 2.7.25, 2.7.26, 2.7.31, 2.7.38, 2.7.39, 2.7.40, 2.7.41, 2.7.42
9. 2.8.4, 2.8.3, 2.8.13, 2.8.14, 2.8.19, 2.8.18
10. 3.1.1, 3.1.5, 3.1.7, 3.1.9, 3.1.11, 3.1.12, 3.1.14, 3.1.15, 3.1.19, 3.1.20, 3.1.22, 3.1.25, 3.1.28, 3.1.35, 3.1.52, 3.1.61
11. 3.2.1, 3.2.2, 3.2.4, 3.2.5, 3.2.6, 3.2.43, 3.2.44, 3.2.51, 3.2.64, 3.2.84
12. 3.3.1, 3.3.3, 3.3.5, 3.3.7, 3.3.8, 3.3.11, 3.3.16, 3.3.20, 3.3.26, 3.3.29, 3.3.32, 3.3.37, 3.3.39, 3.3.45, 3.3.46
13. 3.4.1, 3.4.4, 3.4.9a, 3.4.11a, 3.4.14, 3.4.37, 3.4.24
14. 3.5.1, 3.5.4, 3.5.9, 3.5.13, 3.5.14, 3.5.15, 3.5.20, 3.5.25, 3.5.28, 3.5.37, 3.5.37b, 3.5.39, 3.5.43, 3.5.51
15. 3.6.2, 3.6.6, 3.6.11, 3.6.12, 3.6.14, 3.6.17, 3.6.19, 3.6.28, 3.6.31, 3.6.38, 3.6.42, 3.6.43
16. 3.7.6, 3.7.29, 3.7.30, 3.7.31, 3.7.32, 3.7.34, 3.7.35, 3.7.36, 3.7.38, 3.7.40, 3.7.41, 3.7.53, 3.7.57, 3.7.65, 3.7.67
17. 3.8.1, 3.8.4, 3.8.9, 3.8.18, 3.8.19, 3.8.24, 3.8.25, 3.8.31, 3.8.32, 3.8.33
18. 3.9.2, 3.9.3, 3.9.6, 3.9.16, 3.9.17, 3.9.25, 3.9.33, 3.9.42, 3.9.45, 3.9.78
19. 3.10.1, 3.10.9, 3.10.20, 3.10.21, 3.10.31, 3.10.38, 3.10.39, 3.10.40, 3.10.48, 3.10.51
20. 3.11.1, 3.11.4, 3.11.5, 3.11.12, 3.11.16, 3.11.17, 3.11.19a, 3.11.21
21. 4.1.2, 4.1.1, 4.1.7, 4.1.13, 4.1.45, 4.1.57
22. 4.2.1, 4.2.2, 4.2.3, 4.2.5, 4.2.7, 4.2.8, 4.2.11, 4.2.14, 4.2.15, 4.2.17, 4.2.18, 4.2.19, 4.2.22, 4.2.23, 4.2.25, 4.2.34, 4.2.39, 4.2.47, 4.2.52, 4.2.67
23. 4.3.2, 4.3.11, 4.3.23, 4.3.25, 4.3.33, 4.3.37, 4.3.41, 4.3.45, 4.3.49, 4.3.56, 4.3.62
24. 4.4.2, 4.4.3, 4.4.8, 4.4.9, 4.4.11, 4.4.13, 4.4.15, 4.4.20, 4.4.21, 4.4.22, 4.4.34, 4.4.50, 4.4.53
25. 4.5.6, 4.5.7, 4.5.8, 4.5.9, 4.5.10, 4.5.12, 4.5.18, 4.5.23, 4.5.35, 4.5.36
26. 4.6.1, 4.6.10, 4.6.11, 4.6.29, 4.6.30, 4.6.34, 4.6.56, 4.6.57, 4.6.63, 4.6.69
27. 4.7.3, 4.7.4, 4.7.8, 4.7.9, 4.7.11, 4.7.29
28. 4.8.1, 4.8.7, 4.8.8, 4.8.23
29. 4.9.1, 4.9.2, 4.9.5, 4.9.7, 4.9.47, 4.9.51, 4.9.52, 4.9.55, 4.9.59, 4.9.63, 4.9.66, 4.9.68
30. 5.1.1, 5.1.3, 5.1.5, 5.1.7, 5.1.12, 5.1.16, 5.1.25, 5.1.31, 5.1.32, 5.1.43, 5.1.46, 5.1.51, 5.1.61
31. 5.2.1, 5.2.4, 5.2.6, 5.2.7, 5.2.8, 5.2.15, 5.2.17, 5.2.21, 5.2.31, 5.2.43, 5.2.58, 5.2.71

MTH 121 Suggested Homework/Review Problems (continued)

NOTE: The format used below is **assignment # chapter.section.exercise number**.

- 32. 5.3.2, 5.3.9, 5.3.18, 5.3.23, 5.3.46, 5.3.55
- 33. 5.4.2, 5.4.3, 5.4.6, 5.4.16, 5.4.18, 5.4.25, 5.4.32, 5.4.37, 5.4.40, 5.4.46
- 34. 05.5: 5.5.2, 5.5.5, 5.5.6, 5.5.8, 5.5.13
- 35. 5.6.7, 5.6.9, 5.6.15, 5.6.17, 5.6.18, 5.6.22, 5.6.23, 5.6.26, 5.6.28, 5.6.31, 5.6.33, 5.6.47, 5.6.48, 5.6.55,
5.6.64, 5.6.65, 5.6.69, 5.6.79, 5.6.80, 5.6.81, 5.6.87, 5.6.94
- 36. 6.1.1, 6.1.4, 6.1.5, 6.1.9, 6.1.12, 6.1.17, 6.1.20
- 37. 6.2.6, 6.2.11, 6.2.39, 6.2.41, 6.2.48, 6.2.49
- 38. 6.3.3, 6.3.15, 6.3.17, 6.3.21, 6.3.39
- 39. 6.4.7, 6.4.8, 6.4.9, 6.4.10, 6.4.49