**1. COURSE TITLE\*:** Calculus I

**2. CATALOG – PREFIX/COURSE NUMBER/COURSE SECTION\*: MATH 2221**

**3. PREREQUISITE\*:**

One of the following:

* Math 1141 with a grade of B or higher and Math 1142
* Four High school STEM or Core Math courses with grades A, A, B, B or higher. This must include a course covering trigonometry
* ACT Math score of 26 or above or SAT Math score of 610 or above.

**COREQUISITE(S)\*: None**

**4. COURSE TIME/LOCATION/MODALITY: (*Course Syllabus – Individual Instructor Specific*)**

**5. CREDIT HOURS\*:** 5 **LECTURE HOURS\*:** 5

**LABORATORY HOURS\*:** 0 **OBSERVATION HOURS\*:** 0

**6. FACULTY CONTACT INFORMATION: *(Course Syllabus – Individual Instructor Specific)***

**7. COURSE DESCRIPTION:**

This course introduces calculus using analytic geometry and transcendental functions. Topics include limits and continuity, derivatives, optimization, related rates, graphing and other applications of derivatives, definite and indefinite integrals, and numerical integration.

**8. LEARNING OUTCOMES\*:**

Upon completion of this course, the student will be able to…

1. analyze limits graphically and numerically. The student visually describes the limiting process with graphs of functions. The student produces/reads tables of function values which illustrate limit properties.
2. find limits algebraically. The student organizes a well-formed presentation of the details involved in the limiting process via formulas.
3. recognize and explain limits at infinity. The student furthers their understanding of infinity and how to logically work with unboundedness.
4. communicate fluently about the concept of continuity.
5. apply the definition of the derivative to differentiate a function at a number and extend to an interval, choose appropriate differentiation rules and apply them, and parse formulas for application of the chain rule.
6. operate the derivative as a tool. The derivative measures rates of change, and the student is able to utilize this tool within the framework of a functional model, including connecting the slope of a tangent line with the value of the derivative.
7. work with implicitly defined functions. The student begins to expand their idea of function beyond a representation where the dependent variable is isolated on one side of an equation.
8. identify critical numbers and extrema values. The student separates function characteristics from features of the graph.
9. sketch curves/graphs of functions using derivatives and limits. The student acquires a level of competency with visual representations.
10. optimize quantities in applied problems. The student develops some fluency with the application of calculus tools to physical situations modeled by functions.
11. create antiderivatives. The student is fluent with the differentiation – antidifferentiation relationship and uses the FTC and integration by substitution.
12. measure area of bounded planar regions. Given a planar region whose boundary curves are described by equations, the student describes the situation in terms of functions and accompanying integration setup.
13. understand the Fundamental Theorem of Calculus (FTC). The FTC connects the measurements of rates of change and accumulation.

**9.       ADOPTED TEXT(S)\*:**

*Calculus*. Third Edition.

 Briggs, Cochran, Gillett, Schulz

Pearson, 2019

ISBN # 978-0-13-476563-1

OR

            *Calculus*. Volume 1.

Strang, Herman

OpenStax, 2016

Download for free at <https://openstax.org/details/books/calculus-volume-1>

**9a: SUPPLEMENTAL TEXTS APPROVED BY FULL TIME DEPARTMENTAL FACULTY (INSTRUCTOR MUST NOTIFY THE BOOKSTORE BEFORE THE TEXTBOOK ORDERING DEADLINE DATE PRIOR TO ADOPTION) \*\*\*.**

**10. OTHER REQUIRED MATERIALS: (SEE APPENDIX C FOR TECHNOLOGY REQUEST FORM.)\*\***

A scientific calculator is required; a graphing calculator is strongly recommended. Symbolic manipulator calculators (e.g., TI–89 or TI-Nspire) are prohibited on tests.

**11. GRADING SCALE\*\*\*:**

Grading will follow the policy in the catalog. The scale is as follows:

A: 90 – 100

 B: 80 – 89

 C: 70 – 79

 D: 60 – 69

 F: 0 – 59

**12. GRADING PROCEDURES OR ASSESSMENTS: (*Course Syllabus – Individual Instructor Specific)***

|  |
| --- |
| *Example 1 - By Percent* |
|  Homework 10% Quizzes/Tests 90% Total 100% |

|  |
| --- |
| *Example 2*  |
| *Category* | *By Total Points* | *% of Grade* |
| Homework (20x10) | 200 | 10% |
| Quizzes/Tests(5x360) | 1800 | 90% |
| Total | 2000 | 100% |

|  |
| --- |
| *Example 3* |
| *Category* | *By Total Points* | *% of Grade* |
| Online Quizzes | 400 | 100% |
| Online Tests(6x100) | 600 | 15% |
| Notebook(2x500) | 1000 | 25% |
| Midterm | 1000 | 25% |
| Final | 1000 | 25% |
| Total | 4000 | 100% |

**13. COURSE METHODOLOGY: *(Course Syllabus – Individual Instructor Specific)***

The course design provides instruction and materials to support the course objectives.  Classes may consist of a variety of means to accomplish this including but not limiting to: lectures, class discussions, small group projects, supplemental materials, and outside assignments.  Practice is an important part of the learning process.  For every one hour of class time, two additional hours of study time should be expected.

**14. COURSE OUTLINE: *(Course Syllabus – Individual Instructor Specific)***

 ***Pearson***

**Chapter 1: Functions**

 1.1 Review of Functions (optional review)

 1.2 Representing Functions (optional review)

 1.3 Trigonometric Functions (optional review)

**Chapter 2: Limits – LO 1, 2, 3, 4**

 2.1 The Idea of Limits

 2.2 Definitions of Limits

 2.3 Techniques for Computing Limits

 2.4 Infinite Limits

 2.5 Limits at Infinity

 2.6 Continuity

 2.7 Precise Definitions of Limits

 **Chapter 3: Derivatives – LO 5, 6, 7**

 3.1 Introducing the Derivative

 3.2 The Derivative as a Function

 3.3 Rules of Differentiation

 3.4 The Product and Quotient Rules

 3.5 Derivatives of Trigonometric Functions

 3.6 Derivatives as Rates of Change

 3.7 The Chain Rule

 3.8 Implicit Differentiation

 3.9 Related Rates

 **Chapter 4 Applications of the Derivative – LO 2, 6, 8, 9, 10, 11**

 4.1 Maxima and Minima

 4.2 Mean Value Theorem

 4.3 What Derivatives Tell Us

 4.4 Graphing Functions

 4.5 Optimization Problems

 4.6 Linear Approximation and Differentials

 4.7 L’Hôpital’s Rule

 4.8 Newton’s Method

 4.9 Antiderivatives

 **Chapter 5 Integration – LO 11, 12, 13**

 5.1 Approximating Areas under Curves

 5.2 Definite Integrals

 5.3 Fundamental Theorem of Calculus

 5.4 Working with Integrals

 5.5 Substitution Rule

**Chapter 7 Logarithmic and Exponential Functions – LO 2, 5, 11**

7.1 Inverse Functions

7.2 The Natural Logarithmic and Exponential Functions

7.3 Logarithmic and Exponential Functions with Other Bases

7.4 Exponential Models

7.5 Inverse Trigonometric Functions

7.6 L’Hôpital’s Rule and Growth Rates of Functions

7.7 Hyperbolic Functions

 ***OpenStax***

**Chapter 1: Functions and Graphs**

 1.1 Review of Functions (optional review)

 1.2 Basic Classes of Functions (optional review)

 1.3 Trigonometric Functions (optional review)

1.4 Inverse Functions (optional review)

1.5 Exponential and Logarithmic Functions (optional review)

**Chapter 2: Limits**

 2.1 A Preview of Calculus – LO1

 2.2 The Limit of a Function – LO1

 2.3 The Limit Laws\* – LO2

 2.4 Continuity – LO4

 2.5 The Precise Definition of a Limit – LO1

\*Note to instructors: Section 2.3 introduces the direct substitution method for evaluating limits of polynomial and rational functions; however, some exercises in this section ask students to use the direct substitution method with limits of other types of functions. Therefore, it is recommended that instructors introduce the direct substitution method in its more general form as a consequence of continuity.

 **Chapter 3: Derivatives**

 3.1 Defining the Derivative – LO5

 3.2 The Derivative as a Function – LO5

 3.3 Differentiation Rules – LO5

 3.4 Derivatives as Rates of Change – LO6

 3.5 Derivatives of Trigonometric Functions – LO5

 3.6 The Chain Rule – LO5

 3.7 Derivatives of Inverse Functions – LO5

 3.8 Implicit Differentiation – LO7

 3.9 Derivatives of Exponential and Logarithmic Functions – LO5

 **Chapter 4 Applications of Derivatives**

 4.1 Related Rates – LO6

 4.2 Linear Approximation and Differentials – LO6

 4.3 Maxima and Minima – LO8

 4.4 The Mean Value Theorem – LO6

 4.5 Derivatives and the Shape of a Graph\* – LO6

 4.6 Limits at Infinity and Asymptotes – LO3, 9

 4.7 Applied Optimization Problems – LO10

 4.8 L’Hôpital’s Rule – LO2

 4.9 Newton’s Method (optional)

 4.10 Antiderivatives – LO11

\*Note to instructors: To prepare students for optimization problems on open intervals, students should be introduced to the fact that one local extremum implies absolute extremum: “Suppose *f* is continuous on an interval *I* that contains exactly one local extremum at *a*. If a local maximum or minimum value occurs at *a*, then *f(a)* is an absolute maximum or minimum value of *f* on *I*.”

 **Chapter 5 Integration**

 5.1 Approximating Areas – LO12

 5.2 The Definite Integral – LO12

 5.3 The Fundamental Theorem of Calculus – LO11, 13

 5.4 Integration Formulas and the Net Change Theorem – LO13

 5.5 Substitution – LO11

 5.6 Integrals Involving Exponential and Logarithmic Functions – LO11

 5.7 Integrals Resulting in Inverse Trigonometric Functions – LO11

Suggested pace for the course, by section numbers (Pearson):

Week 1: 2.1, 2.2, 2.3

Week 2: 2.4, 2.5

Week 3: 2.6, 2.7

Week 4: 3.1, 3.2, 3.3

Week 5: 3.4, 3.5, 3.6

Week 6: 3.7, 3.8, 3.9

Week 7: 4.1, 4.2, 4.3

Week 8: 4.4, 4.5

Week 9: 4.5, 4.6, 4.7, 4.8

Week 10: 4.9, 5.1, 5.2

Week 11: 5.3, 5.4

Week 12: 5.5, 7.1

Week 13: 7.2, 7.3

Week 14: 7.4, 7.5

Week 15: 7.6, 7.7

Week 16: **Finals**

Suggested pace for the course, by section numbers (OpenStax):

Week 1: Review, 2.1, 2.2

Week 2: 2.2, 2.3, 4.6

Week 3: 2.4, 2.5

Week 4: 3.1, 3.2, 3.3

Week 5: 3.4, 3.5, 3.6

Week 6: 3.7, 3.8

Week 7: 3.9, 4.1

Week 8: 4.2, 4.3

Week 9: 4.4, 4.5

Week 10: 4.6, 4.7

Week 11: 4.8, 4.10

Week 12: 5.6, 5.7, 5.1

Week 13: 5.2, 5.3, 5.6, 5.7

Week 14: 5.3, 5.4

Week 15: 5.5

Week 16: **Finals**

**15. SPECIFIC MANAGEMENT REQUIREMENTS\*\*\*:**

**16. FERPA:\***

Students need to understand that their work may be seen by others. Others may see your work when being distributed, during group project work, or if it is chosen for demonstration purposes. Students also need to know that there is a strong possibility that your work may be submitted to other entities for the purpose of plagiarism checks.

**17. ACCOMMODATIONS:\***

Students requesting accommodations may contact Ryan Hall, Accessibility Coordinator at rhall21@sscc.edu or 937-393-3431 X 2604.

Students seeking a religious accommodation for absences permitted under Ohio’s Testing Your Faith Act must provide the instructor and the Academic Affairs office with written notice of the specific dates for which the student requires accommodation and must do so no later than fourteen (14) days after the first day of instruction or fourteen (14) days before the dates of absence, whichever comes first. For more information about Religious Accommodations, contact Ryan Hall, Accessibility Coordinator at rhall21@sscc.edu or 937-393-3431 X 2604.

**18. OTHER INFORMATION\*\*\*:**

**SYLLABUS TEMPLATE KEY**

**\*** Item cannot be altered from that which is included in the master syllabus approved by the Curriculum Committee.

**\*\*** Any alteration or addition must be approved by the Curriculum Committee

\*\*\*Item should begin with language as approved in the master syllabus but may be added to at the discretion of the faculty member.