



COURSE OUTLINE

Course Number	Course Title	Credits
MAT151	Calculus I for the Mathematical and Physical Sciences	4
Hours: Lecture/Lab/Other	Co- or Pre-requisite	Implementation sem/year
4 Lecture	MAT146 with a minimum C grade or better or equivalent placement score on the College Level Math Placement Test	Spring 2019

Catalog description (2018-2019 Catalog):

First course in the standard integrated calculus sequence. Topics include differentiation of algebraic, exponential, logarithmic, trigonometric, hyperbolic, and inverse trigonometric functions. Applications include curve sketching, related rates, maxima, minima, and approximations. Integration and applications of the definite integral are covered

Is the course New, Revised or Modified? No

Required texts/other materials

1. Text: Calculus with Early Transcendentals, 8th Edition
Author: Stewart
Publisher: Thomson
2. Calculator: A graphing calculator is required. Recommended: TI-83, 84 or 86. Calculators with symbolic manipulation are not permitted.

Revision date:

Spring 2019

Course coordinator:

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Information resources:

- The college library has many books, CDs and videos available.
- WebAssign is an on-line companion to the text offering practice problems, solutions, and other online resources.
- The Learning Center has tutoring and help available to the students.

Course-specific General Education Knowledge Goals and Core Skills:**MCCC Core Skills:**

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.

Goal D. Information Literacy. Students will recognize when information is needed and have the knowledge to locate, evaluate and effectively use information for college work.

Goal E. Computer Literacy. Students will use computers to access, analyze or present information, solve problems and communicate with others.

General Education Knowledge Goals:

Goal 1. Communication. Students will communicate effectively in both speech and writing.

Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

In the following Course-Specific Competencies/Goals, **MCCC Core Skills** will be denoted MCS and **General Education Knowledge/Goals** will be denoted GE.

Course Competencies/Goals:

Students will be able to demonstrate the ability to:

1. find limits of functions including finding limits of indeterminate form. (MCS A,B,D,E; GE 1,2,4)
2. understand that graphically the derivative may be thought of as the slope of a tangent line and that the derivative is the instantaneous rate of change of one variable with respect to another variable. (MCS A,B; GE 1,2)
3. find the derivative of various kinds of functions and use the derivative to solve related rate, optimization, and other kinds of problems. (MCS A,B,E; GE 1,2,4)
4. graph functions using the first derivative and second derivative to find extrema and inflection points. (MCS A,B,D,E; GE 1,2,4)
5. understand the concept of integration and visualize an integral as an area under a curve. (MCS A,B,D,E; GE 1,2,4)
6. find antiderivatives of simple functions understanding that applications and other methods of integration will follow in the next course. (MCS A,B; GE 1,2,4)
7. use the Fundamental Theorem of Calculus to find definite integrals using substitution. (MCS A,B; GE 1,2)

In the following **Units of study in detail** Course Competencies/Goals will be denoted CG.

Unit I – Functions and Graphs (4 weeks)

The student will be able to:

1. define and use properly in written and oral communication all of the vocabulary presented in this unit. (CG 1)
2. determine one-sided and two-sided limits of various functions from their graphs. (CG 1)
3. determine infinite limits and limits at $\pm \infty$ from graphs. (CG 1)
4. use various theorems on limits to calculate limits of functions algebraically. (CG 1)
5. use the delta-epsilon definition of limit to determine delta when given epsilon, or to prove the truth of a given limit. (CG 1)
6. define continuity and be able to determine points of discontinuity, if they exist, for given functions; and be able to describe discontinuity points as removable or non-removable discontinuities. (CG 1)
7. determine vertical and horizontal asymptotes, if they exist, for a given function. (CG 1)
8. explain how limits at specific values of “x” or at infinity can fail to exist. (CG 1)
9. state and use the Intermediate Value Theorem to approximate roots. (CG 1)
10. find limits and determine points of discontinuity of trigonometric functions using

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1 \text{ and } \lim_{x \rightarrow 0} \frac{1 - \cos x}{x} = 0. \text{ (CG 1)}$$
11. state and use the Squeezing Theorem to find limits. (CG 1)

Unit II: The Derivative (5 weeks)

The student will be able to:

1. determine average versus instantaneous velocity using the slope of the secant line through two points and the slope of the tangent line through a given point on the position function. (CG 2,3)
2. calculate the instantaneous rate of change of y with respect to x and distinguish this from average rate of change of y with respect to x for a given function. (CG 2,3)
3. define the derivative $f'(x)$ or $\frac{dy}{dx}$ or y' to be

$$\frac{dy}{dx} = \lim_{x \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$
 and be able to find the derivative and the equation of the tangent line to $y = f(x)$ at a given point $x = a$. (CG 2,3)

4. use the theorems on techniques of differentiation to differentiate constant, polynomial, products, quotients, exponential, logarithmic, inverse trigonometric, and hyperbolic functions. (CG 2,3)
5. find higher order derivatives (y'' , y''' etc.) of functions. (CG 2,3)
6. use the chain rule to find derivatives of composite functions. (CG 2,3)
7. use differentials to approximate changes in function values, and to find the local linear approximation of f at x_0 using $f(x) \approx f(x_0) + f'(x_0)(x - x_0)$. (CG 2,3)
8. find the propagated error, relative error, and percentage error in applications problems caused by given errors in measurements. (CG 2)
9. find dy for a given function. (CG 2,3)
10. use differentiation with respect to time, t , to solve related rate problems. (CG 2,3)
11. apply the concept of rate of change to solve problems in natural and social science problems. (CG 2,3)
12. define and use properly in written and oral communication all of the vocabulary presented in this unit. (CG 1)

Unit III Analysis of Functions and Their Graphs (3.5 weeks)

The student will be able to:

1. determine intervals where a function is increasing, decreasing, or constant by analyzing its first derivative. (CG 2,4)
2. use the Extreme Value Theorem to find absolute extrema of a function, if they exist. (CG 2,4)
3. define and find critical numbers. (CG 2,3,4)
4. use the first and second derivative tests to find intervals of increase, decrease, upward and/or downward concavity. (CG 2,3,4)
5. analyze other limits of indeterminate forms such as $0 \cdot \infty$, $\infty - \infty$, 0^0 , ∞^0 , 1^∞ to see if they can be found; or if L' Hospital's Rule should be applied to find the limit. (CG1, 2)
6. define and locate points of inflection for a function. (CG 2,3,4)
7. graph functions using knowledge learned in precalculus courses as well as the tools of calculus such as limits, first derivative, and second derivative. (CG 2,3,4)
8. know, understand its shortcomings, and be able to apply Newton's Method to find zeros of functions. (CG 2,3,4)
10. solve optimization problems. (CG 34)
11. state Rolle's Theorem and the Mean-Value Theorem, and use the theorems to solve problems. (CG 2,3,4)
12. find antiderivatives of simple polynomial, logarithmic, trigonometric, and exponential functions. (CG 5,6)
13. define and use properly in written and oral communication all of the vocabulary presented in this unit. (CG 2,3,4,5,6)

Unit IV Integration

(2.5 weeks)

The student will be able to:

1. associate integration with finding the area under a curve. (CG 5,6)
2. use a u – substitution to find an indefinite integral and, when given conditions, evaluate the constant of integration. (CG 5,6)
3. define and be able to find a definite integral. (CG 6,7)
4. state and apply the Fundamental Theorem of Calculus. (CG 5,6,7)
5. use integration techniques to determine velocity and position functions when given an acceleration function. (CG 5,6,7)
6. use u – substitution to rewrite the integrals and redefine its bounds to evaluate composite function integrals. (CG 6)
7. define the natural logarithm as an integral and use the definition and the properties of limits to aid in evaluating limits of exponential and logarithmic functions. (CG 1,2,6)
8. define and use properly in written and oral communication all of the vocabulary presented in this unit. (CG 2,3,4,5,6)

Evaluation of Student Learning:

Tests, quizzes, homework assignments and projects may be used in evaluating the students' progress throughout the course depending on the individual instructor. It is suggested that four unit tests and a final exam be used in evaluating the students' progress. A suggested day-by-day schedule and suggested homework problems should be available to the students. A final exam must be given in the course.

A possible plan for determining the students' final grades is as follows:

Unit tests (4 – one for each unit)	60%
Cumulative Final Exam	25%
Homework, Projects and quizzes	15%

Statement of Academic Integrity

Under no circumstance should students knowingly represent the work of another as one's own. Students may not use any unauthorized assistance to complete assignments or exams, including but not limited to cheat-sheets, cell phones, text messaging and copying from another student. Violations should be reported to the Academic Integrity Committee and will be penalized. Please refer to the Student Handbook for more details.