Effective Fall 2018, 201920

Required Syllabus Information – all must be included in the course syllabus

MAT 201
Course Title: Calculus I: MA1
Course Credits: 5
Course Description: Introduces single variable calculus and analytic geometry. It includes limits, continuity, derivatives, and applications of derivatives as well as indefinite and definite integrals and some applications.

GT Pathways Requirements:

Guaranteed Transfer (GT) Pathways Course Statement:
The Colorado Commission on Higher Education has approved MAT 201 for inclusion in the Guaranteed Transfer (GT) Pathways program in the GT- MA1 category. For transferring students, successful completion with a minimum C– grade guarantees transfer and application of credit in this GT Pathways category. For more information on the GT Pathways program, go to http://highered.colorado.gov/academics/transfers/gtpathways/curriculum.html.

MATHEMATICS CONTENT CRITERIA GT-MA1

a) Demonstrate good problem-solving habits, including:
   - Estimating solutions and recognizing unreasonable results.
   - Considering a variety of approaches to a given problem, and selecting one that is appropriate.
   - Interpreting solutions correctly.
b) Generate and interpret symbolic, graphical, numerical, and verbal (written or oral) representations of mathematical ideas.
c) Communicate mathematical ideas in written and/or oral form using appropriate mathematical language, notation, and style.
d) Apply mathematical concepts, procedures, and techniques appropriate to the course.
e) Recognize and apply patterns or mathematical structure.
f) Utilize and integrate appropriate technology.

COMPETENCIES & STUDENT LEARNING OUTCOMES FOR GT-MA1

Quantitative Literacy:

1. **Interpret Information**
   a. Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).
2. **Represent Information**
   a. Convert information into and between various mathematical forms (e.g., equations, graphs, diagrams, tables, words).
3. **Perform Calculations**
   a. Solve problems or equations at the appropriate course level.
   b. Use appropriate mathematical notation.

c. Solve a variety of different problem types that involve a multi-step solution and address the validity of the results.

4. **Apply and Analyze Information**
    a. Make use of graphical objects (such as graphs of equations in two or three variables, histograms, scatterplots of bivariate data, geometrical figures, etc.) to supplement a solution to a typical problem at the appropriate level.
    b. Formulate, organize, and articulate solutions to theoretical and application problems at the appropriate course level.
    c. Make judgments based on mathematical analysis appropriate to the course level.
5. **Communicate Using Mathematical Forms**
    a. Express mathematical analysis symbolically, graphically, and in written language that clarifies/justifies/summarizes reasoning (may also include oral communication).

SYSTEM REQUIREMENTS:

REQUIRED COURSE LEARNING OUTCOMES

1. Evaluate limits using appropriate analytical, numerical or graphical techniques.
2. Analyze the continuity of functions.
3. Apply the definition and techniques of differentiation to find derivatives, including derivatives of transcendental functions.
4. Analyze functions represented by an equation or a graph using derivatives and limits.
5. Create graphs of functions using properties of derivatives and limits.
6. Apply techniques of integration to find the antiderivative of a function.
7. Evaluate definite integrals using Riemann Sums and the Fundamental Theorem of Calculus.
8. Utilize Calculus techniques to solve application problems.

REQUIRED TOPICAL OUTLINE

The required topical outline information MUST be included in the syllabi. It may be incorporated using one of the following variations: copying the topical outline as written below, integrating the topics within the assignment schedule, or listing the topics to be covered.

I. Limits using appropriate analytical, numerical or graphical techniques
    a. Limits computation
    b. Properties of limits
    c. Limits at infinity
    d. Infinite limits
II. Continuity of functions
    a. Definition of continuity
    b. Discontinuities with respect to type (removable or non-removable)
    c. Intermediate Value Theorem
III. Definition of derivative and techniques of differentiation
    a. The limit definition of a derivative
    b. Basic rules of derivatives
    c. Product Rule
    d. Quotient Rule
    e. Chain Rule

f. Higher order derivatives
g. Implicit differentiation
h. Introduction of differentials
i. Derivatives of trigonometric functions
j. Derivatives of inverse trigonometric functions
k. Derivatives of exponential and logarithmic functions

IV. Functions represented by an equation or a graph using derivatives and limits
a. Critical values
b. Absolute extrema on an interval
c. Increasing and decreasing intervals
d. First and Second Derivative Tests for relative extrema
e. Inflection points
f. Intervals of concavity
g. Graphical connection between f and f'
h. Asymptotic behavior with limits
i. Graphs of functions using properties of derivatives and limits
j. Graphing techniques without technology
k. Graphing techniques with appropriate technology

V. Techniques of integration to find the antiderivative of a function
a. Indefinite integrals
b. Integration by substitution
c. Integration of trigonometric functions
d. Integration involving inverse trigonometric functions
e. Integration involving exponential and logarithmic functions

VI. Definite integrals using Riemann Sums and the Fundamental Theorem of Calculus.
a. Riemann's Sums
b. Definite integrals
c. Fundamental Theorem of Calculus
d. Integration techniques with appropriate technology

VII. Calculus techniques to solve application problems
a. Mean Value Theorem
b. Equations of tangent lines
c. Related rates
d. Rates of change
e. Optimization
f. Net signed area
g. Area between two curves

RECOMMENDED TOPICAL OUTLINE

I. Additional limit topics
a. Verify limits using the limit definition
b. Integration and differentiation of additional functions.
c. Hyperbolic functions

II. Additional integration topics
a. Numerical integration
b. Mean Value Theorem for integrals
c. Average Value of a function

d. Techniques of integration for evaluating functions

III. Additional applications
   a. Volumes of revolution using disk and shell methods
   b. Euler's Method
   c. Linearization of a function
   d. Newton's Method
   e. Physics problems involving work
   f. Fluid: pressure and force

Syllabi requirements, including legal compliance information must be included. Individual College syllabi guidelines may include additional information. Please contact your VPI/CAO for specific College requirements.