Effective Spring 2019, 201930

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

MAT 202
Course Title: Calculus II: MA1
Course Credits: 5
Course Description: Continues the study of single variable calculus which will include techniques of integration, analytic geometry, improper integrals, convergence of infinite numerical series and power series.

GT Pathways Requirements:

Guaranteed Transfer (GT) Pathways Course Statement:
The Colorado Commission on Higher Education has approved MA 202 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.

CONTENT CRITERIA FOR GT-MA1 COURSES

Students should be able to:

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 AND STUDENT LEARNING OUTCOMES ASSOCIATED WITH GT-MA1 COURSES

GT PATHWAYS COMPETENCY: QUANTITATIVE LITERACY
Competency in quantitative literacy represents a student's ability to use quantifiable information and mathematical analysis to make connections and draw conclusions. Students with strong quantitative literacy skills understand and can create sophisticated arguments supported by quantitative evidence and can clearly communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc.)

1. Student Learning Outcome (SLO 1): Employ Rhetorical Knowledge
    a. Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).

2. Student Learning Outcome (SLO 2): Employ Rhetorical Knowledge
    a. Convert information into and between various mathematical forms (e.g., equations, graphs, diagrams, tables, words).
3. Student Learning Outcome (SLO 3): Employ Rhetorical Knowledge
    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. Student Learning Outcome (SLO 4): Employ Rhetorical Knowledge
    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. Student Learning Outcome (SLO 5): Employ Rhetorical Knowledge
    a. Express mathematical analysis symbolically, graphically, and in written language that clarifies/justifies/summarizes reasoning (may also include oral communication).
6. Student Learning Outcome (SLO 6 required for Statistics courses only): Address Assumptions
    a. Describe and support assumptions in estimation, modeling, and data analysis, used as appropriate for the course.

REQUIRED COURSE LEARNING OUTCOMES

1. Solve application problems related to integration.
2. Solve introductory differential equations and associated initial value problems.
3. Apply appropriate integration techniques including integration by parts, trig substitution and partial fractions to evaluate definite, indefinite, and improper integrals.
4. Demonstrate the convergence or divergence of infinite sequences and series.
5. Express functions as power series (including Taylor series) with the appropriate interval of convergence.
6. Estimate errors in series approximations.
7. Graph curves in polar and parametric form.
8. Analyze curves in polar and parametric form using calculus techniques.

REQUIRED TOPICAL OUTLINE

I. Application problems related to integration
    a. Volumes of revolution using disk and shell methods
    b. Arc length
    c. Surface area of revolution
    d. Work
    e. Centroids

II. Introductory differential equations and associated initial value problems
    a. Separation of variables
    b. Initial value problems

III. Integration techniques including integration by parts, trig substitution and partial fraction to evaluate definite, indefinite, and improper integrals

    a. Integration by parts
    b. Integrating powers of the trigonometric functions
    c. Trigonometric substitutions
    d. Integration of inverse trigonometric functions
    e. Integration of exponential and logarithmic functions
    f. Integration using partial fractions decomposition
    g. Evaluating improper integrals

IV. Convergence or divergence of infinite sequences and series
    a. Definition of sequence convergence
    b. L'Hopital's Rule
    c. Definition of an infinite series convergence
    d. Convergence of geometric series
    e. Sum of a convergent geometric series
    f. Application of the nth term test for divergence
    g. Application of the integral test
    h. Identification and classification of p-series as convergent or divergent
    i. Use of direct and limit comparison tests to determine convergence
    j. Use of ratio and root tests
    k. Use of alternating series test to determine convergence
    l. Classification of series as absolutely or conditionally convergent

V. Functions as power series (including Taylor series) with the appropriate interval of convergence
    a. Taylor polynomials and approximations
    b. Taylor series
    c. Maclaurin series
    d. Binomial series
    e. Geometric power series
    f. Manipulation of power series to express functions
    g. Interval and radius of convergence of power series
    h. Differentiation and integration of power series

VI. Errors in series approximations
    a. Alternating series remainder theorem
    b. Taylor's Remainder Theorem

VII. Curves in polar and parametric forms
    a. Plane curves and parametric equations
    b. Transformation of parametric to rectangular forms and vice versa
    c. Graphing polar coordinates and curves
    d. Transformation of polar expressions to rectangular forms and vice versa

VIII. Curves in polar and parametric forms using calculus techniques
    a. Slopes and tangent lines for equations in polar coordinates
    b. Areas and arc length in polar coordinates
    c. Slope of a tangent line to a parametric curve
    d. Arc length of a parametric curve

RECOMMENDED TOPICAL OUTLINE

I. Application problems related to Integration
    a. Fluid pressure and force

II. Integrate and differentiate additional functions.

a. Hyperbolic functions

III. Additional integration methods.
   a. Integration tables
   b. Numerical methods of integration

IV. Integrate and differentiate additional functions.
   a. Hyperbolic functions

V. Additional sequence and series tests and definitions.
   a. Monotonic sequences
   b. Using the integral test to control the error in an approximation

VI. Conic, polar and parametric forms.
   a. Graph conic sections
   b. Translation and axes rotation
   c. Surface area of revolution in polar and parametric form