COURSE OUTLINE

Course Number MAT 116	**Course Title** Algebra and Trigonometry II	**Credits** 3
Hours: **Lecture/Lab/Other** 3 lecture hours	**Co- or Pre-requisite** Completion of MAT115 with a grade of C or better; successful completion of a course equivalent to MAT115, or permission of the department chairperson	**Implementation** **Semester & Year** Spring 2022

Catalog description: Primarily for students majoring in engineering technology or related programs. Topics include graphs of linear functions, logarithmic and exponential functions and equations, complex numbers, systems of nonlinear equations, trigonometric identities and equations, inverse trigonometric functions, polar coordinates, and analytic geometry.

General Education Category: Goal 2: Mathematics	**Course coordinator:** Alison Becker-Moses, 609-570-3808, beckera@mccc.edu

Required texts & Other materials:

- Algebra and Trigonometry, Abramson, Jay, Openstax.org
  https://openstax.org/details/books/algebra-and-trigonometry
  Hardcover: ISBN-10: 1-938168-37-2
        ISBN-13: 978-1-938168-37-6
  Paperback: ISBN-13: 978-1-50669-800-7
  Digital: ISBN-10: 1-947172-10-7
        ISBN-13: 978-1-947172-10-4

- Calculator: A graphing calculator such as the TI-83 or TI-84 is required. No calculator with a symbolic manipulator is allowed.

Course Student Learning Outcomes (SLO):
   Upon successful completion of this course the student will be able to:
1. solve and graph linear and quadratic functions and inequalities. (ILG # 2)
2. express complex numbers, perform operations with complex numbers, and apply DeMoivre's theorem. (ILG #2, 11)
3. perform polynomial and synthetic division and use it determine roots of polynomial functions. (ILG #2)
4. demonstrate knowledge of exponential and logarithmic functions and equations. (ILG #2, 11)
5. express and use inverse trigonometric functions to solve trigonometric equations and applications. (ILG #2, 11)
6. apply the fundamental trigonometric identities to simplify trigonometric expressions (ILG#2, 11)

7. recognize algebraically and graphically the conic sections and find pertinent information about them. (ILG #2, 11)

Course-specific Institutional Learning Goals (ILG):

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

Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Units of study in detail – Unit Student Learning Outcomes:

Unit I.   **Graphs and Equations (Supports Course SLO# 1, 2, 3)**

Learning Objectives
The student will be able to:
- plot points and identify quadrants on the coordinate plane.
- identify independent (*x*-variable) and dependent (*y*-variable) axes.
- read, interpret, and explain trends in graphs which model applications.
- calculate and interpret slope, especially as a rate of change.
- determine relationship between slope and horizontal, vertical, parallel, and perpendicular lines.
- express and graph linear equations in two variables.
- identify and graph *x*- and *y*-intercepts of a graph, and interpret them in context.
- express and graph linear equations in slope-intercept form.
- use linear modeling to find the equation of a line through two given points, or a slope and *y*-intercept.
- find equations of lines that are horizontal, vertical, and parallel/perpendicular to given lines.
- use the imaginary unit, *i*, to write complex numbers.
- perform the algebra of complex numbers.
- use complex conjugates to write the quotient of two complex numbers in standard form
- solve quadratic equations with complex solutions
- solve quadratic inequalities by factoring, extracting square roots, completing the square and using the quadratic formula.
- perform algebraic long division and synthetic division of polynomials.
- find all real zeros of a polynomial function using polynomial or synthetic division.

Unit II.   **Exponential and Logarithmic Functions and Equations (Supports Course SLO #4)**
Learning Objectives
The student will be able to:
- distinguish between linear and exponential growth.
- solve exponential equations in which it is possible to convert to the same base and equate exponents.
- simplify and evaluate logarithmic expressions.
- write logarithmic expressions in simpler form using the properties of logarithms
- write a given expression as a single logarithm using the properties of logarithms
- solve logarithmic equations using the properties of logarithms.
- use a calculator to evaluate expressions involving common and natural logarithms.
- solve applications that result in exponential or logarithmic models.
- solve exponential equations by converting to logarithmic form.

- solve logarithmic equations by converting to exponential form.
- use the change of base formula to find the logarithm of any number in any base > 0 using base 10 or base *e*.

Unit III.   **Trigonometric Identities and Equations (Supports Course SLO #5, 6)**
Learning Objectives
The student will be able to:
- find the acute angle θ when given a trigonometric function value of θ by using inverse trigonometric functions.
- evaluate given inverse trigonometric expressions.
- solve applications that result in trigonometric or inverse trigonometric equations.
- use graphing calculator technology to accomplish these tasks, where applicable.
- apply the basic trigonometric identities including the reciprocal, quotient, negatives, and Pythagorean identities.
- apply the sum and difference identities.
- apply the cofunction identities; that is, cofunctions of complementary angles are equal.
- apply the double- and half-angle identities.
- solve conditional trigonometric equations.
- distinguish between trigonometric identities and conditional trigonometric equations.
- verify trigonometric identities by using definitions or previously verified trigonometric identities such as the reciprocal, quotient, Pythagorean, sum and difference, cofunction, double- or half-angle identities.
- use appropriate sum/difference identities to find exact values of trigonometric functions of given angles in radical form.
- solve conditional trigonometric equations by using identities to rewrite in terms of one or two trigonometric functions and factoring, or using a graphing calculator to find all solutions for $0 \le \theta < 2\pi$ or $0° \le \theta < 360°$.
- solve applications that result in trigonometric equations and utilize trigonometric identities

Unit IV.   **Analytic Geometry (Supports Course SLO #2, 7)**
Learning Objectives
The student will be able to:
- convert Cartesian coordinates to polar coordinates and vice-versa, and apply DeMoivre's Theorem.
- describe how conic sections are formed and how to recognize from an equation which of the conic sections the equation represents.
- write the equation of a parabola using focus, directrix or vertex.
- find the focus, directrix and vertex given the equation of a parabola.
- sketch a parabola given focus, directrix and vertex or given its equation
- find the equation of an ellipse or hyperbola using center, focus, and vertices or using the eccentricity and vertices
- find the center, vertices, foci and asymptotes of a hyperbola given the equation and vice versa.
  write the equation of a circle given the center and radius.
- find the center and radius of a circle given the equation and vice versa.
- solve application problems involving conic sections.

Evaluation of student learning:

Students should receive regular feedback on their work through tests, quizzes, and homework. All learning outcomes are assessed through tests. Questions will be selected to evenly assess all expected outcomes.

Grades will be assigned as detailed below:

Unit Tests (2)	30%
Quizzes and Homework	10%
Midterm Exam	25%
Final Exam	35%