Course Outline for MATH 55

INTERMEDIATE ALGEBRA FOR BSTEM

Effective: Fall 2019

I. CATALOG DESCRIPTION:
MATH 55 — INTERMEDIATE ALGEBRA FOR BSTEM — 5.00 units

Intermediate Algebra concepts, in the service of Business, Science, Technology, Engineering and Math fields (BSTEM), will be explored in this course including: an introduction to functions; linear and absolute value functions; absolute value equations and inequalities; compound linear inequalities; rational expressions, functions and equations; radical expressions, functions and equations; rational exponents; complex numbers; quadratic functions and equations; inverse of a function; exponential and logarithmic functions; properties of logarithms; exponential and logarithmic equations; conic sections; and systems of equations and inequalities. Multiple representations, applications and modeling with functions are emphasized throughout.

5.00 Units Lecture

Strongly Recommended
MATH 110 - Elementary Algebra
with a minimum grade of C
or

MATH 110B - Elementary Algebra B
with a minimum grade of C
or

NMAT 210 - Elementary Algebra
with a minimum grade of C

Grading Methods:
Letter or P/NP

Discipline:
- Mathematics

	MIN
Lecture Hours:	90.00
Expected Outside of Class Hours:	180.00
Total Hours:	270.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering this course, it is strongly recommended that the student should be able to:

A. MATH110
1. Perform arithmetic operations on real numbers and polynomial expressions;
2. Simplify and evaluate algebraic expressions;
3. Translate a verbal statement into an algebraic expression;
4. Solve linear equations in one variable;
5. Solve a formula for a specified variable;
6. Solve and graph a linear inequality in one variable and express the solution using correct interval or set notation;
7. Find the equation of a line;
8. Develop and graph linear equations in two variables using various methods;
9. Apply concepts of slopes and rates of change;
10. Solve systems of linear equations in two variables by one of the following methods: graphing, elimination or substitution;
11. Solve linear inequalities in two variables and systems of linear inequalities in two variables;
12. Apply the rules for integer exponents;
13. Write numbers and perform computations using scientific notation;
14. Factor polynomials completely;
15. Solve polynomial and quadratic equations;

16. Solve, justify, and interpret the solution in the context of a modeling problem.
    B. MATH110B
        1. Solve systems of linear equations in two variables by one of the following methods: graphing, elimination or substitution;
        2. Solve linear inequalities in two variables and systems of linear inequalities in two variables;
        3. Apply the rules for integer exponents;
        4. Write numbers and perform computations using scientific notation;
        5. Factor polynomials completely;
        6. Solve polynomial and quadratic equations;
        7. Solve, justify, and interpret the solution in the context of a modeling problem.
    C. NMAT210
        1. Perform arithmetic operations on real numbers and polynomial expressions;
        2. Simplify and evaluate algebraic expressions;
        3. Translate a verbal statement into an algebraic expression;
        4. Solve linear equations in one variable;
        5. Solve a formula for a specified variable;
        6. Solve and graph a linear inequality in one variable and express the solution using correct interval or set notation;
        7. Find the equation of a line;
        8. Develop and graph linear equations in two variables using various methods;
        9. Apply concepts of slopes and rates of change;
        10. Solve systems of linear equations in two variables by one of the following methods: graphing, elimination or substitution;
        11. Solve linear inequalities in two variables and systems of linear inequalities in two variables;
        12. Apply the rules for integer exponents;
        13. Write numbers and perform computations using scientific notation;
        14. Factor polynomials completely;
        15. Solve polynomial and quadratic equations;
        16. Solve, justify, and interpret the solution in the context of a modeling problem.

IV. MEASURABLE OBJECTIVES:
Upon completion of this course, the student should be able to:
   A. Recognize and determine the distinctions between relations and functions, numerically, graphically, symbolically, and verbally;
   B. Given a function, determine the domain and range and express them in interval notation;
   C. Solve polynomial, rational, absolute value, radical, linear, exponential, and logarithmic equations;
   D. Apply basic operations on functions, including composition of functions and finding inverse functions;
   E. Solve systems of linear equations in three variables;
   F. Develop and use equations or function models to analyze and solve applied problems involving linear, quadratic, rational, radical, exponential or logarithmic expressions. Topics should minimally include growth, decay, geometry, optimization and uniform motion.
   G. Solve compound inequalities, sketch the graph of the solution and use appropriate set and interval notation to express the solution;
   H. Solve absolute value equations and inequalities and, where appropriate, sketch the graph of the solution and use set or interval notation to express the solution;
   I. Factor polynomials, including using the sum and difference of cubes;
   J. Use the properties of radicals, complex numbers, exponents and logarithms;
   K. Sketch the graphs of nonlinear relations, including parabolas and circles, and identify key components of the graphs;

V. CONTENT:
    A. Functions and Relations
        1. Definition and identifying a function and relation
        2. Representations of functions in different representations such as:
            a. Verbal - real word examples
            b. Symbolic
            c. Numerical
            d. Graphical
        3. Domain and range and representing it using interval notation
        4. Types of Functions
            a. Linear and nonlinear functions
            b. Absolute value functions
            c. Polynomial functions
            d. Rational functions
            e. Radical functions
            f. Exponential functions
            g. Logarithmic functions
        5. Operations with functions and function notation
        6. Composition of functions
        7. Inverse of a function
    B. Linear Functions
        1. Representations
        2. Domain and range
        3. Linear models
        4. Midpoint formula
    C. Linear Inequalities and Compound Linear Inequalities
        1. Solving
        2. Union and intersection
        3. Number line
        4. Interval notation
    D. Absolute Value Functions
        1. Representations
        2. Domain and range
        3. Absolute value equations
        4. Absolute value inequalities
    E. Factoring Techniques
        1. Review of factoring techniques
        2. Factoring sums and difference of cubes
        3. Factoring using substitution in order to solve equations in quadratic form
    F. Rational Expressions and Equations
        1. Simplification
        2. Undefined expressions
        3. Operations on rational expressions, including:
            a. Multiplication and division with rational expressions
            b. Addition and subtraction with like denominators

      c. Addition and subtraction with unlike denominators
- 4. Simplification of complex fractions
- 5. Solving rational equations
- 6. Applications involving rational functions, including inform motion

G. Proportions and variation

H. Systems of Linear Equations in Three Variables
- 1. Types of solutions
- 2. Solving by substitution and elimination
- 3. Using technology (optional)
- 4. Applications involving systems of linear equations with three variables

I. Radical Functions
- 1. Radical notation
- 2. Simplifying radicals
- 3. Addition, subtraction, multiplication and division of radical expressions
- 4. Rational exponents
- 5. Radical functions
  - a. Square root functions
  - b. Cube root functions
  - c. Power functions
  - d. Representations
  - e. Domain and range
- 6. Solving radical equations
- 7. Applications involving radical equations
- 8. The Distance Formula

J. Complex Numbers
- 1. Definition
- 2. Complex conjugates
- 3. Addition, subtraction, multiplication and division with complex numbers
- 4. Powers of i

K. Quadratic Functions
- 1. Representations
- 2. Domain and range
- 3. Graphs of quadratic functions
  - a. Transformations and translation
  - b. Vertex form
- 4. Min-Max applications with quadratic functions
- 5. Solving quadratic equations using the following methods:
  - a. Factoring
  - b. Square root property
  - c. Completing the square
  - d. Quadratic formula
  - e. Factoring using substitution in order to solve equations in quadratic form
- 6. Solving quadratic equations that result in complex solutions and the implications of the discriminant
- 7. Quadratic inequalities
  - a. Applications involving quadratic functions, including optimization and projectile motion

L. Exponential and Logarithmic Functions
- 1. Definitions
- 2. Representations and models, including growth and decay
- 3. Exponential function base e
- 4. Common and natural logarithm
- 5. Logarithms with other bases
- 6. Relationship between exponential and logarithmic functions of the same base
- 7. Properties of logarithms
- 8. Solving exponential and logarithmic equations
- 9. Applications involving exponential and logarithmic functions

M. Conic Sections
- 1. Parabolas with horizontal axes of symmetry
- 2. Circles

VI. METHODS OF INSTRUCTION:
- A. **Lab** - Assignments incorporating modeling real-world BSTEM applications
- B. Any of the following at the discretion of the instructor 1. Individual problem solving 2. Group work 3. Student presentations
- C. **Lecture** -
- D. **Audio-visual Activity** - online video and tutorials
- E. **Classroom Activity** -
- F. **Individualized Instruction** -
- G. **Discussion** -

VII. TYPICAL ASSIGNMENTS:
- A. Homework
  1. Problems from the text should be assigned for each section covered. The number of problems assigned may vary from section to section and from instructor to instructor, but the homework assignments should include a sufficient number and variety of problems to develop both skill, conceptual understanding and application of the concepts to real world sitations. A typical assignment should take an average student 1 to 2 hours for each hour in class.
  2. The majority of the problems assigned should be those for which answers are readily available (e.g., from the answer appendix in the text), so that students may obtain immediate feedback on their work.
  3. Homework assignments may include reading the text. Students may be asked to read sections in advance of the lecture and then to re-read them after the lecture, to reinforce important concepts and skills. An instructor may require written work in conjunction with the reading assignments (e.g., have students complete a Q & A sheet related to the assigned reading).
- B. Laboratory
  1. Lab assignments can be used to reinforce fundamental concepts, skills and applications or to explore certain concepts in more depth than is possible in-class. They may be designated for individual or group work. Lab assignments are completed in the Open Math Lab where students have access to assistance with the assignments.
  2. Sample lab assignment: Students explore concepts related to radical functions, their graphs, domains and ranges and applications that can be modeled with a radical function, find and interept the result.
- C. In-Class
  1. Collaborative learning, done in small groups of 2-4 students, can be used to introduce new concepts, build skills, or teach problem solving. Students may be asked to present their results on the board.
  2. Sample collaborative learning assignment: Students explore the differences between linear, quadratic and exponential growth

by developing graphical and numerical representations of these three types of functions. They create linear and exponential models showing the growth of money over time and determine which model will yield the most money.

VIII. EVALUATION:
   Methods/Frequency

   A. Exams/Tests
      Recommend minimum of four exams plus the cumulative final
   B. Quizzes
      Recommend frequent quizzes or graded homework, to provide regular feedback to the student regarding mastery of concepts. Number of quizzes and collaborative activities are at the discretion of the instructor.
   C. Class Work
      Time should be allowed in class for students to apply the concepts being covered. This can be done individually, in groups or as part of projects.
   D. Home Work
      Homework should be assigned for each section covered
   E. Lab Activities
      Recommend minimum of eight laboratory assignments over the semester.
   F. Other
      Comprehensive final examination

IX. TYPICAL TEXTS:
   1. Blitzer, Robert. *Introductory & Intermediate Algebra* . 5th ed., Pearson, 2017.
   2. Rockswold, Gary, and Terry Krieger. *Beginning and Intermediate Algebra.* 4th ed., Pearson, 2018.
   3. Tussy, Alan, and Diane Koenig. *Intermediate Algebra.* 5th ed., Brooks/Cole, 2015.

X. OTHER MATERIALS REQUIRED OF STUDENTS:
   A. Scientific calculator