

**Math Course Descriptions**  
**&**  
**Student Learning Outcomes**

## Table of Contents

|  |    |
|--|----|
| MAC 100: Business Math.....                  | 1  |
| MAC 101: Technical Math .....                | 3  |
| MA 090: Basic Math.....                      | 4  |
| MA 095: Introductory Algebra .....           | 5  |
| MA 098: Intermediate Algebra.....            | 7  |
| MA 102: College Algebra.....                 | 8  |
| MA 104: PreCalculus.....                     | 9  |
| MA 105: Introduction to Statistics.....      | 10 |
| MA 106: Quantitative Reasoning.....          | 11 |
| MA 109: Elements of Math I.....              | 12 |
| MA 119: Elements of Math II.....             | 14 |
| MA 200: Calculus I.....                      | 16 |
| MA 201: Calculus II .....                    | 17 |
| MA 202: Calculus III.....                    | 18 |
| MA 210: Introduction to Linear Algebra ..... | 19 |
| MA 211: Differential Equations.....          | 20 |

# Course Description & Student Learning Outcomes

## MAC 100: Business Math

**1. Course Number:** MAC 100  
**Course Title:** Business Math

**2. Description:** Concepts and practices of financial mathematics, elementary probability, and descriptive statistics are covered in this course. Simple and compound interest, present and future value, and annuities are covered. Measures of central tendency and dispersion including normal distribution and standard deviation are studied. Combinations, permutations, randomness and principles of counting including set notation are considered. Emphasis is on the use of mathematics, not theoretical derivation. Designed for students in career programs. Not an equivalent course for 100 level MA courses.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student will be able to:

- Understand the simple interest formula.
- Use the compound interest formula to calculate future value.
- Determine payments for an add-on loan.
- Compute finance charges on a credit card using the unpaid balance method.
- Use the average daily balance method to compute credit card charges.
- Compare credit card finance charge methods.
- Calculate the future value of an ordinary annuity.
- Perform calculations regarding sinking funds.
- Calculate the payment to pay off an amortized loan.
- Construct an amortization schedule.
- Find the present value of an annuity.
- Calculate the unpaid balance on a loan.
- Calculate the annual percentage rate from a table.
- Estimate the annual percentage rate.
- Understand the language of sets.
- Comparing sets.
- Use of Venn diagrams to illustrate set relationships.
- Perform the set operations of union, intersection, complements and difference.
- Count elements in a set.
- Use tree diagrams to represent counting situations graphically.
- Use counting techniques to solve applied problems.
- Understand fundamental counting principals.
- Use of the factorial notation.
- Calculate permutations and combinations.
- Apply the theory of permutations and combinations to solve counting problems.
- Calculate probabilities by counting outcomes in a sample space.
- Use counting formulas to compute probabilities.
- Understanding probability of an event and its complement.
- Calculate the probability of the union of two events.
- Understand how to compute conditional probability.
- Calculate the probability of the intersection of two events.
- Understand and be able to calculate expected values.

- Compute binomial probabilities.
- Understand the difference between a sample and a population.
- Organize data in a frequency table.
- Use bar graphs, histograms, pie charts, and stem-and-leaf to display data.
- Compute the mean, median, and mode of distributions.
- Apply measures of central tendency to compare data.
- Compute the range of a data set.
- Compute and understand the use standard deviation.
- Use the coefficient of variation to compare the standard deviation of different distributions.
- Understand the basic properties of the normal curve.
- Relate the area under the curve to  $z$ -scores.
- Make conversions between raw scores and  $z$ -scores.
- Use of the normal distribution to solve applied problems.
- Construct a scatterplot to show the relationship between two variables.
- Understand the properties of the linear correlation coefficient.
- Use linear regression to find the line of best fit for a set of data points.

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 090 or higher

# Course Description & Student Learning Outcomes

## MAC 101: Technical Math

**1. Course Number:** MAC 101  
**Course Title:** Technical Math

**2. Description:** Algebra with technical applications. Rational numbers, exponents, scientific notation, percent, ratio and proportion, linear equations, elementary plane geometry, solving systems of linear equations, elementary plane geometry, solving systems of linear equations by graphing and algebraic methods, solving literal equations, introduction to right angle trigonometry. Intended for students enrolled by career technology programs. Not an equivalent course for 100 level MA courses.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student will be able to:

- Work with fractions and decimals
- Perform arithmetic operations with exponents
- Understand scientific notation
- Perform arithmetic operations with percents
- Understand ratio and proportion
- Determine precision and accuracy of measurements
- Solve linear equations and literal equations
- Understand the basics of plane geometry
- Solve systems of equations
- Understand the basics of right angle trigonometry

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 090 or higher

# Course Description & Student Learning Outcomes

## MA 090: Basic Math

**1. Course Number:** MA 090  
**Course Title:** Basic Math

**2. Description:** Basic Math Studies is the first of three classes in the developmental mathematics sequence. It provides for a preparation for Introductory Algebra and a solid mathematical background for subsequent classes in the sequence. The focus of the class is on reinforcement of the student's arithmetic background and its application to common mathematical tasks to include percentage, order of operation, fractions, decimals, average, geometric quantities, and graphical representations of numbers. The emphasis of the three semester sequence is fortification of mental calculation power with minimum reliance on digital calculation.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Perform mathematical operations on whole, integer, and rational numbers.
- Use exponential notation and order of operations.
- Factor and prime factor whole numbers.
- Identify prime and composite numbers.
- Identify the least common multiple and greatest common factor.
- Demonstrate a conceptual understanding of fractions, including the ability to write equivalent fractions, reduce fractions, and perform mathematical operations on fractions.
- Demonstrate a conceptual understanding of decimals, including the ability to convert between fractions and decimals and perform mathematical operations on decimals.
- Demonstrate a conceptual understanding of ratio, rates, and proportion.
- Solve problems involving percents.
- Convert between fractions, decimals, and percents.
- Perform dimensional analysis on US units of measurement, the metric system and between the two systems of measurement.
- Create and glean information from graphs including bar graph and circle graph.
- Find the mean, median, and mode of numerical data.
- Define and describe lines and angles.
- Find the area and perimeter of plane geometric figures and composite geometric figures.
- Find the surface area and volume of a rectangular solid.
- Find the square root of perfect squared numbers.
- Solve relevant and appropriate application problems.

**4. Credit(s):** 3

**5. Prerequisite(s):** Placement through placement testing.

# Course Description & Student Learning Outcomes

## MA 095: Introductory Algebra

**1. Course Number:** MA 095  
**Course Title:** Introductory Algebra

**2. Description:** Introductory Algebra is the second of three classes in the developmental mathematics sequence. It provides a development of concepts of variables, expressions, and equations using symbolic algebra to represent primarily linear relationships both graphically and analytically. The concept of function will be developed for the application of linear equations and concepts of dependent and independent variable. Students will also learn to solve simultaneous linear equations as well as how to construct linear equations from slope and point information. Application problems will include geometric figure quantities, ratio and proportion, direct and indirect variation, and conversion of units. Finding the greatest common factor of a polynomial will also be included. The emphasis of the three semester sequence is fortification of mental calculation power with minimum reliance on digital calculation.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Use inequality symbols with real numbers.
- Find the additive inverse and absolute value of a number.
- Evaluate a variable expression
- Perform operations on real numbers.
- Use the Order of Operations
- Simplify a variable expression using the Properties of Addition and Multiplication and the Distributive Property.
- Translate a verbal expression into a variable expression.
- Graph an inequality on the number line.
- Determine whether a given number is a solution of an equation.
- Solve linear equations of varying forms.
- Solve application problems using formulas.
- Solve application problems involving percents.
- Solve application problems involving perimeters and areas of geometric figures.
- Solve inequalities in one variable.
- Graph points in a rectangular coordinate system.
- Determine ordered-pair solutions of an equation in two variables.
- Evaluate a function.
- Graph a linear function in standard form and slope-intercept form.
- Find the x- and y- intercepts of a function.
- Find the slope of a line given two points.
- Graph a line given a point and the slope.
- Find the equation of a line given a point and the slope.
- Find the equation of a line given two points.
- Identify parallel and perpendicular lines.
- Solve a system of linear equations in two unknowns by graphing, the substitution method, and the addition method.
- Multiply and divide monomials

- Simplify expressions with negative exponents.
- Write and use scientific notation in problems.
- Evaluate polynomial functions.
- Perform operations on polynomials.
- Factor a monomial from a polynomial.

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 090 or placement through placement testing.

# Course Description & Student Learning Outcomes

## MA 098: Intermediate Algebra

**1. Course Number:** MA 098

**Course Title:** Intermediate Algebra

**2. Description:** Intermediate Algebra is the last of three classes in the developmental mathematics sequence. It provides a development of primarily non-linear function, specifically quadratic, radical, and rational. Students will learn to apply concepts of combining like terms, using the distributive property, and factoring quadratic expressions. Students will also learn to understand and apply algebraic methods to solve literal equations, applications of Pythagorean Theorem, and geometric problems of perimeter, area, and volume. The emphasis of the three semester sequence is fortification of mental calculation power with minimum reliance on digital calculation.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Review of linear functions.
- Rewrite expressions by understanding and applying the concepts of combining like terms and distributive property.
- Factor a monomial from a polynomials
- Factor by grouping
- Factor a trinomial
- Factor the difference of two perfect squares
- Simplify a rational expression
- Perform operations on rational expressions.
- Simplify a complex fraction.
- Solve rational equations.
- Solve absolute value equations
- Simplify an expression with rational exponents.
- Convert between radical notation and exponential notation.
- Simplify radical expressions.
- Perform operations on radical expressions.
- Solve radical equations.
- Solve a quadratic equation by factoring, taking the square root, completing the square and using the quadratic formula.
- Graph a quadratic function.
- Find the x-intercepts of a parabola.
- Solve application problems involving surface areas and volumes of geometric figures.

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 095 or placement through placement testing.

# Course Description & Student Learning Outcomes

## MA 102: College Algebra

**1. Course Number:** MA 102  
**Course Title:** College Algebra

**2. Description:** Analytic study of functions: polynomial, rational, logarithmic and exponential. Systems of equations, elementary matrices and complex numbers.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Become familiar with mathematical terminology
- Solve linear, quadratic, rational and absolute value inequalities
- Find equations of lines using slope, slope- intercept and point-slope formulas
- Simplify and perform operations on functions and find composite functions
- Graph linear and quadratic functions
- Graph polynomial, rational, radical, absolute value, and exponential functions
- Graph functions using translations and reflections
- Graph and manipulate inverse functions and logarithmic functions
- Find domain, range, increasing and decreasing intervals
- Find rational and irrational roots and solve equation using polynomial division
- Solve application problems that define functions
- Solve systems of equations in two variables
- Perform matrix operations including adding, subtracting, scalar multiplication and products of matrices

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 98 or higher

# Course Description & Student Learning Outcomes

## MA 104: PreCalculus

**1. Course Number:** MA 104  
**Course Title:** PreCalculus

**2. Description:** This preparation for calculus involves a study of functions: polynomial, rational, logarithmic, exponential and trigonometric. Study of functions include: asymptotes, symmetry, roots, range, domain and introduction to limits. Appropriate application of problems are presented throughout the course.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Become familiar with mathematical terminology
- Solve linear, quadratic, rational and absolute value inequalities
- Find equation of line using slope, slope- intercept and point-slope formulas
- Simplify and perform operations on functions and find composite functions
- Graph linear and quadratic functions
- Graph polynomial, rational, radical, absolute value, and exponential functions
- Graph functions using translations and reflections
- Graph and manipulate inverse functions and logarithmic functions
- Find domain, range, increasing and decreasing intervals
- Find rational and irrational roots and solve equation using polynomial division
- Solve application problems that define functions
- Solve systems of equations in two variables
- Develop definitions of trigonometric functions by using a right triangle and a unit circle
- Sketch graphs of trigonometric functions and inverse trigonometric functions
- Prove trigonometric identities
- Apply trigonometric identities to solve trigonometric equations
- Use laws of sine and cosine to solve application problems
- Solve relevant application problems

**4. Credit(s):** 4

**5. Prerequisite(s):** MA 98 or higher

# Course Description & Student Learning Outcomes

## MA 105: Introduction to Statistics

**1. Course Number:** MA 105

**Course Title:** Introduction to Statistics

**2. Description:** Fundamental concepts of inferential and descriptive statistics with emphasis on interpretation of statistical arguments. An introduction to data analysis including graph analysis, measures of central tendency, correlation, regression, concepts of probability theory, sampling errors, confidence intervals in the normal distribution, hypothesis testing, and analysis of variance.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Define common statistical terms.
- Identify level of measurement, unusual values, and rare events.
- Distinguish between good statistical practices and improper uses of statistics.
- Organize and display data by constructing frequency distributions, histograms, stem and leaf plots, boxplots, and scatterplots.
- Calculate measures of central tendency and dispersion.
- Compare individual values by using z-scores, quartiles, and percentiles.
- Apply the Empirical Rule.
- Calculate probabilities using relative frequency method and classical methods.
- Find the probability of compound events using probability rules, counting rules including permutations and combinations, and simulations.
- Identify and calculate means, standard deviation, percents, probabilities, and values using tables, formulas, and technologies for discrete and continuous random variables including binomial, normal distribution, and the sampling distributions of sample means and proportions.
- Calculate and interpret expected values, point estimates, and confidence intervals.
- Conduct and interpret hypotheses tests including tests for a one population proportion, tests for a one population mean, tests for a one population variance/standard deviation, tests for two population means, tests for two population proportions, and tests for regression.
- Find and interpret the least squares regression line and the correlation coefficient.
- Analyze errors and required sample sizes for testing.
- Solve application problems

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 98 or higher

# Course Description & Student Learning Outcomes

## MA 106: Quantitative Reasoning

**1. Course Number:** MA 106

**Course Title:** Quantitative Reasoning

**2. Description:** This course is designed to engage students in solving and analyzing real world problems that are quantitative in nature. Students will develop the ability to use concepts and processes from arithmetic, algebra, geometry, logic, probability and statistics to become better informed citizens, sound financial planners, productive workers, and life-long learners. Technology is used to explore mathematical models of real-world phenomena.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Represent data symbolically, visually, numerically and verbally
- Think critically about quantitative issues confronting them in: the news, their lives, the environment, public policy, economics and public health.
- Use algebraic, geometric and/or statistical methods to solve real world problems.
- Recognize fallacies in an argument.
- Use truth tables to analyze statements.
- Use Venn diagrams to determine the validity of a statement.
- Use unit analysis to arrive at an answer and make standard unit conversions.
- Write and use scientific notation.
- Use the Compound Interest Formula.
- Understand sampling methods and various types of statistical studies.
- Be able to read and interpret statistical tables and graphs.
- Understand correlation and causality.
- Be able to use basic statistical language such as: mean, median, mode, outlier, right and left skews, variation, range, quartiles, standard deviation, and normal distribution.
- Be able to use basic probability including theoretical, empirical and subjective probability.
- Use mathematical modeling to model linear, exponential and logarithmic real world applications.

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 98 or higher

# Course Description & Student Learning Outcomes

## MA 109: Elements of Math I

**1. Course Number:** MA 109

**Course Title:** Elements of Math I

**2. Description:** This course provides a comprehensive, conceptually based study of the mathematics of the natural number, whole number, integer, and rational number systems. Topics studied include quantitative reasoning, estimation and computation, number theory, sets, whole number, integer, and rational number operations, and proportional reasoning. Active learning and problem-solving strategies are emphasized. This course is required for Liberal Arts: Early Childhood Education program and Liberal Arts: Elementary Education program.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student will be able to:

- Articulate the basic concepts of numeration, number theory, natural numbers, whole numbers, integers, and rational numbers. This will be accomplished through writing and speaking in an effective, organized, clear and grammatically correct English appropriate for Mathematics.
- Interpret, analyze and solve mathematical problems appropriate for elementary teachers.
- Perform mathematical operations and apply them to practical situations.
- Generate and evaluate alternative solutions to mathematical problems appropriate for elementary teachers.
- Demonstrate a variety of problem-solving techniques using different mathematical tools and alternative representations of numerical and analytical concepts with application to numerical data.
- Use the technology of a changing world appropriate to practical mathematics.
- Display academic honesty and adhere to professional standards in their fields.
- Apply problem-solving strategies to solve a variety of mathematical problems.
- Use basic set theory to characterize the real number system, make mathematical conjectures, and solve problems.
- Investigate and develop ideas about the nature of numbers using number theory. Topics in number theory include primes, composites, divisibility, greatest common factor and least common multiple.
- Identify and apply associative, commutative and distributive properties and the properties of closure, identity and inverse for whole, rational and real numbers.
- Relate the sets of natural numbers, whole numbers, integers and rationals. Be able to express numbers in different forms—as fractions, decimals, and percents.
- Discuss relationships between numbers and solve problems using ratio, proportions and percents.
- Discuss numeration systems with respect to such characteristics as place value, zero and base for decimal and non-decimal systems.
- Develop a selection of standard and non-standard arithmetic algorithms, including estimation and mental computation, and be able to apply them to whole numbers, decimal and non-decimal number systems.
- Use representations and the language of mathematics to express mathematical ideas verbally and symbolically.
- Recognize and apply mathematics in contexts outside of mathematics.

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 098 or higher

# Course Description & Student Learning Outcomes

## MA 119: Elements of Math II

**1. Course Number:** MA 119

**Course Title:** Elements of Math II

**2. Description:** This course provides a comprehensive, conceptually based study of the real number system. Topics studied include statistics, probability, geometry, measurement, algebra, and coordinate geometry. Inquiry based instruction, problem-solving strategies, problem solving skills, and the appropriate use of technology including calculators and computers are emphasized. This course is required for Liberal Arts: Elementary Education program.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student will be able to:

- Articulate the concepts of the real number system, probability, statistics, plane and transformational geometry, and measurement. This will be accomplished through writing and speaking in effective, organized, clear and grammatically correct English appropriate for mathematics.
- Interpret and analyze formulas, equations, table, graph, and diagrams to convey quantitative information and solve problems.
- Perform mathematical operations and apply them to practical situations.
- Generate and evaluate a variety of problem-solving techniques using different mathematical tools and alternative representation of numeric, geometric and analytical concepts with application to numerical data and problem-solving.
- Use the technology of a changing world appropriate to mathematics and problem solving.
- Display academic honesty and adhere to professional standards in their fields.
- Apply problem-solving strategies, including visualization, spatial reasoning and various representations, to solve a variety of mathematical problems.
- Develop, evaluate and use various types of reasoning in mathematical conjectures and arguments.
- Use various tools (including calculators) to explore, create, manipulate, and measure graphs, data and geometric figures.
- Solve geometric problems using coordinate geometry and algebra.
- Describe and use conditions that produce congruence or similarity of figures.
- Apply transformations of geometric figures and use symmetry to analyze mathematical situations.
- Solve problems of probability using both empirical and theoretical approach.
- Solve statistical problems using measure of central tendency and variability and statistical inference.
- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- Identify and apply measurements for length, area, volume, and weight.
- Use representations and the language of mathematics to express mathematical functions verbally and symbolically.
- Recognize and apply mathematics in contexts outside of mathematics.
- Recognize and use connections among different mathematical ideas.

**4. Credit(s):** 3

**5. Prerequisite(s):** MA 109 or higher

# Course Description & Student Learning Outcomes

## MA 200: Calculus I

**1. Course Number:** MA 200  
**Course Title:** Calculus I

**2. Description:** Designed to parallel first-semester calculus courses at four-year institutions of learning and to prepare the student for further work in calculus. Topics include a review of functions and their graphs, properties of limits, continuity, derivatives of algebraic and transcendental functions, differentials, Max-Min applications, related rates, the Fundamental Theorem of Calculus, the anti-derivative, and the definite and indefinite integrals. For students in mathematics, engineering, sciences and liberal arts.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Find one-sided limits, limits, infinite limits, and limits at infinity
- Find critical numbers, extreme values, and sketch graphs of functions by identifying critical points, points of inflection, intervals of increase/decrease, and concavity
- Find derivatives of functions using limit as  $\Delta x$  goes to zero
- Find derivatives by applying addition rule, product rule, quotient rule, chain rule, power rule, and rules for trigonometric functions
- Use implicit differentiation
- Applying fundamental theorem of calculus
- Demonstrate understanding of limits, continuity, derivative, anti-derivative, and definite integral
- Solve application problems

**4. Credit(s):** 4

**5. Prerequisite(s):** MA 104 or higher

# Course Description & Student Learning Outcomes

## MA 201: Calculus II

**1. Course Number:** MA 201  
**Course Title:** Calculus II

**2. Description** Differentiation and integration of the inverse functions, applications of integration, special integration techniques (substitution, parts, partial fractions, and trigonometric substitution), improper integrals, infinite series, and an introduction to differential equations. Designed for students in mathematics, engineering, sciences and liberal arts. The course is made to parallel the second-semester calculus course at four-year colleges, and to provide a continuation of the calculus sequence.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student will be able to:

- Differentiate and integrate the natural logarithmic function
- Differentiate and integrate exponential functions including bases other than  $e$
- Use separation of variables to solve simple differential equations
- Use exponential functions to model growth and decay
- Differentiate and integrate inverse trigonometric functions
- Find the area between two curves
- Find volume using the disk method and shell method
- Find arc length of a smooth curve and area of a surface of revolution
- Find an anti-derivative using integration by parts
- Solve trigonometric integrals
- Use trigonometric substitution to solve an integral
- Use partial fractions to integrate rational functions with linear and quadratic factors
- Recognize limits that produce indeterminate forms and apply L'Hôpital's Rule to evaluate a limit.
- Define an improper integral
- Apply the concepts of limits, convergence, and divergence to evaluate some classes of improper integrals.
- Determine convergence or divergence of sequences and series
- Use Taylor and MacLaurin series to represent functions.
- Solve application problems

**4. Credit(s):** 4

**5. Prerequisite(s):** MA 200

# Course Description & Student Learning Outcomes

## MA 202: Calculus III

**1. Course Number:** MA 202  
**Course Title:** Calculus III

**2. Description:** To introduce the elements of the calculus (differentiation and integration) of functions of several variables, vectors and vector fields, optimization, and line and flux integrals. Designed to parallel a Calculus III course at four-year institutions of learning. Designed for students in mathematics, engineering, sciences and liberal arts.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Understand and identify vectors in the plane and in three dimensional space.
- Understand the dot product of two vectors including the cross product of two vectors, surfaces, and cylindrical and spherical coordinates in space.
- Understand the concept of vector-valued function, differentiation and integration of vector-valued functions.
- Understand functions of several variables, limits, continuity, partial derivatives, differentials chain rules, directional derivatives gradients, tangent planes, normal lines and extrema of functions of two variables.
- Calculate and understand iterated integrals, double integrals, triple integrals, triple integrals in cylindrical and spherical coordinates, and change of variables in multiple integrals.
- Understand vector analysis, vector fields, line integrals, and Green's theorem. Conservative Vector fields, and independence path. Surface integrals, divergence theorem and Stokes's theorem.
- Solve application problems.

**4. Credit(s):** 4

**5. Prerequisite(s):** MA 201 or higher

# Course Description & Student Learning Outcomes

## MA 210: Introduction to Linear Algebra

**1. Course Number:** MA 210

**Course Title:** Introduction to Linear Algebra

**2. Description:** An introduction to matrix theory and linear algebra. Vector spaces, linear transformation, matrices, determinants, systems of linear equations, and applications.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Understand the basic concepts of linear algebra.
- Identify systems of linear equations, Gauss-Jordan elimination, vectors and matrices.
- Understand linear independence, vector equations, matrix equations, and linear models in business, science, and engineering.
- Understand vector algebra, inverse of a matrix, partitioned matrices, matrix factorizations, subspaces of  $\mathbb{R}^n$ , dimension, and rank.
- Identify and understand determinants and their properties.
- Understand vector spaces, subspaces, null spaces, column spaces, and dimension of a vector space, rank, and change of base.
- Compute eigenvalues, eigenvectors, diagonalization, and solve relevant application problems.

**4. Credit(s):** 4

**5. Prerequisite(s):** MA 201 or equivalent

# Course Description & Student Learning Outcomes

## MA 211: Differential Equations

**1. Course Number:** MA 211  
**Course Title:** Differential Equations

**2. Description:** An introduction to the theory and applications of elementary differential equations and boundary value problems. Intended for engineering and the physical sciences. Designed to parallel a course in Differential Equations at a four-year college or university.

**3. Student Learning Outcomes (instructional objectives, intellectual skills):** Upon successful completion of the course, the student shall be able to:

- Understand the concept of differential equations, classification, their solutions, and their applications, qualitative techniques for obtaining information about solutions to differential equations, and direction fields.
- Analytical techniques for solving commonly occurring differential equations including numerical methods for finding approximate solutions to differential equations that cannot be solved analytically.
- Solve differential equations by different methods such as separation of variables, transformation of variables, exactness, and method of inspection.
- Understand the linear differential equations, complimentary solution, auxiliary equation, linear independence and Wronskians.
- Understand the method of undetermined coefficients, method of variation of parameters, and the Euler equation. Laplace Transformation and its properties, Gamma function, the Heaviside unit Step function, impus function, and Dirac Delta function, and application of Laplace Transformation to differential equations.
- Understand the numerical solution of differential equations, numerical solution of  $y' = f(x,y)$ , the constant slope of Euler method, and the Runge-Kutta method.
- Apply differential equations to problems in engineering, and an understanding of the mathematical modeling process.

**4. Credit(s):** 4

**5. Prerequisite(s):** MA 201 or higher