Middlesex Community College
COURSE OUTLINE

MAT	268	Calculus III	4
Dept. Abbr.	**Course No.**	**Course Title**	**Credits**

Course Description

Two- and three-dimensional vector algebra, calculus of functions of several variables, vector differential calculus, line and surface integrals.

Prerequisite: Eligible for ENG*101 and MAT*256 (or higher) with a grade of "C" or better OR eligible for ENG*101 and math placement

General Objectives of the Course

After successful completion of this course, the student will be able to demonstrate knowledge and understanding of the concepts of:

- Two- and three-dimensional vector algebra analytically and geometrically both in theory and as applied to real world problems such as velocity and acceleration.
- Calculus of functions of several variables, both symbolically and graphically, and the defining features of surfaces as components that comprise and contribute to three dimensional figures as a whole
- Finding areas and volumes using multiple integration and evaluating the results for accuracy and reasonable ness as compared to geometrical methods , and
- Patterns in vector fields and vector calculus as a unifying conclusion to the calculus sequence
- Technology to explore and draw reasonable conclusions from two- and three-dimensional graphs and figures.
- Provide clear, logical and organized explanations through verbal and written responses

General Education Competencies

Students in this course will:

- Quantitative Reasoning (D)

  (1) Represent mathematical and quantitative information symbolically, graphically, numerically, and verbally.
  (2) Apply quantitative methods to investigate routine and novel problems. This includes calculations, procedures, mathematical and /or statistical modeling, prediction, and evaluation.
  (3) Interpret mathematical and quantitative information and draw logical inferences from
  Representations such as formulas, equations, graphs, tables and schematics
  (4) Evaluate the results obtained from quantitative methods for accuracy and/or reasonableness.

- Critical Analysis and Logical Thinking (E)
  (2) Formulating arguments: Formulates good arguments, including a significant focus on inductive reasoning.
  (3) Analysis: Break subject matter into components and identify their interactions to ascertain the defining features of the work and their contributions to the whole.
  (5) Synthesis: Draw together disparate claims into a coherent whole in order to arrive at well-reasoned and well-supported inferences that can be justified as a conclusion.

- Written Communication (E)

  (3) Craft Logical Arguments
    - Generate a controlling idea or thesis
    - Provide clear and logical evidence, support, or illustration for their assertions
    - Choose appropriate and effective organizing methods, employing effective transitions and signposts.

Unit No.	Instructional Unit	Specific Objectives of Instructional Unit Assume that each statement is prefixed with "The student will be able to".
1	Vectors	• Represent vectors in 2-dimensional spaces analytically and geometrically. • Construct a 3-dimensional rectangular coordinate system. • Represent vectors in 3-dimensional spaces analytically and geometrically. • Add (subtract) vectors and multiply vectors by scalars. • Perform the dot product and cross product of two vectors. • Find equations of lines and curves in space. • Discuss limits and continuity for vector-valued functions. • Find derivatives and integrals of vector-valued functions. • Find arc lengths. • Applications involving velocity and acceleration, trajectories on circles and spheres, two- and three-dimensional motion.
2	Functions of Several Variables	• Obtain equations of planes and surfaces and graph them. • Discuss limits and continuity for functions of two variables and extend the concept to functions of three variables. • Extend the concept of differentiation to multivariable functions. • Calculate partial derivatives and extend the concept to higher-order partial derivatives. • Apply Chain rule using partial derivatives. • Compute directional derivative; define gradient; find directions of steepest ascent and descent; sketch the level curves and directions of change. • Obtain equations of tangent planes. • Find linear approximations to given non-linear functions. • Find differentials. • Use second derivative test to obtain critical points. • Extend the concept to find local maximum and minimum as well as the absolute maximum and minimum for given functions. • Applications of partial derivatives and maximum/minimum concepts. • Use Lagrange multipliers to find the maximum and minimum values of the given function (Optional).

3	Multiple Integration	• Extend the concept of integration to multivariable functions. • Evaluate double integrals on rectangular regions. • Evaluate double integrals on non-rectangular regions. • Evaluate double integrals by changing the order of integration. • Find volumes of region between two surfaces using double integrals in rectangular coordinates. • Find areas using double integrals in rectangular coordinates. • Find volumes of region between two surfaces using double integrals in polar coordinates. • Find areas using double integrals in polar coordinates. • Extend the concepts to work on triple integrals in cylindrical and spherical coordinates. • Transform between one set of coordinates to another. • Applications involving center of mass in two- and three-dimensions. • Define Jacobian determinant of a transformation of two- or three-variables. • Use change of variables concept to evaluate double / triple integrals. • Applications of transformations.

4	Vector Calculus	• Sketch vector fields in two and three dimensions. • Understand the association between gradient field and potential function. • Evaluate line integrals. • Find average value of the given function on the given curve. • Use line integral to find the length of the curve. • Applications involving work done to move an object. • Compute the circulation and flux of a vector field. • Define conservative vector field. • Determine if a given vector field is conservative • Find the potential function of a given conservative vector field. • Evaluate line integrals on closed curves. • Describe Green's Theorem in circulation form and flux form. • Define and compute curl of a vector field. • Define and compute divergence of a vector field. • Define stream functions. • Compute divergence of radial fields. • Give parametric representation for given surfaces. • Describe the surface with the given parametric representation. • Find area of the surfaces using parametric description. • Evaluate surface integrals using parametric description. • Use Stokes' Theorem to evaluate surface integrals and line integrals. • Compute flux using Divergence Theorem. • Applications.