Faculty members are required to have the outline submitted to the Academic Affairs Office. The course outline is the form used for approval of new courses by the Academic Affairs and Standards Council.

**DEPT.** **MATH**  **COURSE NUMBER:** 2201

**NUMBER OF CREDITS:** 4  **Lecture:** 4  **Lab:**

<table>
<thead>
<tr>
<th>Course Title:</th>
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<tbody>
<tr>
<td>Calculus III</td>
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<tr>
<th>Catalog Description:</th>
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<tbody>
<tr>
<td>Calculus III extends applications of derivatives and integrals to three-dimensions and continues Calculus II. Topics include vectors, vector-valued functions with applications, functions of two or more variables, partial derivatives, multiple integrals, and vector analysis topics including line and surface integrals, Green’s Theorem, the Divergence Theorem, and Stoke’s Theorem.</td>
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**FULFILLS MN TRANSFER CURRICULUM AREA(S) (Leave blank if not applicable)**

Goal 4: Mathematics/Logical Reasoning: Already met by pre-requisite course Calculus I

<table>
<thead>
<tr>
<th>Prerequisites or Necessary Entry Skills/Knowledge:</th>
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<tbody>
<tr>
<td>MATH 1122 Calculus II</td>
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<tr>
<th>Topics to be Covered (General)</th>
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</table>
| Three Dimensional Coordinate systems and vector definitions  
Vector Dot and Cross Products  
Equations of lines, plane and surfaces (function approach).  
Cylindrical and Spherical coordinates.  
Vector Functions and space curves  
Derivatives and Integrals of Vector Functions.  
Arc Length, Curvature and Motion in Space.  
Parametric Surfaces  
Functions of several variables  
Limits, Continuity, and Partial derivatives  
Tangent Planes and Linear Approximations  
Chain Rule for many variables  
Directional Derivatives and the Gradient vector |
Maxima, Minima, and Saddle Points
Lagrange Multipliers
Double Integrals over Rectangles and over General regions
Iterated integrals
Double Integrals in Polar Coordinates
Surface Area and other applications of double integrals
Triple Integrals and their applications
Changing Variables in Multiple Integrals
Vector Fields and Line Integrals
Green’s Theorem
Curl and Divergence and Surface Integrals
Stoke’s Theorem
Divergence Theorem

**Student Learning Outcomes**

- Explain the concepts of limits and continuity for real-valued functions of two or more variables.
- Find derivatives of vector-valued functions and use those derivatives to describe an object’s motion.
- Evaluate iterated integrals using rectangular, cylindrical, and spherical coordinate systems.
- Use triple integrals to solve problems such as calculating volume, center of mass, moments of inertia, and the expected value of a continuous random variable.
- Recognize vector fields. Compute and interpret curl, divergence, and flux.
- Use line integrals to calculate work done by a force field in moving an object along a curve.
- State and apply the Fundamental Theorem of Line Integrals, Green’s Theorem, Stokes’ Theorem, and the Divergence Theorem.
- Compare and contrast the generalizations of the Fundamental Theorem of Calculus listed above.
- Compute gradients and directional derivatives and apply them to finding tangent spaces and normal lines.

*Is this course part of a transfer pathway: Yes ☐ No ☒*

*If yes, please list the competencies below*

Revised 2/20