MATH 241 Calculus IV

1. Catalog Description

MATH 241 Calculus IV (4)
(Crosslisted as HNRS 241)

Partial derivatives, multiple integrals, introduction to vector analysis. 4 lectures. Prerequisite: MATH 143.

2. Required Background or Experience

Math 143.

3. Learning Objectives

The student should be able to:

a. Do partial differentiation and study applications such as tangent planes, maximum/minimum problems with and without constraints.

b. Do multiple integration and/or applications such as volumes, surface area and moments.

c. Work with vector fields, and vector integral theorems.

4. Text and References


5. Minimum Student Materials

Paper, pencils, and notebook.

6. Minimum University Facilities

Classroom with ample chalkboard space for class use.

7. Content and Method

The sections listed below are considered to be the core of the course. It is estimated that about 30 lectures will be needed to cover them. Quarters vary from 38 to 41 lectures. Possible uses for any remaining lectures include:

1. Covering more sections

2. Covering some sections in more depth

3. Computer labs

4. Group projects/class presentations

<table>
<thead>
<tr>
<th>Content</th>
<th>No. of Lectures</th>
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<tbody>
<tr>
<td>CHAPTER 12 – Vectors and the Geometry of Space</td>
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<tr>
<td>12.6 Cylinders and Quadric Surfaces (focus on graphing techniques; deemphasize terminology)</td>
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<tr>
<td>CHAPTER 14 – Partial Derivatives</td>
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14.1 Functions of Several Variables
14.2 Limits and Continuity in Higher Dimensions (may be covered lightly)
14.3 Partial Derivatives
14.4 The Chain Rule
14.5 Directional Derivatives and Gradient Vectors
14.6 Tangent Planes and Differentials (differentials may be deemphasized)
14.7 Extreme Values and Saddle Points
14.8 Lagrange Multipliers (may be covered lightly or skipped entirely)

CHAPTER 15 – Multiple Integrals
15.1 Double and Iterated Integrals over Rectangles
15.2 Double Integrals over General Regions
15.3 Area by Double Integration
15.4 Double Integrals in Polar Form
15.5 Triple Integrals in Rectangular Coordinates
15.6 Moments and Centers of Mass
15.7 Triple Integrals in Cylindrical and Spherical Coordinates

CHAPTER 16 – Integration in Vector Fields
16.1 Line Integrals
16.2 Vector Fields and Line Integrals: Work, Circulation, and Flux
16.3 Path Independence, Conservative Fields, and Potential Functions
16.4 Green’s Theorem in the Plane (connections of divergence with physics should be made; include a discussion of curl and divergence in 3-dim from sect. 16.7, p. 962-3 and sect. 16.8, p. 972-973)
16.5 Surfaces and Area (optional)
16.6 Surface Integrals (optional)
16.7 Stokes’ Theorem (optional)
16.8 The Divergence Theorem and a Unified Theory (optional)

Total 30

Method

Largely lecture with chalkboard illustration of the discussion along with supervised work and individual conferences.

8. Methods of Assessment

The primary methods of assessment are examinations, quizzes and homework. A comprehensive final examination is required. Students are expected to show their work, and are graded on the correctness of their answers as well as their understanding of the concepts and techniques.