Topics for Exam 2

1. **Differentiability: The Chain Rule**

    1.1 Directional derivatives of scalar fields

    1.2 The Jacobian matrix of a differentiable function

    1.3 The derivative of a composition of functions

2. **Differentiable Paths**

    2.1 C^1 curves and parametrizations

    2.2 Simple C^1 curves.

    2.3 Piecewise C^1 simple curves

    2.4 Simple closed curves

    2.5 Arclength of a curve; arclength parameter

3. **Integrals on Curves**

    3.1 Re-parametrizations

    3.2 Path integrals

    3.3 Line integrals

    3.4 Flux across a closed curve

4. **Differential forms and the Fundamental Theorem of Calculus**

    4.1 Differential 1–forms

    4.2 Differential 0–forms

    4.3 The differential of a 0–form

    4.4 Differential 2–forms

    4.5 Wedge product of 1–forms

    4.6 Algebra of forms

    4.7 The differential of a 1–form

    4.8 Calculus of forms

    4.9 Integration of forms

    4.10 The Fundamental Theorem of Calculus

    4.11 Evaluating differential 2–forms in oriented triangles: Double integrals

Relevant sections in the text: Sections 2.5, 2.6, 2.7, 3.6, 3.7, 3.8, 4.4, 5.2, 5.3, 5.4, 5.5, 11.2 and 11.3.

Relevant sections in the online class notes: 4.6, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7 and 5.8.

Relevant Assignments: Assignments 10, 11, 12, 13, 14, 15, 16, 17, 18 and 19.

Important Concepts: C^1 curves, piecewise C^1 curves, simple curves, simple closed curves, parametrizations, re–parametrizations, arclength, path integral, line integral, flux, differential forms, wedge product of forms, and double integrals.

Important Skills: Know how to compute the Jacobian matrix of a differentiable map; know how to apply the Chain Rule; know how to evaluate the arclength of C^1 curves; know how to evaluate path integrals; know how to evaluate line integrals; know how to compute flux across a simple closed curve; know how to evaluate differential 1–forms and differential 2–forms; know how to compute the differentials of forms; know how to evaluate double integrals; know how to apply the Fundamental Theorem of Calculus.