Vector Analysis
Course Outline (Updated)
MATH 25500 Section 01 [1955], Spring 2017
Tuesdays and Fridays 14:10 - 15:25, Room: HW409
CUNY Hunter College

Instructor: Dr. Byungdo Park

Email: bpark@gradcenter.cuny.edu

Office hours: Tuesdays 11:30–12:30 at HE 924 or by appointment.

Section webpage: Announcements, homework, exam schedules and other relevant information will be posted on the following webpage: `http://tinyurl.com/s17huntermath255` which is also accessible via instructor's webpage: `http://wfs.gc.cuny.edu/bpark/www`

Textbooks:

- Jerrold Marsden and Anthony Tromba, *Vector Calculus*, 6th Edition, W. H. Freeman, ISBN-10: 1429215089
- A textbook on differential forms and calculus on manifolds: Manfredo P. do Carmo, *Differential forms and applications*, Springer-Verlag Berlin, ISBN-10: 3540576185

Course description: We shall study integration theorems from calculus in $\mathbb{R}^n$, leading to foundations of differential geometry. To this end, we will learn vector fields, line and surface integrals, and three main integration theorems: Green's theorem, Stoke's theorem, and Gauss' divergence theorem, followed by algebra of differential forms in $\mathbb{R}^n$, integration of differential forms, and differentiable manifolds. Gradually, we will be familiarized with languages describing and underpinning modern mathematics and theoretical physics.

Since this is a course that lays out foundations for *MATH 331: Geometries* and *MATH 454: Calculus on Manifolds*, naturally the course progression will be more friendlier to mathematics major, and the instructor will assume a certain level of mathematical maturity after finishing the first text (Marsden & Tromba). However, the instructor does not dissuade students from non-mathematics major registering for this course at his/her own risk.

Exam policies: A midterm exam and a final exam.

Make-up exam policies: If you miss the midterm exam under a justifiable and documentable reason, your final exam score will be used also for the midterm score. There will be no make-up midterm exam. There will be an emergency make-up for final exam for those who meet the criteria.

Homework policies: A list of homework problems will be posted on the webpage roughly in weekly basis. Late homework will be accepted. The instructor will assign as many homework problems as it is needed to master the subject. The instructor will scan through each submitted homework and assign a score 2, 1, or 0 depending on quality of work. The homework score for the

total grade will be calculated based on the following formula: $(\sum_{i=1}^{h} h_i \cdot n_i)/(\sum_{i=1}^{h} 2 \cdot n_i)$, where h is total number of homework assignment, h_i is the score for the i^{th} homework score, n_i is the number of problems in the i^{th} homework.

Attendance policies: Attendance data will be collected in every class meeting and will be used for various purposes, including determination of grades INC, WN, or WU. However the total score for the final letter grade will not reflect the attendance record.

Grading Policies: 30% from homework, 35% from midterm exam, and 35% from final exam.

Cell phone and electronic device policies: Cell phones are not allowed to use in class. Electronic devices should not be shown in any in-class exam.

Important dates:

- Monday April 10th – Tuesday April 18th: Spring Recess
- Friday May 19th: No class — Reading day

Tentative list of sections to be covered:

Chapter 4. Vector-Valued Functions

4.3. Vector Fields

4.4. Divergence and Curl

Chapter 7. Integral Over Paths and Surfaces

7.1. The Path Integral

7.2. Line Integrals

7.3. Parametrized Surfaces

7.4. Area of a Surface

7.5. Integrals of Scalar Functions Over Surfaces

7.6. Surface Integrals of Vector Fields

7.7. Applications to Differential Geometry, Physics, and Forms of Life

— Midterm exam covers chapters 4 and 7 —

Chapter 8. The Integral Theorems of Vector Analysis

8.1. Green's Theorem

8.2. Stokes' Theorem

8.3. Conservative Fields

8.4. Gauss' Theorem

8.5. Differential Forms (Will be skipped and covered using a different text)

Additional topics from do Carmo's Differential forms and applications. It will be a subset of the following items.

1. Differential forms in $\mathbb{R}^n$
2. Line integrals
3. Differentiable manifolds
4. Integration on manifolds; Stokes theorem and Poincaré's lemma.
5. Differential geometry of surfaces
6. The theorem of Gauss-Bonnet and the theorem of Morse