Math 20E Syllabus - Vector Calculus (revised June 2021)

Lecture schedule based on *Vector Calculus, sixth edition* by Jerrold E. Marsden and Anthony Tromba

Section	**Lectures**	**Topic**
Review Assignment (no lecture): Sections 1.1 - 1.4, 2.1 - 2.6, 3.1, 3.3 - 3.4 and 4.1 - 4.2		
5.1, 5.2	1	The Double Integral
5.3	1	The Double Integral Over More General Regions
5.4	1	Changing the Order of Integration
5.5	1	The Triple Integral
6.1	1	The Geometry of Maps from $\mathbb{R}^2$ to $\mathbb{R}^2$
2.3; 2.5	1	Differentiation; Properties of the Derivative
1.4	1	Cylindrical and Spherical Coordinates
6.2	2	The Change of Variables Theorem
4.3	1	Vector Fields
7.1	1	The Path Integral
7.2	1	Line Integrals
7.3	1.5	Parametrized Surfaces
7.4	1.5	Area of a Surface
7.5	1.5	Integrals of Scalar Functions Over Surfaces
7.6	1.5	Surface Integrals of Vector Fields
8.1	2	Green's Theorem
4.4; 8.2	2	Curl; Stokes' Theorem
4.4; 8.4	2	Divergence; Gauss's Theorem
8.3	1	Conservative Vector Fields

Notes:

1. The prerequisite for this course is Math 18 (or Math 20F) and Math 20C. Thus, the students are expected to have a working knowledge of linear algebra and multivariable calculus. No lecture time should be allotted to the Review Assignment (except perhaps to address questions).

2. Double and triple integration (Sections 5.1 - 5.5) are also topics in Math 20C. Reviewing those topics here is helpful since integration is the central theme of this course. (Also, triple integrals are the last topic of Math 20C, so it is likely the students did not get the desired amount of exposure to the topic.)

3. The textbook used in Math 20C teaches multivariable differentiation in terms of partial derivatives only, and does not include a discussion of the total derivative D that is used extensively in Math 20E. For this reason, the total derivative D should be introduced before it is needed in Section 6.2. The total derivative is introduced in Section 2.3 and the properties are investigated in Section 2.5. Discuss the topics of these sections after Section 6.1 (The Geometry of Maps from $\mathbb{R}^2$ to $\mathbb{R}^2$). The students should be familiar with the properties of partial derivatives and special cases of the chain rule, but will likely be unfamiliar with how they look in the context of the total derivative.

4. Section 1.4 (Cylindrical and Spherical Coordinates) may be treated as a subtopic of Section 6.2 (The Change of Variables Theorem). Since polar, cylindrical, and spherical coordinates are important coordinate systems that are frequently used in other disciplines, they should be treated explicitly as part of the discussion on change of variables.

5. The lecture schedule is, at best, approximate. However, it allots 25 lectures for the course, so there should be enough flexibility to complete it in a standard quarter with 25 - 26 lecture days available.