MA 426/591M Syllabus Fall 2017 S.O. Paur

Text: *Elementary Classical Analysis* (2nd edition) by Marsden and Hoffman

Course Objectives:

The material covered in MA 426 focuses on extending the concepts learned in MA 425 for real-valued functions of a real variable to vector-valued functions of a vector variable. The course separates into two main parts.

In the first part (Chapters 1-4), we work on extending the kind of sets we work with from intervals in **R** to more general sets in n-dimensional Euclidean Space ($\mathbf{R}^n$). Thus the first part of the course focuses on the properties of $\mathbf{R}^n$, including such basic topological concepts as open and closed sets, and compact and connected sets. We also consider the properties of continuous functions defined on these types of sets. You will see that many of the theorems you studied in MA 425 extend nicely to the more general situation in $\mathbf{R}^n$. Many of the topological concepts will seem strange and somewhat difficult at first, but it is important that you learn the basic definitions and theorems. You will also be expected to work with these definitions to prove theorems on your own. Just as in MA 425, it is important not just to learn the material but also to think and write mathematically.

In the second part (Chapters 6-9) we will be looking at extending the definitions of derivative and integral to the higher dimensional case. You will see that the derivative becomes considerably more complicated when we switch to vector-valued functions. The integral for functions of more than one variable is also more involved but probably will be easier for you than the derivative. In this section of the course we will concentrate on understanding the definitions and theorems and being able to work with them on a more concrete basis. Several of the theorems we will encounter (the Inverse and Implicit Function Theorems in chapter 7 and the Fubini and Change of Variables Theorem in chapter 9) are very important so it is necessary that you know these theorems and be able to apply them. However, the proofs of these theorems are too long to do in class so when we get to them I'll just give "plausibility " arguments, rather than formal proofs. The material we cover in the second part of the course is more complicated than in the first part, but if you work at understanding what the definitions and theorems are saying, you may find it easier than the first part since the second part is treated less abstractly than the first.

We will cover the following sections although parts of some of the sections may be omitted.

Chapter 1: 1.6, (light on 1.7) (Euclidean space and metric spaces)

Chapter 2: 2.1 - 2.8 (open and closed sets, interiors and closures, accumulation points, boundary of a set, sequences and completeness)

Chapter 3: 3.1 (just definition 3.1.2), 3.2-3.5 (compactness, Heine-Borel Theorem, Nested Set property, path-connected and connected sets)

Chapter 4: 4.1 - 4.6 (continuity and continuity theorems, uniform continuity)

Chapter 6: all (derivative and matrix representation, conditions for differentiability, chain rule, product rule and gradients, Mean Value Theorem, Taylor's Theorem and higher derivatives, maxima and minima)

Chapter 7: 7.1, 7.2, (7.7 if time permits) (inverse and implicit function theorems)

Chapter 8: 8.1 - 8.4 (Riemann integral, volume and sets of measure zero, Lebesgues Theorem and properties of the intergral)

Chapter 9: 9.1 - 9.5 (Fubini's Theorem, Change of Variables Theorem with applications)

Grading policy: There will be 2 exams with the first one probably coming when we complete chapter 4 and the second after we complete chapter 8. That schedule depends on the rate at which the class progresses so it is subject to change. Also, to ensure that students have sufficient time to think about the problems, I usually schedule the exams on Friday afternoon at 3 pm and allow a maximum of 2.5 hours to take the exam. I will arrange alternative times for students who have other commitments at that time. Each hour exam is worth 22%, homework counts 22% and the final exam counts 34%. The final exam will be given Monday, December 11, from 8 am – 11 am. Homework assignments will be due at the beginning of class on the day due. . Practice problems will be assigned every day but do not need to be turned in. However, to do well on the exams generally requires that students do the practice problems in addition to the turn-in homework problems. You are expected to attend all classes on time. If you have to miss an exam for reasons of illness or some other excused absence, please contact me prior to the exam so we can arrange for a makeup. Incomplete grades will be handled on an individual basis. . I will honor all written requests by the Office of Disability Services for Students. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.1). It is my understanding and expectation that your signature on any exam or assignment means that you have neither given nor received any unauthorized aid. Students may discuss assignments with other students in this section of the class and with me, but no other persons. Students are expected to write up their assignments individually for the first two or three homework assignments. However, the remaining homework assignments will be group projects – I will assign the groups. No late homework will be accepted. In addition, we will have weekly definition/statement of theorem quizzes, whose grades will be included in the final homework grade.

Supporting fellow students in distress: As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remains a healthy and safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you, either for the classmate's well-being or yours. When this is the case, I would encourage you to report this behavior to the NC State Students of Concern website: http://studentsofconcern.ncsu.edu/ . Although you can report anonymously, it is preferred that you share your contact information so they can follow-up with you personally.

General Information:

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