

MAT 441/541 Advanced Calculus

Bulletin Description: Prerequisite: Prerequisite: MAT 280 and 340. Point set theory, sequences, continuity, uniform continuity, limits, mean values theorems.

Text: *Advanced Calculus*, Gerald B. Folland, Prentice Hall, (2002).

References: The following is a partial list of supplemental reading:

1. *Mathematical Analysis*, T.M. Apostol, Addison Wesley (1975).
2. *Advanced Calculus*, W. Fulks, Wiley (1978).
3. *The Maple Handbook*, Darren Redfern, Springer-Verlag, (1993).
4. *Foundations of Analysis*, D.F. Belding and K. J. Mitrchell, Prentice Hall (1991).
5. *Mathematical Analysis*, S.A. Douglass, Addison Wesley (1996).
6. *Introduction to Real Analysis*, R.G. Bartle and D.R. Sherbert, Wiley (1992).

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Goals To provide an introduction to advanced calculus and to develop foundational ideas in modern analysis. The understanding of basic point set topology and the development of more rigorous methods in limits, continuity and differentiability is central to the course material. Areas of study include:

1. Basic topology. Finite, countable and uncountable sets. Set theory. Sequences of real numbers.
2. Functions, limits, continuity.
3. Linear operators and differentiability.
4. Infinite series.

Topics: The intent is to cover chapters 1-3, 6, and 7 of the text. Areas of emphasis include:

1. Bolzano-Weierstrass theorem, Heine-Borel theorem, mean, extreme and intermediate value theorems, Rolle's theorem, Taylor's theorem, and the implicit function theorem.
2. Completeness, compactness, and uniform continuity.
3. Differentiability in one and several variables. The partial derivative, and vector valued functions. Change of coordinates.
4. Infinite series and functions defined by series and integrals.

Assessment: The course assessment is based on total accumulated points which are earned through papers and examinations. The exams will consist at a minimum of a final comprehensive examination stressing proficiency (closed book), and an extended midterm paper stressing problem solving (open book). Class attendance is require as students will be required to present solutions to weekly chapter problems. Please review the comprehensive document on grading at http://delphi.st.usm.edu/kolibal/courses_html/policies.html

Because theory and analysis is stressed throughout, the course requires that the student develop proficiency in developing proofs. The use of symbolic algebra (Maple) is useful, but not required, in working through the details of assignments, especially in applications involving derivatives. The graduate component of the course includes developing the ability to work with the published literature, and requires mastery of concepts in analysis.