MATH 409, Section 501

Advanced Calculus I

Fall 2013

Instructor: Yaroslav Vorobets
Time: TR 9:35 – 10:50 a.m.
Location: BLOC 161
Web page: `http://www.math.tamu.edu/~yvorobet/MATH409/`

Office: Milner 004 (e-mail: `yvorobet@math.tamu.edu`)

Office hours: Tuesday 1:00–3:00 p.m., Wednesday 1:30–2:30 p.m., and by appointment.

Text: William R. Wade, *An Introduction to Analysis*, 4th ed., Pearson Prentice Hall, Upper Saddle River, NJ, 2010 (ISBN 978-0-13-229638-0).

Prerequisites: MATH 220 (Foundations of Mathematics), MATH 221 (Several Variable Calculus).

Course content: see the next page.

Grading system: There will be 2 in-class tests and the final comprehensive exam. The tests are worth 90 points (or 22.5% of the final grade) each, the final exam is worth 100 points (or 25% of the final grade). Extra credit can be earned by solving bonus problems. Also, there will be homework assignments, which will account for another 120 points (or 30% of the final grade). The final grades will be assigned according to the 90–80–70–60% scale, namely, A for 360+ pts, B for 320–359 pts, C for 280–319 pts, D for 240–279 pts, and F for less than 240 pts.

The *tentative* dates for the two tests are October 10 and November 14. The final exam is scheduled for Friday, December 6, 12:30 – 2:30 p.m.

I will assign and collect homework about once per week. Late homework will be accepted only for legitimate reasons and may be penalized if circumstances warrant.

Make-ups: Make-ups for missed tests will only be allowed for a university approved excuse in writing. Wherever possible, inform the instructor before a test is missed. Consistent with University Student Rules, students are required to notify the instructor by the end of the next working day after missing a test. Otherwise, they forfeit their rights to a make-up.

Academic integrity: Although students are encouraged to discuss homework problems, each student is required to write his/her own solutions and proofs. Copying another student's work is dishonest and academically worthless. Information about the Honor Council Rules and Procedures can be found at `http://aggiehonor.tamu.edu/`

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Students with disabilities: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Room B118 of Cain Hall or call 845–1637. For additional information, visit `http://disability.tamu.edu/`

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Course content: This is an advanced undergraduate course on calculus of functions of one variable. The emphasis of the course is on the rigorous and systematic development of the theory, starting with the axiomatic model of the real line, then proceeding to the study of limits and continuity, and eventually to differential and integral calculus.

The main topics to be covered are: axioms of the real number system; point set theory of the real line; compactness, completeness and connectedness; continuity and uniform continuity; sequences, series; differentiability; theory of Riemann integration.

The student should be able to state main definitions and theorems and to present their proofs in a rigorous way.

Course outline

Part I ($\approx$ 3 weeks): *Axiomatic model of the real numbers*

- Axioms of an ordered field
- Completeness axiom
- Principle of mathematical induction
- Countable and uncountable sets

Wade's book: Chapter 1, Appendix A

Part II ($\approx$ 4 weeks): *Limits and continuity*

- Limits of sequences
- Bolzano-Weierstrass theorem
- Cauchy sequences
- Limits of functions
- Continuity, uniform continuity

Wade's book: Chapters 2–3

Part III ($\approx$ 5 weeks): *Differential and integral calculus*

- Differentiability, properties of the derivative
- The mean value theorem
- Taylor's theorem
- Riemann sums, the Riemann integral
- The fundamental theorem of calculus

Wade's book: Chapters 4–5

Part IV ($\approx$ 1.5 weeks): *Infinite series*

- Convergence of series
- Absolute convergence
- Alternating series
- Tests of convergence

Wade's book: Chapter 6