MATH 409, Section 501

Advanced Calculus I

Spring 2020

Instructor: Yaroslav Vorobets

Time: MWF 11:30 a.m. – 12:20 p.m.

Location since March 23: ZOOM meeting (to get the link, see eCampus or your email)

Web page: `http://www.math.tamu.edu/~yvorobet/MATH409/`

E-mail: `yvorobets@tamu.edu`

Office hours since March 23: via ZOOM (to get the link, see eCampus or your email) on MWF 10:15–11:15 a.m. and 1:00–2:00 p.m., and by appointment.

Text: B. S. Thomson, J. B. Bruckner and A. M. Bruckner, *Elementary Real Analysis, Volume I*, 2nd edition, 2008 (open access textbook, available at `http://www.ClassicalRealAnalysis.com`).

Prerequisites: MATH 300 (Foundations of Mathematics), MATH 221 or 251 or 253 (Several Variable Calculus).

Grading system: There will be 2 tests and the final comprehensive exam. The tests are worth 100 points (or 22.2% of the final grade) each, the final exam is worth 150 points (or 33.3% of the final grade). Also, there will be homework assignments, which will account for another 100 points (or 22.2% of the final grade). Extra credit can be earned by solving bonus problems. The final grades will be assigned according to the 90–80–70–60% scale, namely, A for 405+ pts, B for 360–404 pts, C for 315–359 pts, D for 270–314 pts, and F for less than 270 pts.

The *tentative* dates for the two tests are February 26 and April 13. The final exam is scheduled for Tuesday, May 5, 10:30 a.m. – 12:30 p.m.

Starting March 23, all assignments (homework, the 2nd test, and the final exam) should be submitted through eCampus. Late submissions may be penalized if circumstances warrant.

Make-ups: Make-ups for missed tests will only be allowed for a university approved excuse. 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/`

Students with disabilities: If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845–1637 (or visit `http://disability.tamu.edu`). Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Title IX and limits to confidentiality: Class materials are generally considered confidential pursuant to student record policies and laws. As a University employee, I, however, must report allegations of sexual assault, sexual discrimination, or sexual harassment when they involve TAMU students, faculty, or staff, or third parties visiting campus if you share such information with me.

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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 (≈ 2.5 weeks): *Axiomatic model of the real numbers*

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

Thomson/Bruckner/Bruckner: Chapter 1

Part II (≈ 4 weeks): *Sequences and infinite sums*

- Limits of sequences
- Bolzano-Weierstrass theorem
- Cauchy sequences
- Convergence of series
- Tests for convergence
- Absolute convergence

Thomson/Bruckner/Bruckner: Chapters 2–3

Part III (≈ 2.5 weeks): *Continuity*

- Topology of the real line
- Limits of functions
- Continuous functions
- Uniform continuity

Thomson/Bruckner/Bruckner: Chapters 4–5

Part IV (≈ 4 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

Thomson/Bruckner/Bruckner: Chapters 7–8