VIRGINIA STATE UNIVERSITY
SCHOOL OF AGRICULTURE, SCIENCE AND TECHNOLOGY
DEPARTMENT OF MATHEMATICS
COURSE SYLLABUS
MATH 400-01 ADVANCED CALCULUS -3 Sem. Hrs

Instructor: Dr. Dawit Haile
Office Hours:
Office: HM 303Sa
Office Phone Number: 524-5410
E-Mail: dhaile@vsu.edu
Course Web-page: http://www.vsu.edu/facultypage/dhaile/index.htm

COURSE DESCRIPTION:

Sets and functions, Sequences, limits and continuity, Differentiation, The Riemann Integral, Infinite Series.

COURSE TEXT:

INTRODUCTION TO ANALYSIS, 5th ed. Edward D. Gaughan, 1998, Brooks/ Cole.

LEARNING OUTCOMES, ACTIVITIES, AND EVALUATION PROCEDURES:

KNOWLEDGE

The student will:

a) recall the definition of the terms: axioms, postulates, theorem, corollaries, lemmas, proposition, hypothesis, conclusion, set, function, series, sequences, convergence and divergence of a sequence / series, subsequence, limit (cluster, accumulation) point of a sequence, monotone sequence, Cauchy sequence, limit of $f(x)$ at $x = a$, $f(x)$ is continuous at $x = a$, Uniform continuity, metric space, open sphere, closed sphere, neighborhood, limit point in metric space, open set, closed set, differentiation.

b) recall concept of upper bound, least upper bound, and least upper bound axiom.

c) recall the Bolzano-Weierstrass theorem.

d) recall the nested interval theorem.
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e) recall the Heine-Borel covering theorem.

f) recall different definitions of the statement " $f(x)$ is continuous at a point."

g) recall proves to mathematical theories involving continuity such as: continuous functions on a closed bounded interval is bounded and attains its bound; sum, difference, product, quotient, and composition of two continuous function is continuous.

h) recall the Rolle's theorem and the Mean-Value theorem.

i) recall the L'Hopital's rule and the Inverse-Function theorem.

j) recall the Riemann integral and classes if integrable functions.

Evaluation Strategy: Every component will be evaluated by in class quizzes and unit tests.

SKILLS

The student will:

a) write proves involving concept of least upper bound and greatest lower bound.

b) write proves of theorem such as " If a sequence is convergent then limit is unique and sequence is bounded".

c) write prove to show that different definitions of the statement: " $f(x)$ is continuous" are equivalent.

d) write proves to mathematical theorems involving continuity such as: continuous functions on a closed bounded interval is bounded and attains its bound; sum, difference, product, quotient, and composition of two continuous function is continuous.

e) write proves involving concept of uniform continuity, such as: If $f(x)$ is continuous on $[a,b]$, then $f(x)$ is uniformly continuous on $[a,b]$.

f) write proves of theorem in metric space, such as: If a set A is open then its complement is closed; the union of any collection of open set is open.

g) write proves of theorems that involve differentiability and integrability of a function.

Evaluation Strategy: Every component will be evaluated by in class quizzes and unit tests.

ABILITIES

The student will:

a) explain mathematical proves involving series and sequences.

b) explain the logical **arguments used to prove theorems such as: Bolzano-Weierstrass theorem and nested interval theorem.**

c) apply abstract concept of continuity to show that a specific function is continuous.

d) use concept of limit to evaluate limits of different functions,

e) evaluate derivatives and integrals**.**

f) write a research paper involving some topic in analysis. (Let me know the topic before starting the research.) This is a **required activity for graduate students taking this course.**

Evaluation Strategy: Components a, b, c d, and e will be evaluated by in class quizzes and unit tests. Component f will be evaluated for its thoroughness and its written and oral presentation.

ADDITIONAL EVALUATION STRATEGIES:

1. Mid-term examination will be conducted during the mid-term examination period assigned by the university and will cover all the material covered by that time.

2. Final examination will be conducted during the final examination period assigned by the university and will cover all the material covered during the semester.

COURSE REQUIREMENTS:

University policies concerning class attendance, grading, academic honesty, and classroom decorum/conduct as listed in the VSU Undergraduate Catalog (1995-98, edition) and Faculty Handbook, 1995 edition will be observed. A copy of these policies is attached with this course syllabus.

Inform the teacher (in private) if you are covered by the American Disability Act, so that appropriate instructional arrangements can be made.

GRADING STANDARDS:

The following components will determine the final grade.

1. **Home Assignments** - At the end of each topic you will be assigned some problems from the textbook or from some other source. Sometimes the assignment will be collected and graded and other times one or two problems from the assignment will be chosen and student will be asked to do it in class. Total score from all home assignments will be 200 points.

2. **Tests** - Four one-hour tests. Each test will be worth 100 points. Test will be comprised of questions discussed in class, home assignments, solved examples in the text, and any other assigned problems. Tests will be announced in advanced. You can expect one test every three to four weeks.

3. **Mid-term Examination** - 100 points.

4. **Final Examination** - 200 points.

5. **Project** - 100 points.

Numerical Scores. The following numerical scores will be assigned to each components in the grade determination process.

	Points
Tests	400
Home Assignments	200
Mid-term	100
Project	100
Final	200
	1000

Letter Grade:

A	**90 - 100**
B	**80 - 89**
C	**70 - 79**
D	**60 - 69**
F	**below 59**

Bibliography:

1. Advanced Calculus, A course in Mathematical Analysis, Patrick M. Fitzpatrick, PWS Publishing Company, Boston, Ma.

2. Advanced Calculus, Wilfred Kaplan, Fourth Edition, Addison Wesley Publishing Company, Reading, Massachusetts.

3. Methods of Real Analysis , Richard R. Goldberg, John Wiley & Sons, Inc., New York, NY.

4. Analysis With An Introduction to Proof, Steven R. Lay, Prentice Hall, Englewood, New Jersey

5. How to read and Do Proofs, Daniel Solow, John Wiley & Sons, New York, N.Y

6. Analysis With an Introduction to Proof by Steven R. Lay; Prentice Hall, Englewood Cliffs, New Jersey.

7. The Way of Analysis, Robert S. Strichartz, Jones and Bartlett Publishers, Boston, Ma.

8. Advanced Calculus, An Introduction to Analysis, Watson Fulks, John Wiley and Sons, New York.

9. Introductory Analysis - The Theory of Calculus, by J. A. Friday, Harcourt Brace Jovanovich, Inc. , New York , NY.

10. A Course in Real Analysis, by John N. McDonald and Neil A. Weiss, Academic Press, San Diego.

11. Introductory Real Analysis, by Frank Dangello and Michael Seyfried, Houghton Mifflin Company, Boston