Advanced Calculus II

Spring 2018

MTH 428 Section 201, CRN 3967

T R 2:00 – 3:15 SH 518

(Revised 1/7/2018)

# Instructor: Dr. Bonita A. Lawrence

614 Smith Hall, Differential Analyzer Lab

696-3040, 696 3854 lawrence@marshall.edu

Office Hours: 10:00 A.M. – 11:30 A.M. M, W

2:00 P.M. – 3:00 P.M. M, W

Or a time that we can find that works for both of us!

**General University**

**Policies:** By enrolling in this course, you agree to the University Policies. You can read the full text of these important policies online at the Marshall website at MU Academic Affairs: University Policies (URL: http://www.marshall.edu/academic-affairs/policies ).

**Attendance Policy**:

I expect you to be in class every day you are physically able. It is your responsibility to determine what you missed, in the event you are unable to attend class. Requesting notes from a colleague would be wise. You will be able to find your assignments at the Blackboard site for our class.

**Academic Dishonesty Policy:** I expect you to do your own work. You can certainly discuss the homework problems with your colleagues but what you present to me for any type of assessment must be your own. When you follow the proof technique of another author, the proof must be written up in your own words.

**Policy for Students with Disabilities:** Marshall University is committed to making all programs, services, and activities fully accessible to students with disabilities. The purpose of the Office of Disability Services Program is to provide the educational and physical accessibility support necessary for students to achieve their academic goals and to promote as much independence as possible on the part of the students with disabilities. Students with disabilities who require accommodations must contact the Office of Disability Services ( <http://www.marshall.edu/disabled> ).

**Course Description from Catalog:** A rigorous development of algebra and topology of Euclidean spaces, differentiability and integrability of functions of several variables.

**Course Prerequisites:** This is a continuation of MTH 427 Student must have earned a grade of *C* or better in MTH 427.

**Textbook:** Introduction to Real Analysis, 4th Edition

Robert G. Bartle and Donald R. Sherbert

John Wiley & Sons, Inc.

**Course Objectives:** We will continue our in-depth study of the behavior of functions on the real line. We will begin with the study of limits theorems for functions and formally define continuity, including uniform continuity. With these tools, we will move to the study of the formal definition of the derivative and results that follow from this definition, including the Mean Value Theorem, L’Hospital’s Rules and Taylor’s Theorem. As in your Calculus training, we will then move to formally defining the Riemann integral and the Fundamental Theorem of Calculus, First and Second forms. Your understanding of these powerful ideas will be expanded as you construct your own proofs and create your own examples. We will return to the limit definition of the derivative and verify many

I am looking forward to an exciting semester!

Success in the course will be measured by your ability to meet the following learning outcomes.

The ability to

1. Exhibit an understanding of fundamental theorems related to the behavior of functions, differentiation and integration of functions.

Skill Development: Individual, small group and whole group discussions of a) the behavior sequences and series, b) differentiation of functions, and c) integration of functions. Daily exercises with review the following class period.

Assessment: Written and oral presentations of proofs of classical theorems including group constructions

1. Comprehend and apply the results found in classical theorems (and proofs of the theorems) in function theory of real variables to related problem settings.

Skill Development: Individual, small group and whole group discussions of applications of classical theorems. Daily exercises with review the following class period.

Assessment: Written and oral presentations as well as group presentations of the solutions process for exercises involving the application of classical theorems.

1. Construct (as well as restate in your own words) formal proofs of propositions that address concepts discussed during the course of the semester. While you will use the technique of a previous author, you must describe the process in your own words.

Skill Development: Individual, small group and whole group discussions about the construction of logical and valid proofs of classical theorems and related propositions. Daily exercises with review the following class period.

Assessment: Written and oral presentations (individual as well as group work) of proofs of classical theorems and related propositions.

1. Present your work clearly and concisely in both written and oral form. Organization and logical flow will be the secrets to success in meeting this objective.

Skill Development: Individual, small group and whole group discussions about precise and concise language in both written and oral form. Daily exercises with review the following class period.

Assessment: All written assignments and oral presentations at the board.

1. Recognize and appreciate various approaches to the same problem.

Skill Development: Individual, small group and whole group discussions about the construction of more than one approach to the proof of a theorem or proposition. This offers the group a chance to learn about the perspective of others. This is a valuable exercise!

Assessment: Exercises that require the construction of more than one approach to an exercise or proof of a proposition.

1. Describe convergence using a physical model.

Skill Development: Set up and run a dynamic equation on one of the Marshall Differential Analyzers.

Assessment: Written and oral descriptions of how the physical model describes the mathematical concept of convergence.

**Textbook and**

**Required Materials** Introduction to Real Analysis, 4th Edition

Robert G. Bartle and Donald R. Sherbert

John Wiley & Sons, Inc.

**Grading Procedure:** You grade will be calculated using the following percentages:

Homework: 15 %

Boardwork: 10 %

Exam I 25%

Exam II 25 %

Final Exam: 25 %

There will be three exams during the semester including the final exam, (**Thursday, May 3, 2018, 12:45 P.M. – 2:45P.M**.). The dates for the first two exams can be found in the schedule of events at the end of the document. In the event you are not able to take the exam on the scheduled date because of serious circumstances, (See General University Policies) please contact me before the scheduled exam time so that we can plan a time for you to take the exam early.

You will be assigned homework in every class period. You will submit your homework at the beginning class. I will not accept late homework. I will ask to you present some of your fine works of art at the board for my enjoyment as well as that of your peers. This is what I call “Boardwork”. You must visit the board at least three times during the semester to get full credit for your boardwork.

Your final grade will be determined using the following scale:

90% - 100% A

80% - 89% B

70% - 79% C

60% - 69% D

0% - 59% F

My best advice (It’s free!) is for you to keep up with your reading and homework assignments.

**A Tentative Schedule of Topics MTH 527**

**Class Days Topics and Events**

**Week 1 Limits of Functions**

**January 9, 11 (Sections 4.1, 4.2)**

**Boardwork**

**Week 2 Continuous Functions and**

**January 16, 18 Some Nice Properties They Enjoy**

**(Sections 5.1, 5.2)**

**Boardwork**

**Week 3 Continuity on Intervals**

**January 23, 25 Uniform Continuity**

**(Sections 5.3, 5.4)**

**Boardwork**

**Week 4 Continuity Related to**

**January 30, February 1 Monotone and Inverse Functions**

**(Sections 5.5, 5.6)**

**Excursion I - Thursday**

**Week 5 The Derivative**

**February 6, 8 (Section 6.1)**

**Boardwork**

**Week 6 The Mean Value Theorem**

**February 13, 15 L’Hospital’s Rules**

**(Sections 6.2, 6.3)**

**Boardwork**

**Week 7 The Riemann Integral**

**February 20, 22 (Section 7.1)**

**Boardwork**

**Week 8 Integrable Functions**

**February 27, March 1 Intro to the Fundamental Theorems**

**(Sections 7.2, 7.3)**

**Boardwork**

**Week 9 The Fundamental Theorems**

**March 6, 8 (Section 7.3)**

**Excursion II - Thursday**

**Week 10 The Darboux Integral**

**March 13, 15 (Section 7.4)**

**Boardwork**

**Week 11 Spring Break**

**March 19 - 23 Enjoy!**

**Week 12 Approximate Integration**

**March 27, 29 (Section 7.5)**

**Boardwork**

**Week 13 Pointwise and Uniform Convergence**

**April 3, 5 (Section 8.1)**

**Boardwork**

**Week 14 Interchange of Limits**

**April 10, 12 Exponential and Logarithmic**

**Functions**

**(Section 8.2. 8.3)**

**Boardwork**

**Week 15 Trig Functions**

**April 17, 19 Absolute Convergence**

**(Sections 9.1 and perhaps 9.2)**

**Boardwork**

**Week 16 Absolute Convergence Revisited**

**April 24, 26 (Sections 9.1 and perhaps 9.2) Boardwork**

**Final Exam:**

**Thursday, May 3, 12:45 P.M. – 2:45 P.M.**