Time Scales Calculus

Fall 2014

MTH 690 Section 101, CRN 3309

**T,R 11:00-12:15, DA Lab**

(Tentative 8/26/2014)

# Instructor: Dr. Bonita A. Lawrence

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Office Hours: 3:00 P.M. – 4:00 P.M. T,R

9:00 A.M. – 10:00 A.M. M, W

Or a time that we can find that

works for both of us!

**Textbook:** Dynamic Equations on Time Scales: An Introduction with Applications

Martin Bohner and Allan Peterson, Birkhauser, Boston.

This is the best book in print for the study of Time Scales Calculus. Although the fundamental theory Time Scale Calculus was developed by Stephan Hilger in his Ph.D. dissertation, this book, known among time scales researchers as “the green book”, is a compilation of research done by many in our field. (Note the list of references in the bibliography!)

**Course Prerequisites:** There is no formal prerequisite for this course. I will assume that you have had or are currently enrolled in the first course in Advanced Calculus and that you have had a proof techniques course or some experience writing proofs using the commonly used techniques. If this is not the case, please come to talk to me about your previous training.

**Course Objectives:** In E. T. Bell’s book Men of Mathematics, the author states “The major task of mathematics today is to harmonize the continuous and the discrete, to include them in one comprehensive mathematics, and to eliminate obscurity from both.” This book was published in 1937, not that long ago if we consider how long our mathematics has been developing. In the late 1980’s, Dr. Stefan Hilger, in his Ph.D. dissertation, created time scale calculus with the goal of developing a structure to do precisely what Dr. Bell had in mind, unifying and “harmonizing” the discrete and the continuous. We will start with a discussion of the motivation for the development of this field and then move to expanding our ideas of calculus to this new structure.

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

The ability to

1. Exhibit an understanding of the motivation for this field of study.

Skill Development: Reading assignments and class discussions of the origins of the field that include examples that exhibit a need for these studies. Daily exercises with review the following day.

Assessment: Review of written and oral presentations of examples that show the link that time scales offers in the unification of the discrete and the continuous for depth of understanding.

1. Exhibit an understanding of the relationships between our usual calculus, difference calculus and time scale calculus.

Skill Development: Group discussions (lead by you or one of you colleagues) of definitions and theorems that make up the structure of time scale calculus and their link to calculus on the real line and on a discrete set. Daily homework exercises with review the following day.

Assessment: Review of written and oral analyses of definitions and theorems, complete with proof, that make up the structure of time scale calculus and how they are related to similar results in continuous and discrete dynamics for conceptual understanding and relationships between ideas. Additionally, a similar review of this process in reverse.

1. Construct formal proofs of propositions that address concepts discussed during the course of the semester.

Skill Development: Peer lead discussions that include the construction of proofs of propositions that develop the structure of time scales calculus. Daily homework exercises with review the following day.

Assessment: Review of all written and oral presentations of proofs for proper construction and clarity of fundamental theorems and other propositions discussed during the course of the semester.

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: Peer lead discussions that include the creation of clear and concise proofs of stated theorems and propositions. Daily homework exercises with review the following day.

Assessment: Review of all written assignments and oral presentations at the board for clarity and understanding.

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

Skill Development: Peer lead discussions of various approaches to the same problem.

Assessment: Review of written and oral exercises requiring the use of more than one approach to the proof of a proposition for proper construction and clarity of process.

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

Homework: 20%

Boardwork: 20%

Midterm Exam: 30%

Final Exam: 30%

I want contribute to your quest to be a lifelong learners. To achieve this goal, I have planned the following format for our class time.

This will be a seminar class. You will be learning the material from the green book and discuss the ideas with your peers and me! Each of you will be assigned certain topics that we will use to develop the structure of time scales calculus. You will lead your colleagues and me in interesting and engaging discussions of these topics. (At your level, I find that this is one of the best ways to study mathematics. It will prepare you for advanced studies of mathematics as well as other topics.) I will oversee the discussion and make comments. My comments will have purpose so take note. You will have homework exercises that you will submit regularly.

There will be two tests during the semester, a midterm and a final exam **Thursday, December 11, 10:15 A.M. – 12:15 P.M**. In the event you are not able to take the exam on the scheduled date because of very serious circumstances, (see http://www.marshall.edu/academic-affairs/policies/) please contact me before the scheduled exam time so that we can plan a time for you to take the exam early.

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.

**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. I will be happy to let you know the assignment for the particular day you missed.

**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 assessment must be your own. The University’s policy concerning academic dishonesty can be found in the Marshall University Graduate Catalog at

www.marshall.edu/ucomm/files/web/Gr\_2014-15\_published.pdf

**Policy for Students with Disabilities:** Marshall University is committed to equal opportunity for all. Students with physical, learning or psychological disabilities should contact the Office of Disabled Students Services (DSS) in Prichard Hall 117, 304 696-2271 and provide documentation of their disability. After consultation the DSS coordinator will send a letter to the student’s instructors describing the accommodations the student will need. For more information, go to <http://www.marshall.edu/disabled> or call or visit the office in Prichard Hall.

**University Computing Services’ Acceptable Use Policy:**

There is a University policy concerning the acceptable use of University computers. The information can be found at <http://www.marshall.edu/ucs/CS/accptuse.asp>. You are responsible for making yourself aware of this important information.

**Affirmative Action Policy:** In the spirit of equal opportunity for all, Marshall University has an Affirmative Action Policy. This can be found in the 2014-15 Graduate Catalog at www.marshall.edu/ucomm/files/web/Gr\_2014-15\_published.pdf.

**Inclement Weather Policy:** In the event of bad weather that may prevent us from coming to school, Marshall has a policy that describes how things will be handled. (Note that I have been here for 11 years and we have only shut down school once during this time.) The policy can be found in the 2014-15 Graduate Catalog or at [www.marshall.edu/ucomm/files/web/Gr\_2014-15\_published.pdf](http://www.marshall.edu/ucomm/files/web/Gr_2014-15_published.pdf).

**Have a great semester and let me know if I can help you. If I can’t answer your question, I’ll find someone who can!**

**Cheers!**

**Dr. Lawrence**