

Quadratic Differentials in Complex Analysis and Related Areas of Mathematics

MATH 5399-006

Spring 2017

Course instructor:

Dr. Alexander Solynin

MA 010

TR

9:30 – 11:00 pm

Office hours:

MW 2:00-4:00 or by appointment

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TEXT: Your lecture notes.

Complementary texts: (1) *Quadratic Differentials*. Springer-Verlag, Berlin, 1984, by Kurt Strebel. (2) *Univalent Functions and Conformal Mapping*, Springer-Verlag, Berlin, 1958 by James A. Jenkins.

• **Course Description:** This is an introductory course to the Theory of Quadratic Differentials (QD's). A QD is a meromorphic $(2,0)$ -form defined on a planar region or, more generally, on a Riemann surface. First goal will be to discuss basic properties of QD's. Then we will study the so-called Jenkins-Strebel QD's which have been found to be very useful in the theory of extremal problems of geometric function theory (analysis), the theory of minimal surfaces (geometry), and the conformal string theory (theoretical physics). Our third goal will be to discuss several applications of the theory of QD's to some particular problems from complex analysis and differential geometry,

The prerequisite for the course is a one year course in Complex Variable. Basic knowledge of ordinary differential equations is also required.

Learning Outcomes: Upon completion *Quadratic Differentials* course students will master concepts and theory of Jenkins-Strebel Quadratic Differentials and theory of Extremal Metrics.

The main emphasis will be given to applications of these theories to Extremal Problems for analytic functions and conformal mappings.

Methods for Assessment of Learning Outcomes: The expected learning outcomes for the course will be assessed through graded activities and ungraded activities. The graded activities include exams, homework, quizzes, and research papers. The ungraded activities will be used to monitor your progress. A variety of these ungraded assessment techniques may be employed, including problems to be completed during class, direct questioning of students, answering students questions in class, one-minute classroom assessment techniques, and discussions during office hours.

General Policies:

In general, no missed in class exams and quizzes will be made up and no homework will be accepted after the deadline. Whether an absence is excused or unexcused is

determined solely by the instructor with the exception of absences due to religious observance and officially approved trips described below.

Absence due to religious observance: The Texas Tech University OP 34.19 states that a student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. As your instructor, I request that notification be made in writing and submitted no later than the 15th class day of the semester. Absence due to officially approved trips - The Texas Tech University OP 34.04 states department chairpersons, directors, or others responsible for a student representing the university on officially approved trips must notify the student's instructors of the departure and return schedules. The instructor so notified must not penalize the student, although the student is responsible for material missed. Any student absent because of university business must be allowed to make up missed work within a reasonable span of time or have alternate grades substituted for work due to an excused absence. Students absent because of university business must be given the same privileges as other students.

Academic Integrity (extracted from OP 34.12): It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and high standard of integrity. The attempt of students to present as their own any work not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offenders liable to serious consequences, possibly suspension.

Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, and any act designed to give unfair academic advantage to the student (such as, but not limited to, submission of essentially the same written assignment for two courses without the prior permission of the instructor) or the attempt to commit such an act.

Civility in the Classroom: Incivility is any action that interferes with the classroom learning environment. This includes, but is not limited to, eating, arriving late, leaving early, a ringing cell phone, text messaging, sleeping, chatting during class, dominating the class discussion by not allowing other students to speak, and putting books away before the end of class. Be respectful to the instructor and to your fellow students. I will ask anyone participating in what I perceive to be inappropriate behavior to stop immediately.

Accommodation for Students with Disabilities (extracted from OP 34.22): Any student who, because of a disability, may require some special arrangements in order to meet course requirements should contact the instructor as soon as possible to make the necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until the appropriate verification from Student Disability Services has been provided. For additional

information, you may contact the Student Disability Services office at 335 West Hall or 806-742-2405.

Absence due to officially approved trips: The Texas Tech University Catalog states that the person responsible for a student missing class due to a trip should notify the instructor of the departure and return schedule in advance of the trip. The student may not be penalized and is responsible for the material missed.

Title IX Syllabus Statement - TTU Resources for Discrimination, Harassment, and Sexual Violence: Texas Tech University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from gender and/or sex discrimination of any kind. Sexual assault, discrimination, harassment, and other [Title IX violations](#) are not tolerated by the University. Report any incidents to the *Office for Student Rights & Resolution*, (806)-742-SAFE (7233) or file a report online at titleix.ttu.edu/students. Faculty and staff members at TTU are committed to connecting you to resources on campus. Some of these available resources are: **TTU Student Counseling Center**, 806-742-3674, <https://www.depts.ttu.edu/scc/> (*Provides confidential support on campus.*) **TTU Student Counseling Center 24-hour Helpline**, 806-742-5555, (*Assists students who are experiencing a mental health or interpersonal violence crisis. If you call the helpline, you will speak with a mental health counselor.*) **Voice of Hope Lubbock Rape Crisis Center**, 806-763-7273, voiceofhopelubbock.org (*24-hour hotline that provides support for survivors of sexual violence.*) **The Risk, Intervention, Safety and Education (RISE) Office**, 806-742-2110, rise.ttu.edu (*Provides a range of resources and support options focused on prevention education and student wellness.*) **Texas Tech Police Department**, 806-742-3931, <http://www.depts.ttu.edu/ttpd/> (*To report criminal activity that occurs on or near Texas Tech campus.*)

Important Dates:

Tuesday, January 24 - Last day to add a course.

Friday, February 3 - Last day to drop a course without academic penalty.

Wednesday, February 15 - Last day to withdraw from the university and receive a partial refund.

Wednesday, March 29 - Last day to drop a course.

Saturday - Sunday, March 11-19 - Spring Vacation.

Monday, April 17 – No Classes.

May 4-10 – Period of no examinations.

Tuesday, May 9 - Last Day of classes.

Thursday, May 11 - 7:30 a.m. – 10:00 a.m. Final Exam.

STUDENT EVALUATION:

● Students will work on their research projects related to the theory of Quadratic Differentials and present results upon completion.

◆ **Final Exam (Optional!) 30 pts**

These 30 pts can be used to substitute any other assignments of your choice.

◆ **Final Presentation /Final Project 40 pts**

- **Midterm Presentation/Midterm Project:** 20 pts
- **Homework:** 20 pts
- **5 min Quizzes:** 20 pts
- **MAXIMAL TOTAL:** 100 pts

GRADING PROCEDURE:

A - 90 - 100%

B - 80 - 89%

C - 70 - 79%

D - 60 - 69%

F - $\leq 59\%$