

# MATH 6363 – 01 & 90L (Integrable Systems) Syllabus for Summer II 2022

**Classroom:** EMAGC 1.208

**Time:** M-F 1:15pm – 2:45pm, July 14, 2022 – August 19, 2022

**Instructor:**

Dr. Zhijun (George) Qiao

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**Office hours:** M & W 11:30am-12:30pm (In Person at MAGC 3.722 or via Zoom at <https://utrgv.zoom.us/j/2824166420>) or by appointment.

**Prerequisite:**

A student must have completed and passed Math 4318 (BVP) or Math 3349 (Differential Equations) with a grade B or better, or consent of instructor. The student not meeting this requirement may be asked to drop the course.

This course includes solitons and integrable systems. Purpose of this course is to show the students how to analyze a partial differential equation from a physical problem and how to solve the equation using traveling wave setting (along with some boundary conditions). Emphasis will be placed on the learning and understanding of definitions and abstractions in mathematics, as well as the study of the use of integration and series in real-world problems. A more detailed list of topics is given in the course materials.

**Textbooks:** Some chapters from Geometric Mechanics, Part I: Dynamics and Symmetry (2nd Edition) Darryl D Holm (Imperial College Press, London, UK) ISBN: 978-1-84816-775-9 (softcover), and some chapters from *Finite-dimensional Integrable System and Nonlinear Evolution Equations*, ISBN 7-04-010516-0 by Zhijun Qiao, 2002, Chinese National Higher Education Press, Beijing, PR China.

**Topics:** Traveling Wave Solutions and Solitons, Lax Pair, Conservation Laws, Hamiltonian Structures, and Classical Integrable Systems.

**Math Software:** Maple/Mathematica or Matlab, which is capable of performing complicated integrals and calculations (e.g. some definite integrals and series etc), is recommended to use for checking if your result is correct.

**Daily supplies:** You need to bring your Notebook, Loose leaf paper, Graph paper, Pen, Pencil etc to the class.

**Course Objectives:** This course includes solitons and integrable systems The purpose of this course is to show the students how to analyze a partial differential equation from a physical problem and how to solve the equation using traveling wave setting (along with some boundary conditions). Emphasis will be placed on the learning and understanding of

definitions and abstractions in mathematics, as well as the study of the use of integration and series in real-world problems. A more detailed list of topics is given in the lessons.

**Student Learning Outcomes:** After completing this course students will

- Understand the terminology, scope, main results, and applications of mathematical solitons and integrable systems.
- Be able to compute and apply fundamental integrability theorem to test if a nonlinear systems is integrable.
- Know the basic terminology and results of traveling wave solutions.
- Understand some weak solution in some functional space.
- Know how to use computer and graphing software like Maple/Mathematica/Matlab to gain insight into the topics discussed in class and to aid in performing computations.
- Demonstrate the way to find Lax pair and conservation laws.

### General Grade Policy

**Homework and Projects** – Homework assignment is assigned daily and will consist of problems and reading from the lecture notes and occasional handout. Projects are based on the homework problems. A project will be taken every 1.5 weeks, namely, 2 or 3 times in the whole summer II semester. *Projects will be designed in two formats: each student gives presentation based on the homework, and the other is to solve some physical problems I will assign.* It is strongly recommended that students work all those homework problems since projects score are used to determine your project grade. Completing the assignments is the **single most important part** of this course. You will be expected to spend, on average, about 4 hours each week to complete the assignments. All students are strongly encouraged to do a team work for your homework and projects. The assigned problems will not be collected or graded, but they will form the basis for projects and all tests and the final exam. I will select your best 2 of your project scores in final grade. A homework assignment sheet will be delivered to everybody on the 1<sup>st</sup> day class. No late re-project will be accepted.

**Tests** – There will be one 1.5-hour test. The test must be taken during their scheduled times. The test time will be announced in advance (basically, a test will be given every two chapters), and a brief review will be given before the test. All students must show their work on the tests. Score will be provided to you separately. No re-test opportunities.

**Final Exam** – The comprehensive final exam is tentatively scheduled on **Friday, August 19, 2022 2:00pm – 3:45pm**. All students must take the final exam on the scheduled time. A summary review will be given in the class before the final exam.

**Grading** – The course grade will be based on

HW/Quizzes/Discussion Board	50 pts
Best 2 out of 3 projects at 75 pts each	150 pts
Mid-term Test	100 pts
Comprehensive Final Exam	100 pts
<hr/> Total	<hr/> 400 pts

The course grade will be assigned according to a scale no higher than A(85-100%), B(75-84%), C(60-74%), F(below 60%).

**THERE WILL BE NO MAKE-UP EXAMS GIVEN.**

If a student is absent during a scheduled major test and quiz, the student must go by the instructor's office during the scheduled office hours to discuss the validity of the excuse. In the case of a valid excuse, the missed test grade will be replaced by the final exam grade. If a student does not have a valid excuse, the grade for the missed test is a zero and cannot be replaced. If you arrive late to a test you will not be given additional time to complete the exam. Anyone arriving to a test after somebody else who took the exam has left will not be allowed to take the exam. Students missing more than one exam may be dropped from the course. With an unexcused absence, a score of 0 will be recorded for the missed HW/Quiz or exam.

**Tutoring: you may use online resources as your own study for the homework problem solving.**

**Classroom Behavior:**

- All beepers and cellular phones must be turned off before you enter the classroom.
- Once in class, a student is expected to remain in class for the duration of the class. If a student needs to leave class early, then the student needs to discuss the situation with the instructor before class begins.
- During class students are expected to be courteous to the instructor and other classmates. Examples of discourteous behavior are unnecessary talking, sleeping, tardiness, leaving class while instructor is lecturing, sharpening pencils during the lecture, etc.
- No Food Allowed In Classroom.
- Chronic tardiness and discourteous behavior will not be tolerated and is cause for a student's dismissal from class for the remainder of the semester.

**UTRGV Policy Statements**

UTRGV requires all electronic communication between the University and students be conducted through the official University supplied systems UTRGV-Mail. Please use your UTRGV-Mail account for all correspondence with me.

**Calculators, Cell Phones, and Other Electronic Equipment**

Calculators will be permitted for use on exams. Electronic equipment such as cell phones, pocket organizers, tablet or laptop computers, or electronic writing pads or pen-input devices will not be permitted during exams. Please make sure that cell phones are turned off and stored away during class.

**MANDATORY COURSE EVALUATION PERIOD:**

Students are required to complete an ONLINE evaluation of this course, accessed through your UTRGV account (<https://my.utrgv.edu/home>); you will be contacted through email with further instructions. Students who complete their evaluations will have priority access to their grades. Online evaluations will be available: July 1 – 8 for summer I semester courses.

**ATTENDANCE:** Students are expected to attend all scheduled classes and may be dropped from the course for excessive absences. UTRGV's attendance policy excuses students from attending class if they are participating in officially sponsored university activities, such as athletics; for observance of religious holy days; or for military service. Students should contact the instructor in advance of the excused absence and arrange to make up missed work or examinations.

### **STUDENTS WITH DISABILITIES:**

If you have a documented disability (physical, psychological, learning, or other disability which affects your academic performance) and would like to receive academic accommodations, please inform your instructor and contact Student Accessibility Services to schedule an appointment to initiate services. It is recommended that you schedule an appointment with Student Accessibility Services before classes start. However, accommodations can be provided at any time. **Brownsville Campus:** Student Accessibility Services is located in Cortez Hall Room 129 and can be contacted by phone at (956) 882-7374 (Voice) or via email at [ability@utrgv.edu](mailto:ability@utrgv.edu). **Edinburg Campus:** Student Accessibility Services is located in 108 University Center and can be contacted by phone at (956) 665-7005 (Voice), (956) 665-3840 (Fax), or via email at [ability@utrgv.edu](mailto:ability@utrgv.edu).

### **SCHOLASTIC INTEGRITY:**

As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism, and collusion; submission for credit of any work or materials that are attributable in whole or in part to another person; taking an examination for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced (Board of Regents Rules and Regulations and UTRGV Academic Integrity Guidelines). All scholastic dishonesty incidents will be reported to the Dean of Students.

### **SEXUAL HARASSMENT, DISCRIMINATION, and VIOLENCE:**

In accordance with UT System regulations, your instructor is a “responsible employee” for reporting purposes under Title IX regulations and so must report any instance, occurring during a student’s time in college, of sexual assault, stalking, dating violence, domestic violence, or sexual harassment about which she/he becomes aware during this course through writing, discussion, or personal disclosure. More information can be found at [www.utrgv.edu/equity](http://www.utrgv.edu/equity), including confidential resources available on campus. The faculty and staff of UTRGV actively strive to provide a learning, working, and living environment that promotes personal integrity, civility, and mutual respect in an environment free from sexual misconduct and discrimination.

**COURSE DROPS:** According to UTRGV policy, students may drop any class without penalty earning a grade of DR until the official drop date. Following that date, students must be assigned a letter grade and can no longer drop the class. Students considering dropping the class should be aware of the “3-peat rule” and the “6-drop” rule so they can recognize how dropped classes may affect their academic success. The 6-drop rule refers to Texas law that dictates that undergraduate students may not drop more than six courses during their undergraduate career. Courses dropped at other Texas public higher education institutions will count toward the six-course drop limit. The 3-peat rule refers to additional fees charged to students who take the same class for the third time.

### **Tentative Course Schedule:**

**Part 1: Traveling wave solutions**

**Part 2: Integrability for nonlinear PDEs**

**Part 3: Hamiltonian Structures**

**Part 4: Finite-dimensional Hamiltonian Systems**