MATH 6363/4399 – 01 (Integrable Systems)
Syllabus for Spring 2013

Classroom: MAGC 1.410
Time: TR 5:45pm – 7:00pm

Instructor:
Dr. Zhijun (George) Qiao
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Webpage: http://faculty.utpa.edu/qiao/
Office hours: M, W 4:00pm – 5:30pm (MAGC 3.722) 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 months, namely, 2 or 3 times in the whole 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 1st day class. No late re-project will be accepted.

Tests – There will be two one-hour tests. All tests 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 each 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 **Monday, May 6, 2013 5:45pm – 7:30pm**. 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

Best 2 of the 3 projects at 50 pts each	100 pts
Test 1	100 pts
Test 2	100 pts

Comprehensive Final Exam	100 pts
Total	400 pts

The course grade will be assigned according to a scale no higher than A(85-100%), B(75-84%), C(65-74%), D(50-64%), F(below 50%).

THERE WILL BE NO MAKE-UP QUIZZES OR EXAMS GIVEN.
If a student is absent during a scheduled major test and project, 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 or next test 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 project or exam.

Tutoring: There are several tutoring available on campus. For example, the MATH LAB I in MAGC 3.510 and the Math Learning Center in the Student Service Building room 304.

Attendance Policy: Attendance is mandatory. An attendance sheet is provided for you to sign at each class. Make sure you sign this sheet after your class attendance. Once you are absent, **it is your responsibility** to determine what class work and notes were missed and make arrangements to comply with all missed assignments by yourself. On the third absence, for any reason, the student will receive an automatic **DR**, unless otherwise approved by the instructor. Students arriving late or leaving early without prior arrangements with me may be recorded absent for the day.

Drop Policies: **A student may drop the course at any time before the final exam**. **A student wishing to drop the course must submit and sign a DROP FORM**. The forms can be obtained at the Registrar's Office or at the Department's Secretary Offices. Remember that it is the responsibility of the student to follow the procedure in the university catalog for dropping a course. DP and DF are no longer given from this semester.

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 students needs to leave class early, than 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.

Special Accommodations: If you have a documented disability which will make it difficult for you to carry out the work as I have outlined and/or of you need special accommodations/assistance due to the disability, please contact the Office of Services for Persons with Disabilities (OSPD), Emilia Ramirez-Schunior Hall Room 1.101 immediately. Appropriate arrangements/accommodations can be arranged. Verification of disability and processing of special services required, such as note-takers, extended time, separate accommodations for testing, will be determined by OSPD. Please do not assume adjustments/accommodations are impossible. Consult with the Coordinator, OSPD at extension 7005.

First day homework:

In order to communicate with all students, I need to edit an email list. Please send me an email and tell me: ***Math course number, Section number, Your name, Student ID, and email address*** you like me to contact, especially your email address is not in the list of UTPA registrar's system. I plan to use dropbox and let you get materials from there.

Tentative Course Schedule:
Part 1: Traveling wave solutions
Part 2: Integrability for nonlinear PDEs
Part 3: Hamiltonian Structures
Part 4: Finite-dimensional Hamiltonian Systems