Methods of Theoretical Physics (LB/PHY 415), Spring 2011
Course Information and Policies

Course Goals

LB/PHY 415 aims to teach a variety of mathematical methods essential for technical proficiency in advanced undergraduate physics, engineering, or other quantitative science courses at Michigan State University. The class focuses on developing both an understanding of useful techniques and skill in their application. The course stresses group work and in-class problem-solving in order to facilitate mastery of techniques. Connections are made with topics covered in other physics courses. Little stress is placed on proving mathematical theorems.

Instructors: Prof. Elizabeth H. Simmons and Prof. R. Sekhar Chivukula

office:	BPS 3221 (EHS);	BPS 3236 (RSC)
phone:	353-6486 (EHS);	884-5567 (RSC)
e-mail:	esimmons@msu.edu;	sekhar@msu.edu

office hours: 12:30-1:30pm Tuesday (Prof. Simmons) and Wednesday (Prof. Chivukula)

Please address all questions about course policies to Prof. Simmons or Prof. Chivukula. Requests for alteration of course deadlines must be discussed with the instructors well in advance; such requests are rarely granted.

Grader: Jacob Gordon, gordon70@msu.edu

ANGEL site: All students enrolled in the course have been automatically subscribed to the site **SS11-LB-415-001 Methods of Theoretical Physics**. You are expected to check the ANGEL site frequently for course information, assignments, and updates.

Class Meetings and Objectives : Tuesday/Thursday, 3:00 – 4:50pm, 111 Biochemistry Building
Specific reading assignments and objectives for **each** course meeting will be provided in advance through the course ANGEL site. Students are expected to familiarize themselves with the objectives and do the reading before coming to class, so they will be prepared to ask questions and participate in the frequent active-learning exercises that clarify new mathematical techniques. Attendance and participation will be incorporated into the course grade.

Academic Honesty

Article 2.3.3 of the Academic Freedom Report states: The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards. In

addition, Lyman Briggs College and the Department of Physics and Astronomy adhere to the policies on academic honesty specified in General Student Regulation 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See Spartan Life: Student Handbook and Resource Guide and/or the MSU Ombudsman Website https://www.msu.edu/unit/ombud/honestylinks.html)

Therefore, you are expected to complete all course assignments, including homework, quizzes, tests and exams, without assistance from any source, except as explicitly authorized by the instructors. You are expected to develop original work for this course; therefore, you may not submit course work you completed for another course to satisfy the requirements for this course. Also, you are not authorized to use the www.allmsu.com Web site to complete any course work in this course. Students who violate MSU rules may receive a penalty grade, including but not limited to a failing grade on the assignment or in the course.

Accommodations for Persons with Disabilities

Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a verified individual services accommodation (VISA) form. Please present this form to one of the instructors at the start of the term and/or two weeks prior to the accommodation date (test, project, etc). Requests received after this date will be honored whenever possible.

Books

Required Course Text: **Mathematical Methods in the Physical Sciences 3rd Edition, M.L. Boas, Wiley. ISBN 0471044091.**

On Reserve in the Engineering Library: *Mathematical Methods for Scientists & Engineers* (McQuarrie, 2003). *Elementary Differential Equations and Boundary Value Problems* (Boyce and DiPrima, 1969). *Mathematical methods for physicists* (Arfken and Weber, 1995). *Mathematical methods for physicists and engineers* (Collins). *Mathematical Methods for Physics* (Wyld). *Mathematical methods for physics and engineering* (Riley, Hobson and Bence, 1998).

Also Recommended: *Basic Training in Mathematics* , (Shankar, 1995). *A Guided Tour of Mathematical Methods,* (Snieder, 2001). *All You Wanted to Know About Mathematics But Were Afraid to Ask: Vol. 2.,* (Lyons, 1998).

Teams

The course stresses group work and in-class problem-solving in order to facilitate mastery of the various techniques. Teams will be formed during the first class period, and teams will be expected to sit together at every class meeting. Team members will work together on active-learning exercises and during the workshop sessions discussed below. Team members will provide peer evaluation of their team-mates several times during the term and these evaluations will be incorporated into the participation component of the course grade. The team peer-evaluation rubric is attached.

Problem Sets

The weekly problem sets are the best way for students to master the techniques being introduced in this course. Students who make an effort to complete assignments tend to do better on the examinations. To make sure your work receives appropriate credit, please write legibly and make your line of reasoning clear (using a few words can help even though this is a mathematical course).

You may discuss the problem sets together with other students from this class or use outside references (*i.e.*, material other than class notes and handouts or the textbook) – but the work you turn in must be your own. On your problem set, please note which classmates you have discussed the problems with and list any outside references used.

The problem sets will generally be due at the start of the Tuesday course meeting each week. Homework must be turned in on time to receive **any** credit. Sometimes, the interval between homework sets will be longer; the number of problems assigned may be correspondingly greater.

Mandatory Discussion Sections (a.k.a. Workshops)

The second hour of the Tuesday course meeting will typically consist of a discussion section, and will be conducted workshop-style focusing on the homework which has just been turned in. Students will work in their assigned course teams. Each team will work together at the blackboard on portions of the homework which they found particularly challenging. The instructors will circulate to answer questions and keep the discussion going. Each student is expected to play an active role in solving problems at the blackboard, suggesting alternative approaches, etc.

Students who wish to do so may turn in a **clearly legible** xerox or carbon copy of their homework at the start of the Tuesday course meeting and retain the original. Anyone who has done so and has participated in that day's workshop can then turn in a revised homework set in lecture the following Thursday (i.e., two days later) to be graded in lieu of the copy. Credit will be given on revised homework **only** for problems originally attempted with vigor in the xerox/carbon copy.

Course Project

An important objective of the course is to understand how the mathematical techniques are applied in order to quantitatively understand nature. To assess the students' ability in this regard, each student is required to complete a course project consisting of a 5-10 minute oral presentation and a 3'x4' poster on an application of the methods discussed in this course to understanding some aspect of nature. Students are encouraged to pick material covered in other courses they are taking or have taken, research projects they have participated in, or even items from the daily newspaper.

- A short course project proposal (5% of the project grade) is due to the instructors by noon on **Feb. 3** via e-mail. Students are encouraged to begin e-mail discussions with the instructors about prospective topics well before that date.
- A written project overview (18% of project grade, 1-2 pages total) is due in class on **March 3**. This should include (a) a one-paragraph summary of the problem discussed and its connection to the course material (b) a description of the layout and visual material to be included in the poster (c) a list of references with comments on how you plan to use each source or what information you think it will contribute. Acceptable references include peer-reviewed or professionally edited materials such as books, newspapers, and journal articles; in contrast, websites such as Wikipedia or MathWorld are **not** acceptable references. On March 4, you will discuss your written overview with one of the Professors in the context of the LB/PHY 415 Course Project Rubric (attached).
- There will be an in-class peer discussion of drafts of the posters on **April 14** (draft poster and participation in discussion is worth 10% of project grade).
- The projects will be presented at the Lyman Briggs Spring Presentation Day in Holmes Hall, scheduled on **Monday April 25** . The posters will be on display all day; the timing of the oral presentations will be arranged in advance. The poster and oral presentation are jointly worth 67% of the project grade.

Each student is expected to complete the project individually and appropriately reference all sources used. **Each student is expected to be aware of and abide by MSU anti-plagiarism policies** (see http://www.msu.edu/unit/ombud/plagiarism.html).

Attached you will find a list of sample project ideas and the "LB/PHY 415 Course Project Rubric" which will be used to evaluate the poster and presentation. Please read the rubric before starting the project so your work is aligned with the requirements!

Honors Option

Students wishing to elect an honors option version of the course project for LB/PHY 415 must discuss this with the instructors and hand in a signed Honors Option agreement by Jan. 20th. Honors option students will be expected to complete an 8-10 page written project report in addition to the poster and oral presentation; the material in the paper must extend well beyond that in the poster and presentation.

Tests

There will be three tests (each lasting 1.5 - 2 hours) during the semester, given during the **Feb. 17 and Mar. 31 course meetings** and on **May 2 from 3-5pm** (the last of these is the scheduled Final Exam date). Students must take all three tests at the appointed times (absent prior permission from the instructors or a written medical excuse) in order to pass the course.

Each student is to work **entirely alone** on all tests. The instructors will inform the class in writing of the written sources which may be used during each exam.

Grading

Your final numerical course grade will be determined by the following weights:

Problem sets (all eleven combined)	36%
Participation	9%
Tests (all three combined)	45%
Course Project	10%

Two thirds of the participation grade (6% of the course grade) will be determined by workshop attendance and participation. The other third of the participation grade (3% of the course grade) will be based on team peer evaluation.

After each midterm exam, we will let you know your approximate standing in the course, based on work turned in so far.

How to Succeed in LB/PHY 415

To help you master the material, you are encouraged to

- visit the course ANGEL site often
- review each course meeting's objectives and complete the assigned reading beforehand
- ask questions about course material during class time and in office hours
- discuss the homework with your classmates, the grader, and the instructors
- participate vigorously in the discussions of homework problems during the weekly workshop
- contact Prof. Simmons and Prof. Chivukula to ask questions about the course material in person (during office hours or by appointment), by phone, or by e-mail
- use the material on course reserve in the Engineering Library, on the course ANGEL site, or handed out in class (books, practice quizzes, solutions to homework and quizzes that have been turned in)

We emphasize active learning and student engagement because of the clear benefits to the students:

- those who review the reading and objectives before class are best prepared to ask questions and complete the in-class exercises
- those who work hard on the in-class exercises and in workshop are best prepared for mastering the full range of homework problems
- those excelling in the homework tend to perform better on exams