

COURSE: **Mechanics**
Mondays, Wednesdays & Fridays 9:00am - 9:50am, CP 397

INSTRUCTOR: **Prof. Isaac Shlosman**
Office - CP289 (phone 257-3461)
Office Hours – Mondays, Wednesdays, 4:15 to 5:15pm
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TEXTBOOKS: 1. *Classical Mechanics*,
by John R. Taylor (University Science Books), 2005 (required)
ISBN-13:978-1-891389-22-1

2. Additional helpful books:
Analytical mechanics by Fowles & Cassiday (on reserve)
Mechanics by Landau & Lifshits

COURSE DESCRIPTION : This is an undergraduate/graduate level course in Mechanics. The prerequisites are PHY 232, or (with permission of Physics Director of Undergraduate Students) PHY 213; concurrently with MAA 214. PHY 404G is a lecture and problem course covering fundamental laws of mechanics. Its topics include Newton's Laws, Kepler's Laws, oscillatory motion, and introduction to Lagrangian methods.

COURSE STRUCTURE : The course meets from 9:00 AM to 9:50 AM in CP397 every MWF except for academic holidays, starting on 8/23, and ending on 12/8, 2017. There is one midterm exam, scheduled in class on Monday, October 16. The comprehensive final exam is scheduled from 8:00 AM to 10:00 AM on Wednesday, December 13, 2016 in our regular classroom, CP397.

Homework problem sets will be assigned on Monday/Wednesdays/Fridays (in class and on website), and will be due and collected in class on specified dates in class and on the website. Late homework submissions will only be accepted with *prior* consent of instructor, or for excused absences in accord with University policy. Students are responsible for all assigned sections of the text posted on the website, even if class time does not permit complete coverage.

COURSE OBJECTIVES : To learn the basic principles of mechanics; To sharpen problem solving and critical thinking skills; To gain experience in rigorous mathematical analysis; To build a foundation for future studies of electromagnetism and quantum mechanics; To prepare for advanced study of theoretical mechanics and/or mechanics related research.

COURSE SUMMARY : Mechanics is the study of how and why things move. It also encompasses the analysis of equilibrium. The natural laws governing motion and equilibrium originated with the investigations of Galileo and Christian Huygens, and were fully formulated by Isaac Newton. They were eventually reformulated for improved applicability by Lagrange and Hamilton. We will focus first on Newton's formulation, and will introduce the Lagrangian formulation later on. A brief description of Hamilton's formulation will be provided to motivate future study.

While these formulations of mechanics are mature subjects, aspects and application of the study of motion remain of current interest and importance in physics, as well as in engineering and other applied fields. A thorough understanding of the principles of mechanics, and experience in solving mechanical problems, provides an essential foundation and needed skills for work in a number of current areas of research, especially in the study of complex systems, non-equilibrium systems, and non-linear and chaotic systems. The study of mechanics also provides the essential conceptual foundation for the study of electromagnetic and quantum phenomena.

The laws of mechanics are expressed in the math language of differential and vector calculus, and so provide exposure to a number of techniques of analysis that are used throughout physics and engineering. These include the study of differential equations and their solutions, variational methods, and Fourier analysis, among others. Students in this course should accordingly be engaged in the study of calculus at least at the level of MA214 (concurrent).

COURSE GRADES and COURSE EVALUATIONS : Weekly homework assignments will constitute 25% of your final grade. The mid-term exam will contribute 35% to your final grade. The final exam will be worth 40%. The letter scores are defined as: A (89-100%), B (76-88%), C (63-75%), D (50-62%) and E (49% and less). For undergraduates, the passing score is D, and it is C for graduate students. Graduate students will be judged on a deeper understanding of the subject.

There will be two course evaluations. The first will be held in-class following the mid-term exam. The second will be the TCE evaluation by UK during the last two weeks of the semester. Students are asked to participate in both evaluations. Part of your education as an A&S student, and as a physicist, is to engage in critical thinking and constructive criticism. The course evaluations are an opportunity for you to practice both, and to improve the course for future generations of students. Please take the evaluations seriously. They are anonymous, and any concerns expressed, even sharp criticisms, will not affect your grade.

CHEATING and PLAGIARISM : Submitted homework assignments are original pieces of scholarship which convey your personal understanding of the material. While you are welcome (and even encouraged) to study and discuss problems collectively, your final submissions must represent your personal understanding. Any indication that a homework assignment has been copied will be submitted to the Department Chair for investigation and possible disciplinary action, in accord with UK policy. Any indication of cheating on tests will likewise be treated as a potential academic offense, with consequences dictated by established UK policy (Senate Rules 6.3.0).

ABSENCES : Class attendance is strongly recommended. An excused absence from class is warranted in cases of serious illness, illness or death of a family member, University-related trips, or major religious holidays. Excused absences from exams must be obtained from the instructor *prior* to the exam, if at all possible. If it is not possible to inform the instructor prior to an excused absence from an exam, then you must inform him, in writing, within one week of the missed class, and you must also explain why it was not possible to notify him beforehand. Make up examinations will be scheduled at the instructor's convenience. Problems with repeated absences are best avoided through regular communication with the course instructor, either in person, or by email. (Don't be shy if you have problems which prevent you from attending class regularly.)