Physics 431/531: Mechanics I
Introduction and Syllabus

Class meeting time/place: Mondays and Wednesdays, 9:55 a.m. – 11:10 a.m., Ayer Hall Room 112
Instructor: “Ben” Yu-Kuang Hu
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Office Telephone Number: (330) 972-8093
E-mail: benhu@physics.uakron.edu
Office Hours: Mondays 11:15 a.m. – 12:00 noon; Tuesdays: 10:00 a.m. – 11:00 a.m.; Wednesdays: 11:15 a.m. -- 12:00 noon, or by appointment.
Grader: Mayevska, Olga
URL: http://nebula.physics.uakron.edu/dept/faculty/byh.htm. You will find a link here to the course web-page, where I will post homework assignments and (non-copyrighted) handouts.


What is classical mechanics?

Classical (as opposed to quantum) mechanics is the study of how objects move in the presence of forces acting on them. A wide variety of phenomena can be explained by classical mechanics, from Halley’s comet’s appearance every 76 years to why tires on cars need to be balanced to the collapse of the bridge over the Tacoma Narrows (see http://www.ketchum.org/bridgecollapse.html). However, classical mechanics breaks down when it comes to describing very small objects such as electrons orbiting atoms – for that, you need quantum mechanics (Physics 441/541 and 442/542).

Plan of material to be covered

You would have seen some of the material at the freshman level, but in this course we will use more advanced techniques, such as vector calculus, solutions of differential equations, and possibly numerical methods (time permitting). This will allow you to solve more complicated mechanics problems. I plan to cover most of the material in the book from chapter 1 to the middle of chapter 9, excluding chapter 5 (non-inertial reference frames will be covered in Mechanics II).
At the end of the semester, I intend to give a quick preview to the elegant “principle of least action,” which will be covered in greater detail in Mechanics II. This topic will be for your information only, and not be included in the final exam.

**Some things you should be able to do after completing this course**

- Calculate the velocity and acceleration of a particle, given its motion in cartesian, cylindrical or spherical coordinates.
- Derive the principle of conservation of energy from Newton’s equations, use this principle to describe the motion of a particle in a given potential.
- Calculate motion of a particle in a uniform gravitational field, including air resistance.
- Describe the motion of a particle attached to a “lossy” spring, with and without an external driving force, using solutions of second-order differential equations.
- Calculate motion of satellites orbiting heavenly bodies.
- Calculate the angular momentum of a rotating rigid object, and explain to a friend why his 78 Chevy Nova vibrates like a jackhammer when it hits 50 m.p.h.

**Class format**

Since this is a small class, I intend to run this course in a hybrid lecture/discussion format. The Monday class will be used mainly for discussions and problem solving, and the Wednesday class will be used for lectures. Since there will be less time devoted to lectures than in a traditional lecture course, I will typically focus on the salient points in the lectures, and rely on you to fill in the details.

**Homework and Examination details**

- **Homework:** There will be a homework assignment every week, due on the Wednesday class. You should attempt to do the homework before the Monday class, so that if you are stuck on any problems, we can discuss them in that class.
- **Midterm test 1:** (given around week 6 or 7) will be in-class, open book.
- **Midterm test 2:** (given around week 11 or 12) will be in-class, open book.
- **Final examination will be:** in-class or take-home, depending on student vote.
Homework Policy

- Working together: You are permitted (in fact, encouraged) to discuss the homework assignments among yourselves. However, writing up the homework must be done separately.
- Late homework: Homework is due in class on the stipulated date. Late homework should be given directly to the grader, who can refuse to accept your homework if she has already finished grading that assignment.

Grading scheme

- Homework: 30%
- Midterm Tests: 20% of higher score (in terms of percentage), 15% of lower score.
- Comprehensive Final Examination: 25%
- Class participation: 10%

Point to letter grade conversion table:

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<thead>
<tr>
<th>Letter Grade</th>
<th>Points (out of 100) to achieve grade</th>
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<tbody>
<tr>
<td>A</td>
<td>85</td>
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<tr>
<td>A-</td>
<td>80</td>
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<td>B+</td>
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<td>70</td>
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Under extenuating circumstances (e.g., if the averages on examinations are low because the exams were inadvertently made too long and/or difficult), the point cut-offs may be adjusted downwards. They will not be adjusted upwards, so if you score an average of 85, you are guaranteed an “A”.