

Course Overview:

Physics 1301 is the first course of a three-semester sequence (1301, 1302, 2503) providing an overview of 21st Century physics from the perspective of students interested in science and engineering. Physics is the study of matter, energy and their interactions, everywhere in the knowable Universe. The primary focus of Physics 1301 is Mechanics, including Kinematics (the description of motion) and Dynamics (the description or prediction of motion as a result of forces, momenta and energies). The primary focus of Physics 1302 is electromagnetism and optics. Physics 2503 explores physics principles and applications developed during the 20th Century.

21st Century physics is a science based on principles rather than on taxonomy. Its goals are to describe the behavior of the Universe in terms of a few (and perhaps ultimately one) general principles. The goals of this course are to help you reach the educational objectives of your major by:

- Building your understanding of how natural phenomena in the Universe can be understood, and often predicted, in the context of a few basic principles;
- Improving your ability to conceptualize natural phenomena, using appropriate physics principles and mathematical models;
- Giving you practice in the use of mathematical models to make quantitative predictions about the behavior of physical systems in the Universe;
- Increasing your skill in making measurements of physical properties;
- Providing an opportunity to practice communicating technical information in an organized and readily understandable way.

Course Style:

Physics 1301 is generally considered to be a demanding course. Section 300 will be particularly demanding in that your grade will depend on successful completion of a large number of tasks. If you are taking this course, you are likely sufficiently intelligent to do well in it. However, to actually do well, you will need to be organized and to actually complete the required assignments **on time**. You should particularly note the following:

- There will be four hour exams on Thursdays/Fridays (see schedule at the end of this syllabus) and one final exam (**Monday, December 19, 2005 at 6:30 p.m. to 9:30 p.m.**). The Thursday section of the hour exam will be a group problem, done in class. It will count for 25% of your total grade for the hour exam The Friday section of the hour exam (75% of the total grade) will be done individually.
- You will do problems, both individually and in *ad hoc* groups, during large group classes (Monday, Tuesday, Wednesday). Some of these problems will be collected and graded. There will also be occasional, one-question quizzes on the reading assignment in the text (see schedule at the end of this syllabus) at random times in large group class (Monday, Tuesday, Wednesday). The grading scheme for these problems and quizzes will be 2 points for a correct answer, one point for an incorrect answer and 0 points if you don't submit (for example, if you cut class or fall asleep).

- There is a problem set assigned for each chapter in the text. See table below. While these problem sets will **not** be collected and graded, each hour exam will include at least one problem highly similar to a problem in the previously assigned problem sets.

Chap.	Assigned Problems	Chap.	Assigned Problems
1	28,43,52,60,73,84	7	11,26,36,48,59,64
2	5,9,19,33,49,62,76	8	7,18,32,40,52,66
3	2,24,27,31,44,51,71	9	8,22,28,36,46,55,58
4	6,17,31,37,55,64	10	11,18,23,33,37,55
5	8,9,18(use Fig. 5-37 here!),34,61,87	11	8,21,28,33
6	15,19,37,45,71,90	13	12,23,35,45,54,63,68,82

- This course fulfills University requirements as *writing-intensive*. Thus, you will need to prepare laboratory reports and submit them for grading. See the **Laboratory** section below for more information.

21st Century physics is highly dependent on mathematical models for quantitative results. Success in Physics 1301 will require you to develop and apply mathematical skills. The most important skill is the ability to describe a physical context in terms of a mathematical model. Geometry and trigonometry are particularly important. Modeling dynamically changing systems will require differential calculus. Aggregating individual effects will utilize integral calculus. If you are taking Calculus I concurrently, you will likely encounter some mathematical techniques in physics **before** you see them in your math class. For that reason, Physics 1301 will include some topics in mathematics, particularly in differential, integral and multivariable calculus and differential equations.

Science and technology in the world today is generally done in collaborative groups. For that reason, much of the work in this class will be done in groups. You are **strongly encouraged** to develop informal problem-solving/study groups with other people in this course. There is some research that suggests mixed gender groups work best and all-male groups are the least effective. The most effective group size is likely 3 or 4 people.

Laboratory:

Because this course satisfies University requirements as a laboratory science class and as a writing intensive course, you must pass the laboratory (60% of the possible score) to receive a passing grade in the course. The laboratory grade will be based on well thought out predictions, collaborative skills as evidenced by effective group work and a well organized and correctly written technical communication of the physics concepts of this course in your laboratory journal and laboratory reports.

You will write a total of five laboratory reports. **The specific part of the laboratory for which you will write a report will be assigned to you by your instructor at the end of each laboratory topic (about every two weeks).** Reports should be about 4 typed pages (use of a word processor is encouraged and such facilities are supplied by the University) including all necessary predictions, graphs, data tables, and calculations. **Reports must be given to your**

laboratory instructor for grading no more than 2 days after they are assigned. Late reports will not be accepted. Graded reports will be returned to you not later than your next laboratory meeting and may be revised, only with instructor permission, to achieve a higher grade. If a revised report is allowed, it must be given to your laboratory instructor within 2 days. Details of the laboratory grading are in your laboratory manual.

Read the relevant portions of the lab manual before attending a lab. Each lab has several sections, your TA will tell you which sections to have prepared each week. All the laboratory problems have sections called Prediction and Method Questions. You should hand in your answers to these sections to your TA the day before your scheduled laboratory session.

To ensure that you have a conceptual introduction to the physics and math concepts needed for beginning the lab, you will take a quiz every week, except the first, on the web (<http://labquiz.physics.umn.edu>) to test your preparation for the lab. No one will be allowed to participate in the laboratory unless they have passed the web-based laboratory preparation quiz for that topic. It is an open book, open note quiz which may be taken as often as necessary but must be passed at least one hour before your scheduled laboratory session; it does not count towards your final grade. Because of the limited number of computers available, make sure to take this quiz at least the day before your lab meets. The pre-lab quizzes are computerized Java applets, which you can take with a Java-enabled web browser such as Netscape Navigator or Microsoft Internet Explorer. The pre-quizzes do not have questions on the lab, but have questions on subjects covered by the labs. Once you pass a pre-quiz, your score is saved in a database and you receive a confirmation number. The TA has access to the database and will check whether you passed the pre-lab quiz.

Failure to participate in the laboratory will result in a laboratory grade of 0 for that topic. Since the laboratory involves teamwork, no laboratory makeup will be allowed except in situations officially recognized by the University. In that case, the laboratory work must be made up by arrangement with your TA before your next scheduled laboratory period. The lab is done in the same small groups as the discussion sections, which are changed periodically. Lab data is taken cooperatively, but **you are responsible for writing your own reports.**

Grades:

Problems and reading quizzes done in large group classes: 10%

Laboratory participation and lab reports: 20% (**not** 15% as indicated in the lab manual)

The better of two options for the remaining 70%:

Option 1: Four hour exams count 10% each and the final exam counts 30%.

Option 2: The lowest hour exam grade is dropped. Three hour exams count 10% each and the final exam counts 40%.

A, A- $\geq 83\%$ of total points

B-, B, B+ $\geq 68\%$ and $\leq 82\%$ of total points

C-, C, C+ $\geq 53\%$ and $\leq 67\%$ of total points

D $\geq 43\%$ and $\leq 52\%$ of total points

F $< 43\%$ of total points **or a laboratory grade of $< 60\%$**

Expectations:

- Turn off the ringer on your cell phone while in class.
- Do your own work on the individual exams and in writing the lab reports.
- Use **only** the provided equation sheets for the exams. Calculators can be used for calculation only; not to store notes or other material.

Questions and Concerns:

You are welcome to address your questions or concerns to the course instructor and/or the Teaching Assistants in person, by email or by telephone. **The goal of this course is to improve your knowledge and understanding of physics.** If something is interfering with that goal, you need to make your concerns known to somebody who can address them.

Course Schedule:**Week 1: Tuesday September 6 to Friday September 9**

Day	Topics	Assignment
Monday	Labor Day	
Tuesday	1. What is physics? Physical quantities, significant figures, math review	Ch. 1: Sections 1-3
Wednesday	2. Dimensional analysis, scalars and vectors, math review	Ch. 1: Sections 4-6
Thursday	Problem Session	
Friday	3. Straight line motion	Ch. 2: Sections 1-3

Week 2: Monday September 12 to Friday September 16

Day	Topics	Assignment
Monday	4. Constant Acceleration	Ch. 2: Sections 4-5
Tuesday	5. Integration of motion	Ch. 2: Section 6
Wednesday	6. 2-Dimensional motion	Ch. 3: Sections 1-2
Thursday	Problem Session	
Friday	Hour Exam 1 on Chapters 1-2	Hour Exam 1

Week 3: Monday September 19 to Friday September 23

Day	Topics	Assignment
Monday	7. Projectile motion	Ch. 3: Section 3-4
Tuesday	8. Uniform circular motion	Ch. 3: Section 5
Wednesday	9. Relative motion and special relativity	Ch. 3: Section 6
Thursday	Problem Session	
Friday	No Class	

Week 4: Monday September 26 to Friday September 30

Day	Topics	Assignment
Monday	10. Forces and Newton's	Ch. 4: Sections 1-2

	Laws I and II	
Tuesday	11. Newton's Law 3 and non-inertial frames	Ch. 4: Sections 3-4
Wednesday	12. Applying Newton's laws	Ch. 4: Section 5
Thursday	Problem Session	
Friday	13. Using Newton's Laws	Ch. 4: Section 6

Week 5: Monday October 3 to Friday October 7

Day	Topics	Assignment
Monday	14. Forces	Ch. 5: Section 1
Tuesday	No Class	
Wednesday	15. Friction	Ch. 5: Section 2
Thursday	Problem Session	
Friday	Hour Exam 2 on Chapters 3-4	Hour Exam 2

Week 6: Monday October 10 to Friday October 14

Day	Topics	Assignment
Monday	16. Drag Forces	Ch. 5: Section 3
Tuesday	17. Circular Motion	Ch. 5: Section 4
Wednesday	18. Fundamental forces	Ch. 5: Section 5
Thursday	Problem Session	
Friday	No Class	

Week 7: Monday October 17 to Friday October 21

Day	Topics	Assignment
Monday	19. Kinetic Energy	Ch. 6: Sections 1-2
Tuesday	20. Variable Forces	Ch. 6: Sections 3-4
Wednesday	21. Power and Relativistic Energy	Ch. 6: Sections 5-6
Thursday	Problem Session	
Friday	No class	

Week 8: Monday October 24 to Friday October 28

Day	Topics	Assignment
Monday	22. Potential Energy	Ch. 7: Section 1
Tuesday	23. Energy conservation	Ch. 7: Section 2
Wednesday	24. Motion in 2/3 Dimensions	Ch. 7: Sections 3-4
Thursday	Problem Session	
Friday	Hour Exam 3 on Chapters 5, 6 and 7	Hour Exam 3

Week 9: Monday October 31 to Friday November 4

Day	Topics	Assignment
Monday	No Class	
Tuesday	25. Momentum and Impulse	Ch. 8: Sections 1-2

Wednesday	26. 1-Dimensional Collisions	Ch. 8: Sections 3-4
Thursday	Problem Session	
Friday	27. 2/3 Dimensional Collisions and Center of Mass	Ch. 8: Sections 5-6

Week 10: Monday November 7 to Friday November 11

Day	Topics	Assignment
Monday	28. Rockets and Relativistic momentum	Ch. 8: Sections 7-8
Tuesday	29. Rotations and rotational energy	Ch. 9: Sections 1-2
Wednesday	30. Rotational inertia	Ch. 9: Section 3
Thursday	Problem Session	
Friday	No Class	

Week 11: Monday November 14 to Friday November 18

Day	Topics	Assignment
Monday	31. Torque	Ch. 9: Section 4
Tuesday	32. Angular Momentum	Ch. 9: Section 5
Wednesday	33. Rolling	Ch. 9: Section 6
Thursday	Problem Session	
Friday	Hour Exam 4 on Chapters 8 and 9	Hour Exam 4

Week 12: Monday November 21 to Friday November 25

Day	Topics	Assignment
Monday	34. Angular Momentum and Torque	Ch. 10: Sections 1 and 2
Tuesday	35. Rotational Dynamics	Ch. 10: Section 3
Wednesday	36. Angular momentum conservation	Ch. 10: Section 4
Thursday	Thanksgiving	
Friday	Holiday	

Week 13: Monday November 28 to Friday December 2

Day	Topics	Assignment
Monday	37. Angular work and energy	Ch. 10: Sections 5 and 6
Tuesday	38. Quantization and precession	Ch. 10: Sections 7 and 8
Wednesday	39. Statics	Ch. 11: Sections 1 and 2
Thursday	Problem Session	
Friday	No Class	

Week 14: Monday December 5 to Friday December 9

Day	Topics	Assignment
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Monday	40. Statics applications	Ch. 11: Section 3
Tuesday	41. Simple harmonic motion	Ch. 13: Sections 1 and 2
Wednesday	42. Springs and energy in SHM	Ch. 13: Sections 3 and 4
Thursday	Problem Session	
Friday	No Class	

Week 15: Monday December 12 to Friday December 16

Day	Topics	Assignment
Monday	43. Pendulums	Ch. 13: Sections 5 and 6
Tuesday	44. Damped and driven harmonic motion	Ch. 13: Sections 7 and 8
Wednesday	45. The Standard Model	
Thursday	No Class	
Friday	No Class	

Lab Schedule:

Week 1: FCI

Weeks 2 and 3: Laboratory 1 (Motion in 1-Dimension)

Weeks 4 and 5: Laboratory 2 (Motion in 2-Dimensions)

Weeks 6 and 7: Laboratory 3 (Forces)

Weeks 8 and 9: Laboratory 4 (Conservation of Energy)

Week 10: Laboratory 5 (Conservation of Momentum)

Week 11: Laboratory 6 (Rotational Kinematics)

Weeks 12 and 13: Laboratory 7 (Rotational Dynamics)

Weeks 14: Laboratory 8 (Mechanical Oscillations)