Physics 200: Relativity and quanta

Introductory information

Course Website

The course website is a central tool for the course. Here you will find lecture by lecture topics and reading, assignments, deadlines, contact information, a detailed outline and more.

http://www.phas.ubc.ca/~joanna/phys200

Instructor

Joanna Karczmarek

- Office: Hennings 280
- Office Phone: 604-822-2929



- Email: joanna AT phas.ubc.ca
 <u>Homepage</u>
- <u>Homepage</u>
 Office hours: Thu 1230pm, or by appointment

TAs: Fernando Nogueira (nogueira AT phas.ubc.ca) and Matt Longton (mlongton AT phas.ubc.ca) TA office hours: TBA

Location

Lectures

- Monday: 1pm-2pm, Woodward Instructional Resources Center, room 4
- Wednesday: 1pm-2pm, Woodward Instructional Resources Center, room 4
- Friday: 1pm-2pm, Hennings 202

Mandatory Interactive Tutorial

Thursday 11am-12:30pm in Woodward Instructional Resources Center, room 4.

Textbook

Knight, "Physics for scientists and engineers," 2nd edition, Volume 5, ISBN 978-0-321-51655-8 (contains chapters 37-43). Note: The UBC bookstore has it bundled with MasteringPhysics and a Workbook, since the bundle was cheaper than the stand-alone book. These additional components are not required and will not be used; all you need is the book itself. Depending on which textbook you used for first-year physics, you might already own it, so check before you buy.

Clickers

You will need an i>clicker for the lectures. i>clicker is a response system that will allow you to respond to questions I will ask during class. You will be graded on your in-class participation. If you don't already have a clicker, you can buy one at the UBC Bookstore. You will also need to register it using WebCT Vista.

Course components

The course will consist of:

• Pre-lecture reading assignments

You will need to read the appropriate sections of the book and take a very short (at most 2 questions) quiz **before** coming to each class. The quizzes will be posted well in advance so you can read ahead and do a bunch at once. The quizzes will be worth 3% of the final grade.

• Lectures with clicker questions

Lecture participation will be worth 4% of the final grade. You will need a clicker (see above) to participate.

• Interactive Tutorials

The tutorials are an integral part of this course. You will work is small groups on a worksheet with simple questions designed to elucidate lecture material and deepen your understanding. Tutorial attendance and participation will be worth 5% of the final grade.

• Weekly Problem Sets

Problem Sets will be handed out in class and posted on the course website. You will have a week to complete them and they will be graded. The Problem Sets will be worth 20% of the final grade. Late Problem sets will not be accepted since solutions will be posted on line shortly after the deadline.

• Midterms

There will be two in-class midterms, each worth 14% of the final grade.

• Final

The 2.5 hour final exam will be worth 40% of the final grade.

Course overview

In the first part of this course, well see that understanding physics involving relative velocities comparable to the speed of light requires a new framework, known as Special Relativity, that significantly alters some of our basic notions of time and distance, and has some startling consequences (e.g. that a person returning from a long voyage in space at a large velocity will find herself younger than her twin who stayed on Earth). Well see that many of the definitions of and relationships between basic physical quantities (e.g. velocities, momenta, energies) that you used in first-year physics are only approximations to more general formulae that hold true at large velocities. Despite their puzzling consequences, the new rules form a completely consistent framework that allows precise calculations for classical phenomena at arbitrary velocity (e.g. you will be able to calculate precisely how much younger the returning twin will be). In the second part of this course, well discuss quantum mechanics, an even more drastic modification of the basic framework of physics at much larger scales. Well discuss experimental evidence that light has particle properties and that particles such as electrons can exhibit wavelike phenomena. Well see that the correct description of both light and electrons has features of both of these classical concepts, but is fundamentally different from anything in classical physics. Some of the questions that we asked in classical mechanics do not even make sense in quantum mechanics, so we will need to understand what questions we are allowed to ask before learning how to predict the answers. Well explore some basic consequences of the new framework and see how these can be used to explain various important phenomena in atomic and nuclear physics.

Grading scheme and policies

Pre-lecture reading quizzes	3%	The quiz must be started no less than an hour before the lecture to which it corresponds. Quizzes will be available on WebCT Vista at least a week before they are to be completed. Reading assignments for each lecture will be posted in advance on the Course Content page. The quizzes are open book, but must be completed
-----------------------------	----	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

		individually. Your two lowest quiz marks will be dropped when computing the final grade.
Clicker participation	4%	Clicker questions will be asked in lectures. To encourage discussion, your grade will depend on the number of questions you participate in, not on whether or not your answers were correct. You will need to answer at least 80% of all questions to receive full marks.
Tutorial participation	5%	During the tutorial, you will work is small groups but will be required to complete your own tutorial worksheet. You will be asked to hand in your tutorial worksheet at the end of the tutorial. You will be given full marks as long as you make a serious attempt at answering the questions. Your lowest tutorial mark will be dropped when computing the final grade.
Problem Sets	20%	Problem Sets will be assigned roughly weekly, and you will have a week to complete each. They will be handed out in class and posted on the course website. They will be typically due in class; if you cannot make it to the class the Problem Set is due on, you need to hand it in ahead of time. Late (even by an hour) Problem Sets will not be accepted for credit under any circumstances, since solutions will be posted immediately after the due date.
		If you do not hand in your Problem Set on time, you will get a zero on that Problem Set. In exceptional circumstances the zero you get on a late Problem Set will not count towards your grade. I will require advance notice of such circumstances or a proof of the emergency (doctors notes and police records are good proofs), and you must still finish the Problem Set. Excuses such as 'I was really busy with other courses' will not be accepted.
		Your lowest Problem Set mark will be dropped when computing the final grade.
		Group discussion of Problem Sets is encouraged, but the solutions you hand in must be your own work. This means you should not be looking at anybody else's notes or assignment while writing up your solutions and you should not share your completed Problem Set with anybody else.
		Problem Sets will be graded using the attached grading rubric.
Midterm 1	14%	The two midterms will be written in-class. Check the Course Content page for scheduling. There will be no make-up midterms and tests. If you miss a midterm for a valid reason (proven illness, a family emergency), the weight of the missed midterm will be reassigned to the other midterm and the final exam.
Midterm 2	14%	If a scheduled test falls on one of your religious holidays, please let me know as soon as possible so that I can make alternative arrangements. A notice of at least two weeks is required.
Final exam	40%	Since many of the learning goals for this course are conceptual, a significant portion of the exam (and midterms) will be made up of (mostly multiple choice) questions requiring little or no calculation. The reminder of the exam will be problems.
Total	100%	

UBC takes academic misconduct (this includes copying of homework, cheating on exams and plagiarism) very seriously, and the penalties are stiff. Please check pages 48-49 and 54-55 of the calendar for official university regulations.

More information

For detailed course outline, learning goals, and up-to-date information on topics, assignments, deadlines, office hours, midterms, etc... please see course website.