PHYSICS 323 - Fall Semester 2017 - ODU

Syllabus – Modern Physics

Class Meetings: 1:30 p.m. - 2:45 p.m. -- Tuesdays and Thursdays
Oceanography & Physics (OCNPS) Building Room 142
Website: **http://ww2.odu.edu/~skuhn/PHYS323/323.html**

Instructor: Dr. Sebastian E. Kuhn
Eminent Scholar & Professor of Physics
Physical Sciences Building (PSB II), Room 2100J
Phone: 683 – 5804 email: skuhn at odu.edu
Web: http://www.odu.edu/~skuhn/

Office hours: Fridays 11:00 – 12:00 in my office
and Tuesdays 11 a.m. – 12 noon in the Physics Learning Center (lobby 2nd floor PSB II); also by appointment (just ask me after class, send email or call)

Textbooks: P.A. Tipler and R.A. Llewellyn: "Modern Physics", 6th Ed., WH Freeman. *This is our main textbook for the course. You are strongly urged but not **required** to buy it. Other options:*

Kenneth S. Krane: "Modern Physics", Wiley

A. Beiser: "Concepts of Modern Physics", McGraw-Hill

The Feynman Lectures on Physics I-III, Pearson

Susskind+Friedman: "Quantum Mechanics: The Theoretical Minimum", Basic Books

P. Collier: "A Most Incomprehensible Thing: Notes Towards a Very Gentle Introduction to the Mathematics of Relativity", Incomprehensible Books

Schaum's Outline of Modern Physics

Grading Scheme: Homework (30%), Midterm (15%), Participation (15%), Final Exam (40%)

Grading Scale: A: 90-100% A-: 85-90% B+: 80-85% B: 75-80%
B-: 70-75% C/C+: 60-70% D/D+ 50-60%

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INTRODUCTION

This course has two distinct but related goals:
1. Study in depth the two revolutionary theories introduced in Physics early in the 20th century: Relativity and Quantum Mechanics. My goal is to help you achieve a genuine understanding of some ideas and techniques of these two bedrocks of all of modern Physics, so you can learn "how to think like a Physicist".
2. Give a cursory overview of the main discoveries of Physics in the 20th century based on this foundation, from condensed matter over atomic, nuclear and particle physics to the large-scale structure and history of the universe. Here, the goal is to show you examples of Relativity and Quantum Mechanics "in action" and to give you some background information you will be able to draw on for your future studies (be they in physics or other fields of science, technology, engineering and math). These areas of active research provide both a deep source of inspiration as well as the underpinnings of much of the natural, technological, economic, and societal developments in recent history and belong to the canon of knowledge each truly "literate" person should possess.

These goals will be accomplished only with your cooperation – in addition to the classroom lectures (in which you are encouraged to participate **actively** - including occasional pop-quizzes), there will be many opportunities to deepen your understanding through additional reading, web-based materials, homework assignments and of course discussions with each other as well as with the instructor (see office hours). Visit the course website frequently so you are aware of updates and notices. (Note: We will **NOT** use Blackboard®). Homework assignments are due **in class** or until midnight of the same day if you submit them typed/typeset as email (attachment).

There is no single text that we will follow strictly. Instead, I will post lecture notes that will be available to you if you want to revisit something discussed in the lecture. However, a significant amount of material will be taken from the book by Tipler and Llewellyn, especially in the 2nd part of the course, which is therefore the book I recommend to buy. (If you have an earlier edition of this book, or one of the other standard texts - including the section on modern physics usually included in the "University Physics" text books, you won't have to buy this one.)

The schedule is on the website for this class and at the end of this document.

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Policy on Classroom Etiquette

Please follow the general rules of courtesy and respect. This means: Do **not** come late or leave early, and while in class, refrain from all other activities (including eating and drinking, talking to others, using electronic devices etc.). If you cannot concentrate fully on class work or cannot participate for the full duration, I prefer if you do not come to class (but there might be a grade penalty if you miss too many classes). I reserve the right to ask students to leave if they disrupt the learning experience of their classmates.

Policy on Cooperation

I consider it advantageous if students cooperate with each other on homework and studying. In fact, I encourage students very strongly to meet with each other for regular discussions and to tackle assignments together.

However, I require that each student turn in their own (hand- or computer- written) version of each homework and assignment. You must be able to demonstrate that you understand and can reproduce any solution you hand in. Also, NO cooperation is allowed on the Midterm and Final (in-class) Exams – everybody has to do ALL of the work her/himself. I consider it unethical and a violation of the honor code to copy the solution of a homework problem or an exam verbatim from another student's solution, an online source or from a book. All material used (other than informal discussions) must be properly cited.

In this context, I want to remind everyone of the **University policy**: Any official sanction for cheating, including the assignment of a grade of F for a quiz or for a course as a penalty for cheating, will appear on the student's permanent academic transcript.

Accommodation Statement

Students are encouraged to self-disclose disabilities that have been verified by the Office of Educational Accessibility by providing Accommodation Letters to their instructors early in the semester in order to start receiving accommodations. Accommodations will not be made until the Accommodation Letters are provided to instructors each semester.

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Date	Day	Time	Topic	Pages	HW Set Due
29-Aug	Tue	1:30 - 2:45	Introduction I Galilean Relativity, Space-Time	4 - 6	
31-Aug	Thu	1:30 - 2:45	Simultaneity, Space and Time	7 - 17; 23 - 29	
5-Sep	Tue	1:30 - 2:45	Scales, paradoxa and Lorentz transformation	17 - 37; 45 - 51	
7-Sep	Thu	1:30 - 2:45	Velocity addition and Invariant Intervals	37 - 45	1
12-Sep	Tue	1:30 - 2:45	Momentum	66 - 76	
14-Sep	Thu	1:30 - 2:45	E = mc2 ?	76 - 97	2
19-Sep	Tue	1:30 - 2:45	Statistics and Probability	-	
21-Sep	Thu	1:30 - 2:45	Postulates of QM	-	3
26-Sep	Tue	1:30 - 2:45	State vectors	-	
28-Sep	Thu	1:30 - 2:45	Wave functions, Superposition and Interference	-	4
3-Oct	Tue	1:30 - 2:45	Operators	250 - 253	
5-Oct	Thu	1:30 - 2:45	Time Dependence		
10-Oct	Tue	No class	*Fall Break*		
12-Oct	Thu	1:30 - 2:45	Schrödinger Equation, free particle	229 - 236	5
17-Oct	Tue	1:30 - 2:45	Square well	237 - 245	
19-Oct	Thu	1:30 - 2:45	MIDTERM EXAM (in-class)		
24-Oct	Tue	1:30 - 2:45	Harmonic Oscillator	253 - 257	
26-Oct	Thu	1:30 - 2:45	Quantum Mechanics in 1D -> 3D	277 - 279	
31-Oct	Tue	1:30 - 2:45	Spherical Coordinates, Angular Momentum	279 - 285	6
2-Nov	Thu	1:30 - 2:45	The hydrogen atom	286 -305	
7-Nov	Tue	1:30 - 2:45	Atoms, Molecules, Photons and Lasers	305-323, 376-426	7
9-Nov	Thu	1:30 - 2:45	Molecules, Condensed Matter	375-387, 427-437	
14-Nov	Tue	1:30 - 2:45	Metals and Semiconductors	452 - 484	8
16-Nov	Thu	1:30 - 2:45	Elementary Particles	579 -	
21-Nov	Tue	1:30 - 2:45	Standard Model	- 637	9
23-Nov	Thu	No class	*Thanksgiving Holiday*		
28-Nov	Tue	1:30 - 2:45	Nuclei: bulk properties and reactions	493 - 522	
30-Nov	Thu	1:30 - 2:45	Nuclear structure and building blocks	522-537; 613-619	10
5-Dec	Tue	1:30 - 2:45	Sun, stars and stellar remnants	639 - 673	
7-Dec	Thu	1:30 - 2:45	Large-scale structure of the Universe	673 - 702	11
12-Dec	Tue	12:30 - 3:30	FINAL EXAM (in-class)		