PHYS 1301 Ideas of Modern Physics May 2020

<u>Coronavirus Impact:</u> If necessary, this course will go ahead as an online course during May Term. Lectures will occur via Zoom and assessment will use Canvas and PollEverywhere. Labs will be conducted by watching a video of the lab procedure and then analyzing measurement data that will be provided; you will be put in contact with student lab partners to work together however you wish.

Course Overview

Everything you need to know about time travel, the Big Bang Theory, Schrodinger's Cat, the Higgs Boson … and more. This is an introductory course designed specifically for non-science majors. In a descriptive, non-mathematical framework, it presents the deepest ideas in modern physics – Relativity and Quantum Mechanics - and their impact on life, the universe, and everything, including the nature of space, time, matter, energy, reality and the high technology we take for granted. A variety of practical work, such as measuring the age of the universe, the speed of the fastest thing in the universe, the structure of the smallest atom, etc. illustrates the course material in a form accessible to all.

Instructor Biography

Prof. Dalley has been teaching physics courses from non-science majors to graduate students at SMU since 2006. PHYS 1301 is a course he has developed over several years and for which he wrote a textbook. Prof. Dalley has received both an Outstanding Professor Rotunda Award and the Provost's Teaching Recognition Award. At SMU he also directs science outreach programs and professional development courses for high-school physics teachers.

UC "tags" and Student Learning Outcomes

This course satisfies the Pure and Applied Sciences Level 1 Pillar of the UC or a Science and Engineering Breadth requiremnent of the UC16, and a Quantitative Reasoning Proficiency

PAS I Pillar or SE Breadth Learning Outcomes

- Demonstrate basic facility with the methods and approaches of scientific inquiry
- Explain how the concepts, advancements, and findings of modern physics shape our world

QR Proficiency Learning Outcomes

- Collect, organize and analyze data from a variety of sources
- Communicate and represent quantitative information or results numerically, visually, verbally, and in writing
- test hypotheses and make recommendations or predictions based on results

Class Meeting: lecture 09:00 – 09:50 am, 1:00 pm – 1:50 pm (via Zoom and PollEverywhere if necessary); lab 10:00 -11:5 am (or flexible 2 hours via Zoom and Canvas if necessary)

Instructor: S. Dalley, Room 207 Fondren Science, sdalley@smu.edu
Office Hour: 8-8:50 am or email any time

Text: *Ideas of Modern Physics*, S. Dalley, 2nd ed., Kendall Hunt, 2016. Recommend buy the e-book directly from the publisher https://he.kendallhunt.com/product/ideas-modern-physics

Website: http://www.physics.smu.edu/sdalley/1301M20/1301home.htm

PHYS 1301 **Ideas of Modern Physics** **May 2020**

Date	Assignment Due	Pre-class Reading & Quizzes
By 5/14		**Scientific Discovery** **1.1** Numbers in Science (no quiz)
Th 5/14		**Classical Physics** **2.1** Space, Time, Motion
		LAB - **Numbers in Science**
		Classical Physics **2.2** Gravity
Fr 5/15	A	**Classical Physics** **2.3** Electricity & Magnetism
		LAB - **Measurement and Error**
		Classical Physics **2.4** Light: Into the Modern Era
Mo 5/18	B	**Special Relativity** **3.1** Space, Time, Motion, Revisited
		LAB - **Speed of Light**
		Special Relativity 3.2 Paradoxes (not)
Tu 5/19	C	**Special Relativity** **3.3** Energy and $E = mc^2$
		LAB - **Moving Clocks**
		Special Relativity **3.4** Space-Time
We 5/20	D	**General Relativity** **4.1** Equivalence Principle
		LAB - **Free Fall**
		General Relativity **4.2** Time Dilation and Light Bending
Th 5/21	E	**General Relativity** **4.3** Curved Space-Time
		LAB - **Hubble's Law**
		General Relativity **4.4** Structure of the Universe
Fr 5/22	F	**Quantum Mechanics** **5.1** Wave-Particle Duality of Light
		LAB - **Probability**
		Quantum Mechanics **5.2** Probability & Uncertainty
Mo 5/25		***No CLASS (Memorial Day)***
		Read and do Quiz for **5.3** Matter Waves
Tu 5/26	G.	**Atoms** **6.1** Structure and Properties
		LAB – **Laser Diffraction**
		Atoms **6.2** Quantized Energy
We 5/27	H	**Atoms** **6.3** The Nucleus
		LAB **- Hydrogen Spectrum**
		Atoms **6.4** Condensed Matter
Th 5/28	I	**Synthesis** **7.1** Space-Time Revisited
		LAB **- Radioactivity**
		Synthesis **7.2** Particles and Force-Fields
Fr 5/29	J	**Synthesis** **7.3** The Standard Model
		LAB - **Particle Identification**
		Final Exam

- The course homepage contains all information you will need (bookmark it now): http://www.physics.smu.edu/sdalley/1301M20/1301home.htm
- I will use your official SMU e-mail address to communicate with you – please check it!
- Academic Dishonesty will result in a course F grade and filing with the Dean of Student Life.
- During class, phones should be put away except when needed for course-related tasks.

Assessment

QUIZZES (20%)

Before each day's lecture classes you are expected to read relevant sections of the textbook and view supplemental material on the textbook website. Answers to short multiple-choice quizzes, found in the textbook, should then be submitted in Canvas. Only original quizzes downloaded from your own e-book will be accepted.

Recommended Time Burden = 1-2 hours per day

LABS (35%)

Each day there is a lab that illustrates the material covered in class.

Important: this course counts as a lab-based science pillar for the University Curriculum. If your average lab score is below **60 %**, your final grade will be determined by your lab score alone.

- You will work in groups of 3. If the course is online, you will view a video of the lab procedure, analyze measurement data provided to you, and upload results to Canvas. You will be given the contact details of two other classmates with the same data, so you can work together however you wish.
- The syllabus shows which lab is on which date.
- Lab descriptions are available on the course website.

ASSIGNMENTS (30%)

Assignments consisting of 3 questions requiring **hand-written** extended responses are due each day by hardcopy in class (if the course is online they should be submitted in Canvas). Assignments are linked on the course website and due dates shown on the syllabus. For each question on an assignment, the grading scheme is:

- 2 points – Mostly correct, some minor errors, omissions, or irrelevant material
- 1 point – some correct but major errors, omissions, or irrelevant material
- 0 points – Nothing correct or nothing relevant to the question asked.

You may use your own words, use wording from the textbook without attribution, and use wording from other sources with attribution. Indiscriminately pasting material not directly relevant to the question asked will reduce your credit.

Recommended Time Burden / Length = 2 hours / 1-2 pages per assignment

FINAL EXAM (15%)

The final exam (50 multi-choice questions) will occur in Canvas in the course is online and covers all Chapters. To focus your preparation, the questions will be provided in advance (but not the options for multi-choice answers!).

Course Grade

Grade Boundaries are fixed

A > 90% > A - > 85% > B+ > 80% > B > 75% > B- > 70% > C+ > 65% > C > 60% > D > 50% > F

- Weight of different components: Labs 35%,Assignments 30%, Quizzes 20%, Final 15%.
- The lowest assignment score is dropped, including absence for any reason. Late assignments and quizzes are not accepted for credit.
- Averaging less than **60 %** in labs alone will result in your course score being your lab score.

Disability Accommodations: Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visithttp://www.smu.edu/Provost/ALEC/DASS to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

Attendance: If you do not submit work in Canvas for two consecutive days, I will enquire by email if everything is OK. If I do not receive a prompt response, or the response is of concern, I will forward the details to the Dean of Student Life for follow up.