

Physics 222: Modern Physics Syllabus

Fall 2015

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Office Hours: Monday 10-12
Tuesday 9-10
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COURSE DESCRIPTION

Writing intensive course designed to familiarize you with the three most common forms of scientific writing; scientific papers, posters, and presentations while introducing the concepts that lead to the breakdown of classical physics and emergence of quantum theory. Topics include relativity and four-vector space-time physics, atomic physics, solid-state physics, nuclear physics, and elementary particles. Prerequisites: Physics 111-112 and Mathematics 171 or permission of instructor.

COURSE GOALS

There are two main goals for this course. The first is for students to develop an understanding of the concepts that lead to a revolution in the mindset of physics which resulted in branching out from classical physics and the development of quantum theory. The second goal is for students to hone their scientific writing skills and become familiar with the formats used by professional physicists by producing a scientific paper, poster and presentation. For each format, students will evaluate examples. The draft, edit, and revision process will be heavily emphasized and comprise up to 50% of the final grade for each project.

TEXT

Twentieth Century Physics by Mark Anthony Reynolds; ISBN # 9781479390205

DO THE ASSIGNED READINGS PRIOR TO CLASS- this will allow you to become familiar with the terms and topics and have questions about the material prepared before lecture

COURSE MATERIALS

All course materials will be made available on Canvas. These materials include this syllabus, grading rubrics, and any solutions I may provide.

GRADING

Your letter grade is determined by a minimum weighted average which is as follows: A/93, A-/90, B+/87, B/83, B-/80, C+/77, C/73, C-/70, D+/67, D/63, D-/60, F/0. The breakdown of the grading will be as follows:

Exam 1	10%
Exam 2	10%
Exam 3	10%
Homework	20%
Writing Center Visit	5%
Scientific Paper	15%
Scientific Poster	15%
Scientific Presentation	15%

EXAMS AND QUIZZES

There will be three exams during the semester which will take place during a three hour lab period. Portions of the exams may be given as take home. Exams will include problem-solving questions, but there may also be conceptually based questions to be answered with words.

HOMWORK

Homework assignments comprise a large percentage of your final grade, the due dates of which are listed on the schedule given in this syllabus. These assignments may not be thoroughly reviewed in class and will be graded outside of class by the instructor. Please feel free to ask questions about the homework and to consult other sources, however **the final assignment that is submitted must be your own work**. Homework is very important. There is a strong correlation between completing the homework assignments and doing well on exams and in the course as a whole.

ATTENDANCE

Attendance is mandatory. If you cannot attend class for any reason, it is your responsibility to contact me with the reason for your absence and to obtain any material you missed. An absence will be considered excused and not count against you if it is due to reasons such as illness, death in the family, etc. **Missed exams and assignment deadlines will only be excused in the event of excused absences, in which case another time can be scheduled to take the exam or turn in an assignment.**

LAB PROJECTS

All students will complete the same first experiment for the scientific paper assignment. For the following two projects, each student will select two labs. There is usually only one set up for each lab so it will be important to work out a schedule with your classmates about when you will be able to use equipment. There will be three major projects comprising the lab grade; a formal lab paper, a poster and a 20 minute presentation. In lieu of a final exam and lab grade, each project will count for 15% of your total grade. **Final presentations will be made during the final exam period on Wednesday, Dec. 16, 1:30 PM.** A synopsis of each project and the due dates for the drafts and final copies of these projects are given in this syllabus. The drafts are very important to keeping your work on track and are worth up to 50% of a total project grade. Students will be required to attend the talks presented by other students and evaluate each other student's presentations and posters, which will contribute to your grade on the final project.

PEER REVIEW PAPER

For each project you will be required to read and edit the draft of a peer's project. You will have to write a two page paper that highlights what you thought your peer did best, suggestions from improvement, and any questions you may have that you think need to be addressed. This process is important because most scientific publications appear in peer-reviewed journals. This will give you the opportunity to practice what it is like to review a paper.

CORRECTION REFLECTION

For each project you will be required to write a two page paper discussing the recommendations of your peers and myself and how you responded to them. The correction reflection paper will be due at the time of the final project submission. This paper gives you an opportunity to comment about how you took these suggestions into consideration when making changes to your final submission. In some cases you may get conflicting recommendations, and this response is when you will explain how you chose which recommendation to take. In other cases you may chose not to change parts of your draft despite the recommendations. This is perfectly acceptable, but will require justification. When writing an article for a peer reviewed article it is sometimes a delicate matter to respond to the comments of a reviewer, so this process will you practice crafting these responses.

WRITING CENTER

For each project you will be required to visit the writing center. This visit should occur after you have received edits from your peer and myself. You will have to provide documentation that you visited the writing center at this time.

IMPORTANT NOTES

Education is all about open communication. My responsibility is to communicate information and problem solving techniques to you. However, communication works both ways. You must also communicate to me if are having trouble with or questions about any material. Your questions are always welcome. I do not know what you do not know. The explanations and examples I give make perfect sense to me, but you may need further clarification. To that end, please feel free to email me or attend my office hours with any questions you may have. If you cannot attend any of the available office hours, please email me and we can schedule another time to meet.

DISABILITIES AND MEDICAL CONDITIONS

Moravian College adheres to the principles and mandates of the Americans with Disabilities Act of 1990 and the Rehabilitation Act of 1973. Students who wish to request accommodations in this class for a disability should contact the Academic & Disability Support Center, located on the first floor of Monocacy Hall (extension 1401). Accommodations cannot be provided until authorization is received from the Academic & Disability Support office. Special classroom set-ups, alternate testing, physical plant (campus) alterations, and other accommodations for students with documented disabilities are available on a case-by-case basis. It is the responsibility of students with disabilities to self-identify and request accommodation through the appropriate office. It is the responsibility of the student to request accommodation well in advance of the need in order to give the College a reasonable amount of time to evaluate the documentation and implement the request. Classroom accommodation requiring notification to faculty must be requested for each semester for which it is needed. Please see Disability Support Services in the Campus Offices and Services section elsewhere in the Moravian College Student Handbook for further information, and check the College's website for periodic updates concerning services for students with disabilities.

ACADEMIC HONESTY STATEMENT

Academic integrity is the foundation on which learning at Moravian College, Moravian Theological Seminary, and the Comenius Center is built. Students are expected to perform their academic work honestly and fairly. In addition, students should neither hinder nor unfairly assist the efforts of other students to complete their work successfully. In an academic community, students are encouraged to help one another learn. Because no two students learn in exactly the same way or absorb exactly the same things from a lecture, students are encouraged to study together. The boundaries on what is or is not acceptable work may not always be clear; thus, if at any point in academic work at Moravian, students are uncertain about their responsibility as scholars or about the propriety of a particular action, please see Academic Honesty in the Academic Life section elsewhere in the Moravian College Student Handbook for further information, and check the College's website for periodic updates.

CLASS SCHEDULE

Date	Topic	Reading before class	Due
8/31	Intro to Modern Physics		
9/2	Intro to First Exp	External Reading	
9/4	Compton Effect	App. H	
9/7	Intro to First Exp		
9/9	Intro to Particle Physics; Mass & Charge	Chapter 1, 2.1-2.2	HW 1
9/11	Cosmic Rays and Muons	App.G	
9/14	Spin & Magnetic Moment	2.3-2.4	Paper Summary
9/16	Color & Weak Interactions	2.6-2.6	HW 2
9/18	Intro to Nuclear Physics; Mass & Charge	3.1-3.2	
9/21	Color & Size	3.3-3.4	Paper Data Analysis
9/23	Spin & Magnetic Moment	3.5-3.6	HW 3
9/25	Radioactivity	3.7-3.9	
9/28	Rutherford Scattering	App. B	Paper Draft
9/30	Intro to Atomic Physics	4.1-4.2	HW 4
10/2	Catch Up and Review		
10/5	EXAM 1	CH 1-3	Conference & Peer Review
10/7	Periodic Table & Mosely's law	4.3-4.4	
10/9	Intro to Relativity; Interferometer	5.1-5.2	Final Paper
10/12	FALL BREAK		
10/14	Time Dilation		HW 5
10/16	Length Contraction	5.2	
10/19	Transformations	5.3	Poster Summary
10/21	Transformations		HW 6
10/23	Paradoxes	5.4	
10/26	Paradoxes		Poster Data Analysis
10/28	Velocity Addition	5.5	HW 7
10/30	Relativistic Dynamics	5.6	
11/2	Photoelectric Effect	App. E	Poster Draft & Session
11/4	Wave-Particle Duality	6.1	HW 8
11/6	Dispersion; Wave & Group Velocities	6.2	
11/9	EXAM 2	CH 4-5	Conference & Peer Review
11/11	Uncertainty	6.3	
11/13	Complimentarity	6.4	
11/16	Schrödinger Equation	7.1	Final Poster
11/18	Schrödinger Equation		
11/20	Solving the T.I.S.E; 1-D	7.2	HW 9
11/23	Solving the T.I.S.E; 2-D		Talk Summary
11/25	THANKSGIVING BREAK		
11/27	THANKSGIVING BREAK		
11/30	Postulates of Quantum Mechanics	7.3	Talk Data Analysis
12/2	Free Particles and Wave Packets	7.4	
12/4	Symmetries & 3-D	7.5-7.6	HW 10
12/7	Practice Talks		
12/9	Practice Talks		
12/11	EXAM 3	CH 6-7	Peer Review

FORMAL LAB REPORT PAPER

The goal of this project is to familiarize you with writing a scientific paper. Each paper should be 10 pages long and include abstract, introduction, methodology, results, conclusion and references sections. The methodology section is essentially the body of the paper and is the most open-ended section. The mathematics used to explain what is being studied should be addressed in this section as well as the experimental method. This is also where you must demonstrate the connection between theory and measurement. How the measured values relate to the equations presented is VERY IMPORTANT. This is also where any assumptions or approximations should be discussed. A rubric will be distributed giving specific requirements for each section.

The materials due on the dates listed on the schedule are described below. Half the credit will be given for completing the draft stage. The remaining credit will be given based on the quality of the draft.

SUMMARY: The summary that is due is essentially your introduction and methodology sections. The introduction should include all of the background necessary to understand your experiment and its significance within the field of physics. The methodology section should explain the basics mathematics, the experimental procedure, and the connection between the two.

DATA ANALYSIS: At this point you should have collected all the data for this lab. The data should be presented in an organized table. You should also have analyzed the data. How you do so will depend on the specific lab, but in general a plot of the data and description of any identifiable trends. **This does NOT guarantee you are done taking data.** Once you have submitted your data, we will review it together and determine that additional data are needed to confirm or strengthen a hypothesis, investigate additional variables, etc.

DRAFT: The full draft is due two weeks before the final paper. This will allow time for me to edit your draft, for a peer to review your draft, for us to conference and discuss any changes that need to be made, and for you to work on the final copy.

CONFERENCE: The conference will be used to discuss your draft and any changes that should be made before the submission of your final paper. The conference may occur any time after the draft due date (providing time for editing) and the conference due date. We will schedule times during lab period. Your peer review will also be due at this time.

POSTER

The goal of this project is to familiarize you with creating a scientific poster. Posters are very different from papers. You do not necessarily have a captive audience, and the poster must be concise and clear enough to attract readers at first glance. A poster that is too busy is intimidating. The less you can say with words and the more you can say with figures, the better. The figures on a poster should be very simple for several reasons. People viewing your poster may not be experts in your field, so the point must be immediately clear to them. Additionally, readers should be able to glean the basic results of your experiment from one graph. Each poster should include abstract, introduction, theoretical model, experimental method, results, conclusion and references sections. Particular emphasis will be given to making clear figures that demonstrate the results of the experiment. A rubric will be distributed giving specific requirements for each section.

The materials due on the dates listed on the schedule are described below. Half the credit will be given for completing the draft stage. The remaining credit will be given based on the quality of the draft.

SUMMARY: The summary that is due is essentially your introduction, theoretical model, and experimental setup sections, including any figures needed for these sections. The introduction should include all of the background necessary to understand your experiment and its significance within the field of physics. The theoretical model section should explain the basics mathematics and how these equations relate to the experiment. The experimental method should include the experimental setup, the experimental procedure, and the connection between the two.

DATA ANALYSIS: At this point you should have collected all the data for this lab. The data should be presented in an organized table. You should also have analyzed the data. How you do so will depend on the specific lab, but in general a plot of the data and description of any identifiable trends. **This does NOT guarantee you are done taking data.** Once you have submitted your data, we will review it together and determine that additional data are needed to confirm or strengthen a hypothesis, investigate additional variables, etc.

DRAFT: The full draft is due two weeks before the final poster. This will allow time for me to edit your draft, for a peer to review your draft, for us to have a poster session and to discuss any changes that need to be made, and for you to work on the final copy.

POSTER SESSION: You must have a completed draft of your poster at this time. At this time you will conduct a short assessment of all your peers' posters using a short rubric during a three minute period. You will receive copies of all the rubrics filled out by your peers.

SCIENTIFIC PRESENTATION

The presentation given must be 18 minutes \pm 2 minutes, with two minutes allowed for questions. Your presentation must include a powerpoint-esque slides. For each slide, you must include a paragraph of what you will discuss during that slide. This will be due on the day of the final talk. A hard copy of the slides should be distributed before your talk so that viewers can make notes and reference specific slides during the questions session.

Your grade for the presentation will also include your participation in a 10 point evaluation of the other presentations. You will be provided a copy of the evaluation prior to the presentations. The most important aspect of your presentation is that it is clear and easily understood by your audience. Even points that may be obvious to you must be explicitly explained to someone who is not as familiar with the material. For example, when giving a presentation it is imperative that you always explain the axis of your figures. You may be very used to looking at a graph of intensity vs. frequency, but without an explanation of what is shown, your audience will be distracted while trying to read the labels of the graph and miss your explanation the features of interest.

The most important aspect of a talk is preparation. Clear, understandable slides and a practiced talk will make the best impression and give you the confidence to speak intelligently about your experiment and answer the audience's questions. A rubric will be distributed giving specific requirements for each section.

The materials due on the dates listed on the schedule are described below. Half the credit will be given for completing the draft stage. The remaining credit will be given based on the quality of the draft.

SUMMARY: The summary that is due is a thorough outline of the introduction, theoretical portion and experimental setup and procedure portions of your talk written, and the presentation slides for these sections.

DATA ANALYSIS: At this point you should have collected all the data for this lab. The data should be presented in an organized table. You should also have analyzed the data. How you do so will depend on the specific lab, but in general a plot of the data and description of any identifiable trends. **This does NOT guarantee you are done taking data.** Once you have submitted your data, we will review it together and determine that additional data are needed to confirm or strengthen a hypothesis, investigate additional variables, etc. Bring your slides and all your graphs and figures.