

# Modern Physics (PH 322): Lecture and Lab Syllabus

Winter 2021 ◦ Northern Michigan University

- Instructor:** Dr. P.W. Mengyan    **Office:** West Science 2513    **Phone:** 906.227.2183  
**Email:** [pmengyan@nmu.edu](mailto:pmengyan@nmu.edu) [preferred comm. method]. Begin subject line with "PH 322:"  
**Office Hours:** *Times available by appointment.*  
**Class Meetings** PH 322 - Lecture [CRN: 10249]: {M,W,F} 14:00 to 14:50 in *West Science 2504*  
*Zoom link in EduCat*  
PH 322 - Lab [CRN: 10250]: Thurs 14:00 to 16:50 in *West Science 2504*  
**Webpage:** <https://educat.nmu.edu> ; [www.physics3.nmu.edu/~pmengyan](http://www.physics3.nmu.edu/~pmengyan)  
**Required Text:** K.S. Krane, Modern Physics. 4th ed. (Wiley, 2020). [ISBN: 978-1-119-49555-0]  
*Lecture Paperback or international versions may be less expensive but under a different ISBN*  
**Required Text:** ONE good quality scientific notebook; these are pre-approved options  
*Lab*
- Ampad Computation Book 22-157
  - National Brand Computation Notebook 43-648
  - Sci. Notebook Co. PH1201-S [9.25"x11.25"]
  - or *approved* equivalent alternative [check with me BEFORE purchase]

**Course Description** (outline and expected outcomes): The lecture and laboratory components of this course will survey topics of Post-Newtonian Physics (~1900's to ~1970's) such as the failures of classical Physics, special relativity, an introduction to quantum theory and atomic structure. If time permits, additional topics such as Solid State, Statistical or Nuclear Physics may be introduced. This course will also encourage critical thinking and general problem solving skills. The expected outcomes are to develop a general understanding of each topic area and demonstrate sound problem solving skills. Progress towards these outcomes will be assessed through in-class exams, homework assignments, quizzes, laboratory and discussion exercises. More information is available via the instructor's webpage.

## Grades:

Lab*:	20%	A: $\geq 90\%$	*Minimum grade of 60% in the laboratory component, in addition to appropriate performance in the rest of the course, is <i>required</i> to earn an overall passing grade in this course  '+' & '-' assigned for grades within $\pm \sim 2.0\%$ of the cutoff
Homework, Quizzes,	20%	B: $\geq 80\%$	
Attendance:	20%	C: $\geq 70\%$	
In-semester Exams:	20%	D: $\geq 60\%$	
Final Exam:	20%	F: $< 60\%$	
Projects:	20%		
<u>Total:</u>	<u>100%</u>		

**Homework:** Assigned periodically during lecture or lab and may include suggested questions, readings and other activities to supplement the lecture and laboratory. Due date, time and assignment description will be indicated on each assignment. Late assignments are *not* typically accepted. The homework will take time and effort to work and may be difficult. Do yourself a favor, start the homework as soon as it is available, and allow plenty of time to work through each question. Be warned that some questions may go quickly and others may take a significant amount of time.

**Quizzes:** Will be administered during the regularly scheduled class time and may include content from lecture, homework, exams, labs or any other relevant sources. They may or may not be announced during class and will *never* be announced via email. **Make up quizzes will not be administered.** These will be designed with a few goals in mind (1) provide students the opportunity to check their

understanding of relevant material and receive feedback from the instructor (2) provide the instructor with feedback as to how well students are understanding the material (3) encourage students to continue to stay on top of the material, develop sound study habits, regularly attend class, etc

**Exams:** There will be a minimum of two (2) scheduled exams during the semester plus a cumulative final exam. Each in-class exam is equally weighted. The in-semester exams will be administered in the normal classroom, during a normal class (lecture or lab) time and may include a take-home component. The final exam will be administered in the same room as lecture and the time pre-determined by NMU. Make up exams will not be administered. If an exam is to be missed due to extenuating circumstances, contact me via email BEFORE the scheduled exam time to see about making the appropriate arrangements. Use of notes, books or electronic gizmos of any sort will not be permitted on the exams unless otherwise specified by the instructor.

**Laboratory:** Lab is a separate course in which you must be enrolled. A minimum score of 60% is *required* in order to qualify for a passing score in the lecture. To be clear, that means if your score is any less than 60.0%, you will have earned an overall FAILING grade in the overall course. The final grade from the laboratory course part of your lecture score and likely to be weighted at ~20%. The laboratory section of this course is designed to provide hands on experience with some of the important experiments contributing to what is commonly called Modern Physics. This lab will also provide you with the opportunity to develop critical writing skills and effectively present your scientific work through keeping an experimental logbook, experimental summaries and reports.

**Projects:** Each student will complete two projects that include a formal scientific paper (PRL-style formatting with 4 page limit) and 15+5 minute presentation. These projects will be based on experiments performed in lab. The first project will be due around week 7 and the second will be due around the last week of the course. Final papers are to be submitted no later than 17:00 the day immediately preceding the scheduled talk. Additional details regarding formatting, content, style and other expectations will be discussed in class.

**Other Requirements and Important Notes:**

- **Attendance:**

You are expected to be in every class (lecture and lab) and on time. Absences will be excused for officially sanctioned university events, illness (documentation *may* be required), court appearance (plaintiff, defendant, witness, juror – documentation is required), family emergencies (at the discretion of the instructor and may require appropriate documentation).

If something occurs that you feel should be grounds for being excused it is your responsibility to contact your instructor, in writing, PRIOR to the absence (if possible, or as soon as possible after the absence) to discuss the situation. Excused absences for situations beyond the purview of NMU policy are at the sole discretion of the instructor, will be evaluated confidentially, on a case-by-case basis and confirmed in writing.

An excused absence does not necessarily excuse you from completing the work. Arrangements for a planned excused absence, if possible, should be finalized (with written confirmation between student and instructor) no later than one business day before the planned absence, if possible. Otherwise, establish contact with the instructor as soon as reasonably possible.

- **Submitted work** (*not including laboratory logbooks*):

Unless otherwise specified by the instructor, any work submitted for credit must be on standard size clean loose leaf paper (i.e. not torn from a notebook and covered in mysterious substances),

well labeled, well organized, written on only one side and for homework and each question should be started on its own fresh sheet of paper

- **MATLAB:**  
is to be used for any data analysis and plotting needs, including homework unless specifically stated otherwise. If you use MATLAB to assist you in solving a question submitted for credit for anything more complicated than what could be otherwise easily done on a handheld calculator, a clean version of the m-file and command output must be submitted with the assignment.
- **Late Assignments:**  
Late work is not generally accepted. Should something arise that will prohibit you from submitting work on time, talk to your instructor as soon as you recognize there may be an issue.
- **ADA Statement:**  
In compliance with the ADA and university policy  
*"If you have a need for disability-related accommodations or services, please inform the Coordinator of Disability Services in the Dean of Students Office at 2101 C. B. Hedgcock Building (227-1737 or [disserv@nmu.edu](mailto:disserv@nmu.edu)). Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state, and University guidelines."*
- **Religious Holidays:**  
Pursuant to university policy, a student who intends to observe a religious holy day should make that intention known, in writing, to the instructor prior to an absence. A student who is absent from a class, exam or exercise for the observance of a religious holy day shall be allowed to complete an assignment or exam scheduled for that day within a reasonable time around that absence.
- **Academic Integrity:**  
Section 2.3.1 of the NMU Student Handbook discusses scholastic dishonesty; all of which will be upheld in all aspects of this course. Academic dishonesty will not be tolerated.
- **Appropriate behavior:**  
I expect students to behave in a respectful, considerate and courteous fashion in any activity related to this course (e.g. Lecture, lab, discussion, office hours etc).  
Rude, disrespectful or disruptive behavior will *never* be tolerated.

#### **Final Notes and Suggestions to Succeed:**

- **Course Assistance:** A plethora of options are available to support your success in this course (e.g. Lecture [Dr. Mengyan], lab and discussion via class, office hours, email or special appointment), your textbook, the library, other text books and your classmates. Take advantage of the available resources. **DO NOT HESITATE TO ASK QUESTIONS AS THEY ARISE!**
- Preparation is the key!
  - o Read your book material before AND after we cover it in class
  - o Take good notes during lecture (reorganize and rewrite if necessary)
  - o Study your notes
  - o Take advantage of available resources (e.g. *actually* attend class, read the book)
  - o If something is unclear during lecture or your own studying, **ASK ABOUT IT!**
- Homework and supplemental work:
  - o Start your homework assignments as early as possible
  - o Read the homework questions when they are available before the related material is presented in class; familiarity with the questions will help you associate the relevant concepts as they are introduced in lecture, lab and while you read the material

- Give yourself plenty of time to complete the assignments as you will likely need to think carefully about the questions, review the relevant sections of the text or your notes and then work towards a solution
- Use a dedicated notebook to *fully* work out homework and supplemental questions
- Studying for any exam should be an ongoing exercise. Structured reviews of material built into your schedule promotes better long-term retention and higher understanding of the material
- I cannot stress enough: ASK QUESTIONS WHEN YOU HAVE THEM!

**TENTATIVE Schedule of Course Topics:**

<b><u>Week</u></b>	<b><u>Start Date</u></b>	<b><u>Content / Additional Detail</u></b>
1	18 Jan 21	Syllabus, expectations Review and Failures of Newtonian Physics
2	25 Jan 21	Special Relativity
3	01 Feb 21	Special Relativity
4	08 Feb 21	Particles and Waves
5	15 Feb 21	Particles and Waves
6	22 Feb 21	~ <b>Exam 1</b> Introduction to Quantum Mechanics (Schrödinger)
7	01 Mar 21	Introduction to Quantum Mechanics (Schrödinger) ~ <b>Project 1</b>
8	08 Mar 21	Atomic models
9	15 Mar 21	Hydrogen
10	22 Mar 21	More atoms, molecular structure
11	29 Mar 21	More atoms, molecular structure
12	05 Apr 21	~ <b>Exam 2</b> Selected topics (e.g.: Statistical Physics, Condensed Matter)
13	12 Apr 21	Selected topics (e.g.: Statistical Physics, Condensed Matter)
14	19 Apr 21	Selected topics (e.g.: Statistical Physics, Condensed Matter) General review <b>Project 2</b>
15	27 Apr 21	<b>Final Exam: 14:00 to 15:50 (Tues 27 Apr 2021)</b>

**Notable dates**

- 18 Jan 2021 Martin Luther King Day (no class)
- 19 Jan 2021 First official day of class
- 14 Mar 2021 Daylight savings time starts ('spring' forward)
- 24 Apr 2021 Last day of class
- Tues 27 Apr 2021 Final exam (14:00 to 16:50)
- Sat 01 May 2021 Commencement