

# PHYS 360 MODERN PHYSICS II

**\*\* PLEASE READ “COVID-19 RELATED INFORMATION”**

## **BASIC INFORMATION**

**Course prefix, catalog number, and title:** PHYS 360, 3353, Modern Physics II

**Number of credits:** 3 credit hours

**Term and year:** Fall 2020

**Classes:** Mon, Wed, Fri 11:00 - 11:50 AM, South Engineering 221/HyFlex (Zoom/Blackboard Ultra)

*The primary method by which course-related information will be communicated is during class. Reminders, notification of any schedule or assignment changes will be communicated through NDSU email and posted on Blackboard announcements page. Your NDSU email address is the official route for information. I will use Zoom or (Blackboard Ultra) for course delivery as appropriate. Virtual participation in this course requires both video and audio capabilities.*

**Instructor's name:** Prof. Yongki Choi

**Email Address:** yongki.choi@ndsu.edu

**Office location:** South Engineering 220A

**Office hours:** Mon, Wed, Fri 11:50 - 1:00 pm and by appointment

*You may meet with me in person during office hours (please remember to wear a face covering). You may meet with me virtually using the Blackboard Collaborate Virtual Classroom or Zoom during office hours.*

## **IT Help Desk for technology concerns**

Contact Information for Help Desk: Email: [ndsu.helpdesk@ndsu.edu](mailto:ndsu.helpdesk@ndsu.edu)

Call: 701-231-8685 (option 1)

## **BULLETIN DESCRIPTION**

Continuation of modern physics covering molecular structure, solid state physics, nuclear and particle physics with an embedded modern physics laboratory with experiment such as atomic and molecular spectroscopy, electron diffraction, nuclear spectroscopy, photoelectric effect and computer simulation of experiments.

Pre-requisite: MATH 266, PHYS 252, PHYS 350

## **COURSE OBJECTIVES**

The main objective of the course is to develop the conceptual and quantitative methods that are critical for a working knowledge of modern physics. The student will be able to explain modern physics concepts and to use laboratory equipment to reproduce experiments in modern physics, as well as measure physics properties described by modern physics concepts.

## **REQUIRED STUDENT RESOURCES**

Recommended book: *Modern Physics* by Paul Tipler and Ralph Llewellyn

Recommended book: *Modern Physics for scientists and Engineers* by John Morrison

## **SYLLABI ON WEB PAGES**

Syllabus, Announcements, and Notes will be posted on our Blackboard course homepage: <https://bb.ndsu.nodak.edu>

## **HOMEWORK ASSIGNMENTS**

Homework will be posted on our Blackboard course homepage. All homework assignments are due on the dates specified.

**Late submission will not receive credit.**

## **#COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS**

Week	Topic	Reading /Assignment
1	Course/lab introduction/preparation	Review lab manuals
2	Experiments/Measurement/Data analysis	Review lab manuals
3	Lab/Experiments	

4	Lab/Experiments	
5	Lab/Experiments	
6	Presentation	
7	Molecular/Atomic Spectra	Chapter 9
8	Molecular/Atomic Spectra	Chapter 9
9	Solid State Physics	Chapter 10
10	Solid State Physics	Chapter 10
11	Solid State Physics, <b>Exam 1</b>	Chapter 10
12	Nuclear Physics	Chapter 11
14	Nuclear Physics	Chapter 12
14	Particle Physics	Chapter 12
15	Particle Physics	Chapter 12
16	Review	Chapter 9-12
17	<b>Exam 2 (TBA)</b>	

### **PHYS 360: EVALUATION PROCEDURES AND GRADING CRITERIA**

Final letter grades for the course will be computed using the following weights:

- Homework                    20 %
- Exam 1                        20 %
- Exam 2                        20 %
- 2 Labs/Presentation    40 %
- Total Points                 100 %

#### **NO MAKE-UP EXAMS ARE ALLOWED**

Grades A:  $\geq 85\%$ , B: 70 to  $< 85\%$ , C: 60 to  $< 70\%$ , D: 50 to  $< 60\%$ , F:  $< 50\%$

Requirements and assessment of the lab reports are described in the attached document.

### **AMERICANS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS**

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the [Disability Services Office \(www.ndsu.edu/disabilityservices\)](http://www.ndsu.edu/disabilityservices) as soon as possible.

### **ACADEMIC HONESTY**

The academic community is operated on the basis of honesty, integrity, and fair play. [NDSU Policy 335: Code of Academic Responsibility and Conduct](#) applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the [Office of Registration and Records](#). Informational resources about academic honesty for students and instructional staff members can be found at [www.ndsu.edu/academichonesty](http://www.ndsu.edu/academichonesty).

*#The instructor reserves the right to adjust or modify this syllabus if it is deemed beneficial to student learning*

# PHYS 360 MODERN PHYSICS LABORATORY

## GENERAL INFORMATION

Each student will individually complete **two experiments** during the semester. Each laboratory will nominally take hours to complete. Students will rotate through the experiments during the course of the semester. Each laboratory period will replace one lecture. Additional times for lab work will be coordinated at the beginning of the semester since the experiments will not usually be completed in one hour. The laboratories will complement the sections covered in lecture and in general the material covered will not be repeated in lecture. Corresponding reading sections will be assigned in the text for the experiment.

## TENTATIVE LABORATORY CHOICES

Lab Number & Topic

1. Atomic and molecular spectroscopy
2. Electron diffraction
3. Michelson interferometer
4.  $e/m$ , photoelectric effect, determination of  $h$
5. Photoelectric effect
6. Millikan oil drop experiment

## LAB REPORT PREPARATION

1. Read the experiment manual before coming to lab.
2. Data is to be defended before writing up the lab. This means presenting your data to the instructor, and proving that it is adequate to meet the goals of the lab.
3. Lab reports will be prepared using Microsoft Word.
4. Images, plots, etc. will be prepared in MatLab, Excel, or your favorite software and inserted into the Word document. MatLab and Excel are available on the SE312 computers.
5. Lab reports will be submitted using BlackBoard Assignment.

## CONTENTS OF LAB REPORTS

Parts A through I below must be included in all reports. One basic standard is that you must include enough information so that another student would be able to easily repeat the experiment, avoiding any problems that you experienced.

- A. In an introductory section, explain the purpose of the experiment and the physics behind the experiment. In the body of your report indicate the purpose of each set of measurements or calculations you report. Clearly explain what you have done. **For calculations explain what you are calculating and how it was calculated (including appropriate equations). Carefully identify all the variables used in equations and calculations. SHOW INTERMEDIATE STEPS IN ALL ANALYSIS.**
- B. Discuss any problems encountered in the experiment and how you overcame them.
- C. Draw or copy a diagram of the experimental apparatus used to perform the experiment. Clearly show how any parts are connected. Also give a complete list of parts (pieces of equipment etc.) used in experiment.
- D. Collect and record at least two sets of data for every measurement you take. Assign experimental errors to your measured data. For example, if you take a reading from an analog meter or a meter stick, an estimate of the experimental error would be some reasonable fraction of the smallest division on the scale. For digital instruments you can usually use changes in the signal over time to estimate an error.
- E. Calculate errors in the physical constants or other parameters you determined in your experiment. Assume that these are random uncorrelated errors. Calculation of random errors will be discussed in class.
- F. Neatly tabulate and plot your data using Excel, Matlab or other software.
- G. **Fitting of equations to experimental data.** In experiments you are requested to fit equations to your data to **determine significant experimental parameters.**
- H. Always plot "best-fit" functions (that is the appropriate equation using the best-fit parameter value or values) as a solid line (without points). On the same graph plot your data points as large symbols like diamonds not connected by a line. This allows a direct comparison that often tells you if something has gone wrong with your attempt to fit an equation to your data or your measurements are corrupted in some way. **As discussed in class, data points should distribute evenly on both sides of your best-fit curve in a "good" fit.**

- I. Finally summarize your experiment. The results found and the conclusions reached should be discussed. For example, if you have determined a physical constant, one part of your summary should be to compare your value with the accepted value for this constant. A discussion of the difference in these quantities in terms of your calculated error in the constant should also be given. Discuss other problems which may produce errors.

# COVID-19 RELATED INFORMATION

## HEALTH AND SAFETY EXPECTATIONS

NDSU web resource for information on COVID-19: [https://www.ndsu.edu/admission/fall\\_2020\\_prelim\\_plan](https://www.ndsu.edu/admission/fall_2020_prelim_plan)

NDSU guidance on face coverings, physical distancing, and sanitation

- NDSU requires students to wear face coverings in classrooms. Wearing face coverings helps reduce the risk to others in case you are infected but do not have symptoms.
- **You must properly wear a face covering (covering both the mouth and nose) for the entirety of the class.**
- **If you fail to properly wear a face covering, you will not be admitted to the classroom. However, you may choose to participate in the class remotely.** The following will be used as needed: referral to Dean of Students Office or administrative removal from class. Students who cannot wear a face covering due to a medical condition or disability may seek accommodation through Disability Services (701-231-8463; <https://www.ndsu.edu/disabilityservices/>).
- Disinfecting supplies are provided for you to disinfect your learning space. You may also use your own disinfecting supplies.
- Students should observe social distancing guidelines whenever possible. Students should avoid congregating around instructional space entrances before or after class. Students should exit the instructional space immediately after the end of class to ensure social distancing and allow for the persons attending the next scheduled class to enter the classroom.
- In accordance with NDSU Policy 601, failure to comply with instructions, including this syllabus, may be handled according to the Code of Student Conduct resolution process and may result in disciplinary sanction.
- No food and drink are allowed in the class.

## ATTENDANCE EXPECTATIONS

According to [NDSU Policy 333 \(www.ndsu.edu/fileadmin/policy/333.pdf\)](http://www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

- Students are expected to attend every class and remain in class for the duration of the session when it is safe to do so in accordance with NDSU guidance regarding COVID19.
- In this course students should participate in the course mostly face-to-face. When needed, students are also able to participate virtually in synchronous or asynchronous discussions and activities and submit assignments virtually.
- While the late participation policy for this course is outlined below, please note that I will be flexible regarding deadlines for students who are experiencing illness or other challenges related to COVID-19. Please contact me as early as possible if you think you may not be able to complete an assignment or participate in the course due to illness.
- This semester due to COVID-19, I do not have an attendance policy as I normally would. Do not come to class if you are sick. You can view the lectures remotely and ask any questions you have on Blackboard Ultra (or Zoom).

## STEPS TO TAKE REGARDING STUDENT ILLNESS

- If you are unable to attend class at the regularly scheduled time due to illness, contact the instructor for alternate arrangements, including recordings of class sessions and assignments as well as accommodations and extensions as needed.
- Do not come to class if you are sick. Please protect your health and the health of others by staying home and participate in class remotely. For information on COVID-19, symptoms, testing, and steps to stay healthy see [https://www.ndsu.edu/studenthealthservice/covid\\_19/](https://www.ndsu.edu/studenthealthservice/covid_19/).
- Do not come to class if you have been exposed to individuals who tested positive for COVID-19 and/or you have been notified to self-quarantine due to exposure.
- If you are absent from class as a result of a COVID-19 diagnosis or quarantine, the decision for approval of all absences and missed work is determined by the course instructor. As instructor, I will do the following to help you make progress in the course:
  - You will be able to participate in class remotely.
  - You will be able to submit assignments and take exams remotely.

- Other remote learning options will be determined on a case-by-case basis.

### **COPYRIGHT OF COURSE MATERIALS**

According to [NDSU Policy 190 \(Intellectual property\)](#):

- In this course recording the lectures is prohibited with your own personal devices (without prior express approval from the instructor).
- In this course recording the lectures for anything other than personal use is prohibited.

### **ASSIGNMENT SUBMISSION**

- In this course Blackboard will be used for assignment submission (and grading) for all students (for both face-to-face and remote participants).
- If you are sick, do not come to class or campus to turn in work. Instead notify the course instructors as soon as practical, so that accommodations can be made.

### **HYFLEX OPTIONS**

According to NDSU guidance of HyFlex: <https://kb.ndsu.edu/learn>

- If you are at high risk of contracting COVID-19 (and/or of infecting someone who is high risk), you have the option of attending class remotely. You may opt to do so at the beginning of the semester or as the need arises during the semester.
- To participate in HyFlex instruction remotely, you must have access to the requisite technology, including a laptop/computer with a functioning microphone, speakers (or headphones) and webcam, as well as reliable internet access.
- To opt for the remote learning experience in this course inform the course instructor via email as soon as possible.

### **ADDITIONAL RESOURCES FOR STUDENTS**

As a member of the NDSU community, resources are available for you should you need help in dealing with adverse reactions to things happening in the world today. A variety of resources are listed below:

For students on campus and remotely (telehealth):

Counseling Services: 701-231-7671; <https://www.ndsu.edu/counseling/>

Disability Services: 701-231-8463; <https://www.ndsu.edu/disabilityservices/>

Student Health Service: 701-231-7331; <https://www.ndsu.edu/studenthealthservice/>

Dean of Students Office: 701-231-7701; <https://www.ndsu.edu/deanofstudents/>

In a crisis or emergency situation:

Call University Police: 701-231-8998

Call 9-1-1

Go to a Hospital Emergency Room

Go to Prairie St. Johns for a Needs Assessment: 701-476-7216 (510 4th St. S.)

Call the FirstLink Help Line: 1-800-273- TALK (8255) or 2-1-1

Call Rape and Abuse Crisis Center: 701-293-7273