*Oakland University* *College of Arts & Science* *Department of Physics*

***PHY 1520 – Introductory Physics II***
***4 Credit Hours***
***Fall 2020***

**Instructor:** Evgeniy Khain **E-mail:** khain@oakland.edu
**Office:** 272 Hannah Hall **Office phone:** 248-370-3412
**Class Time:** Tuesday, Thursday, 3:00 - 4:47 pm **Office hours:** Once a week in Yuja
**Auditorium:** ONLINE

**Course (Catalog) Description:** Electricity and magnetism. Topics include:

***Electricity & Magnetism:*** *Electric Field*: Coulomb's Law, Electric Flux, Gauss's Law, Electric Potential, Conductors and Dielectrics, Capacitance; *Electric Current*: Resistance, Ohm's Law, Superconductors, Electric Energy and Power; *Direct Current Circuits:* Kirchhoff's Rules, RC Circuits. *Magnetic Field:* Force on a Current-Carrying Conductor, Torque on a Current Loop, the Biot-Savart Law, Force between two Parallel Conductors, Ampère's Law, the Magnetic Field of a Solenoid, Magnetism in Matter. *Inductance:* Faraday's Law, Lenz's Law, Self-Inductance, RL Circuits. Energy Stored in a Magnetic Field. *Electromagnetic Waves:* Maxwell's Equations, The Spectrum of Electromagnetic Waves, Polarization.

***Optics:*** The Nature of Light, Ray Model in Geometric Optics, Reflection and Refraction of Light, Image Formation by Mirrors and Lenses, Lens Aberration. *Wave Optics:* Interference and the Double-Slit Experiment, Diffraction, the Diffraction Grating, X-Rays Diffraction by Crystals. ***Modern Physics:*** *Quantum Physics:* Blackbody Radiation and Planck's Theory, the Photoelectric and Compton Effects, the Particle Model of Light, the Wave Properties of Matter, the Quantum Particle, the Uncertainty Principle, the Schrödinger Equation, the Tunneling Effect. *Atomic Physics:* Early Models of the Atom, the Hydrogen Atom, Quantum Numbers and their Interpretation, the Exclusion Principle and the Periodic Table, Atomic Spectra. *Nuclear Physics:* Properties of Nuclei, Binding Energy, Radioactivity and the Radioactive Decay Processes, Nuclear Reactions. *Particle Physics:* The Fundamental Forces in Nature, Elementary Particles, Antiparticles, Conservation Laws and Classification of Particles, Quarks and the Standard Model.

**Course Prerequisites:**

**PHY 1520**: Prerequisite(s): PHY 1510; MTH 1555 recommended; Co-requisite(s): PHY 1110

**PHY 1520 (4 credits with Lab)** satisfies the university general education requirement in Natural Science and Technology knowledge exploration area.

**General Education Learning Outcomes for PHY 1520:** The learning outcomes for Natural Science and Technology courses state that the student will demonstrate:

- Knowledge of major concepts from natural science or technology, including developing and testing of hypotheses; drawing conclusions; and reporting of findings through some laboratory experience or an effective substitute (Laboratory experiences are met by either a limited number of interactive experiences, collecting and interpreting raw data, or other effective experiences such as a virtual laboratory). Requires at least 3 laboratory experiences during the course.
- How to evaluate sources of information in science and technology.

In addition to the general-education learning outcomes, this course also includes the crosscutting capacity of Critical Thinking.

**Course Goals and Objectives:** Goals of this course include: applying notions and models learned in the previous Introductory Physics I course to the understanding of new, advanced concepts and principles of physics; applying notions learned in the previous Calculus I course for problem solving; learning to utilize advanced Calculus methods to produce a mathematical representation of and to analyze physical situations; introduce a wide range of applications to fields other than physics; incorporate contemporary physics in the course and utilize this to analyze the ethical and societal implications of its applications.
To achieve these goals:

- Strong emphasis is given to sound physical arguments and conceptual learning, to strengthen the student's logical capacities.
- Emphasis is given to problem-solving methodology: a modeling approach, based on four types of models commonly used by physicists, is introduced for the students to understand they are solving problems that approximate reality. Then they learn how to test the validity of the model. This approach helps the students see the unity in physics, as a large fraction of problems can be solved using a small number of models.
- Quite often problems require the student to relate to concepts covered in previous chapters or in the previous course.
- Some problems require the use of a computer or graphing calculator. Modeling of physical phenomena enables the students to obtain graphical representations of variables and to perform numerical analyses.
- The course includes practical examples that demonstrate the role of Physics in other disciplines, including engineering, chemistry, life sciences and medicine, and applications relating to modern technology.
- The course connects physics principles to examples of
    - Natural phenomena - such as Lightning, Earthquakes and the Northern Lights;
    - Technological advances - such as Magnetic Levitation Vehicles, Magnetic Resonance Imaging, the Electron Microscope, and Optical Fibers;
    - Ethical and Philosophical issues - such as how making measurements at the atomic or subatomic level alters the status of the system, and the origin and fate of the universe;
    - Societal issues - such as the utilization of Nuclear energy.

**Textbook:** *Serway/Jewett, Principles of Physics: A Calculus-Based Text, Hybrid, 5th Edition.*

*Bundled with EWA and EWA Start Guide ISBN: 9781305586871*

Notice that the Hybrid format of the textbook is cheaper than the hardcover one. It does not include end-of-chapter problems, but these can be found on the e-book. **Register to WebAssign with the following class key: oakland 3377 8244**

**Equipment:** Protractor, metric ruler, scientific calculator.

**Homework:** There will be assigned homework every week. I will use the online program WebAssign, which will accept and automatically grade the homework. The homework for each chapter can be submitted a maximum of 5 times. For accessing WebAssign: see the next page. Due time: the assignments are usually due at 11:59 pm on the specified date. No email homework is accepted. The homework is worth 30% of the final grade.

**Lecture problems:** One problem/question will be assigned every week during the Tuesday lecture; it will be due on Friday of the same week at 11:59 pm. This written assignment should be sent by email to khain@oakland.edu before the due time. There will be 10 such problems given during the semester. The overall grade for this part is worth 10% of the final grade.

**Exams:** There will be two midterm exams; each midterm exam is worth 20% of the final grade. The exams consist of Problems and Conceptual Questions and will be mostly conducted in WebAssign during the class time (the details will be given later). Please note: clear writing and clarity of expression is a very important component of the exams and the final project.

**Final Project:** Due to coronavirus and online teaching and learning, the final exam is replaced by the final project, which is worth 20% of the final grade. The project topics will represent the final third of the course, the list of topics will be given later. The written part of the project must be submitted by email to khain@oakland.edu by Thursday, **December 10**. This will be followed by the oral part (conducted during the exam week), where each student will discuss the project with the instructor in a **one-on-one online conversation**. Please keep in mind that a poor performance at this "mini-defense" can substantially lower your grade for the project. A student may decide to skip the oral mini-defense part; in this case the **maximal** project grade will be 70 out of 100.

**Make-up Policy:** In order to be fair to the majority of students who take the exams on time, the general policy is: *NO make-up exams* will be given. A score of zero will be entered for missed tests. If you cannot be present for an exam due to an unavoidable emergency, contact me before the exam if possible or as quickly as possible after the exam to see if an exception can be made.

**Laboratories:** PHY 1520 includes a laboratory experience aimed at introducing the students to the scientific method of investigation of physics phenomena and principles. Detailed information is provided on a syllabus which will be distributed at the labs. Attendance to all lab sessions is mandatory. Location: Rooms HHS 169. Please notice: although the laboratory's grade is separate from the course grade, since the course and the laboratory are co-requisites, a student failing the course will have to re-take the lab even if he/she passed the lab component of the course.

| **Grading Scale:** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture Problems** | **10%** | | | | | | |
| **Midterm Exam 1** | **20%** | A | ≥96% | C+ | 70-74% | D+ | 55-59% |
| **Midterm Exam 2** | **20%** | A- | 90-95% | C | 65-69% | D | 50-54% |
| **Final Project** | **20%** | B+ | 85-89% | C- | 60-64% | F | 0-49% |
| **Homework** | **30%** | B | 80-84% | | | | |
| **Total** | **100%** | B- | 75-79% | | | | |

**Attendance:** Attendance to all lectures is expected. Poor attendance usually correlates with poor course grade.

**Add/Drops:**

The University's add/drop policy will be explicitly followed. It is the student's responsibility to be aware of the university deadline dates for dropping courses.

**Reasonable Accommodations:**

Accessibility and Accommodations: It is the University's goal that learning experiences be as accessible as possible. Students with disabilities who have questions about course accessibility are encouraged to contact the instructor immediately. The Office of Disability and Support Services (DSS) is available to help. The DSS office is located in room 103A North Foundation Hall.
For more information, call 248-370-3266 or visit **https://www.oakland.edu/dss**

**Policy on Academic Misconduct:**

The University's regulations that relate to academic misconduct will be fully enforced. Any student suspected of cheating and/or plagiarism will be reported to the Dean of Students and, thereafter, to the Academic Conduct Committee for adjudication. Anyone found guilty of academic misconduct in this course may receive a course grade of F, in addition to any penalty assigned by the Academic Conduct Committee. Students found guilty of academic misconduct by the Academic Conduct Committee may face suspension or permanent dismissal. The full policy on academic misconduct can be found in the General Information section of the Undergraduate Catalog.

**Excused Absence Policy:**

The University excused absence policy applies to participation as an athlete, manager or student trainer in NCAA intercollegiate competitions, or participation as a representative of Oakland University at academic events and artistic performances approved by the Provost or designee.
For the excused absence policy, see:
**https://www.oakland.edu/provost/policies-and-procedures/**

**Student Preferred Name/Pronoun Policy:**

Course rosters are typically provided to the instructor with the student's legal names. If you do not identify with the name that is listed with the Registrar's office, please notify me. I will gladly honor your request to address you by an alternate name or gender pronoun. For more information on indicating a preferred first name on university records, please visit:
**https://www.oakland.edu/uts/common-good-core-resources/name-services/**

# WEB Assign: How to Get Started

**Day One: Register**

1. Go to https://webassign.net and click on LOG-IN.
2. Click on 'I have a Class Key'
3. Enter the Class Key: **oakland 3377 8244** (this allows me to see your homework grades)
4. Enter your chosen Login name and the required information
5. Click on 'Create my Account'

A review screen will appear with your Username, Institution code & Password.
Print and retain a copy of this information.

6. Once you Login, you need to enter the WebAssign Access Code.

- If you purchased a new textbook, the Access Code card is inside the book.
- If you purchased a used book, you may choose to purchase the Access Code online.

Notice: there is a 14 day grace period to use WebAssign. If you have not purchased your textbook yet, during this time you can do your homework without a registering code.

7. Once you have logged in, you will see the Homepage.

- I suggest you click on Guide (upper right corner) and read the Student Guide.
- For Technical Support click on Help or go to http://www.webassign.net/info/support/report.html~

**To access the Homework:**

1. Go to http://www.webassign.net/login.html (I suggest you Bookmark this page)
2. After you Login, click on 'My Assignments'.

Please notice:

- You may save your work without grading by clicking on 'Save Work' at the end of the question. Next time you access the assignment, your work will still be available.
- Web Assign will not automatically submit your answer if you only 'Save' your work. Make sure you 'Submit' it before the due date and time.
- You may also choose to 'Submit New Answers to Question xx' or 'Submit All New Answers'.

Remember that there is a maximum of 5 submissions for each problem.

# Tentative Course Schedule

| Day | Date | Lecture Topics | Chapters |
|---|---|---|---|
| Th | 9/3 | Electric charge, Coulomb's law, Electric field | 19.1 – 19.5 |
| T | 9/8 | Electric field, motion in the Electric field | 19.5 – 19.7 |
| Th | 9/10 | Electric flux, Gauss's law and its applications | 19.8 – 19.10 |
| T | 9/15 | More applications of Gauss's law, Electric potential | 19.10, 20.1, 20.2 |
| Th | 9/17 | Electric potential and Electric field (connections) | 20.3 – 20.6 |
| T | 9/22 | Capacitance, capacitors, combinations | 20.7 – 20.10 |
| Th | 9/24 | Electric current, resistance, Ohm's law, conduction; electric power, parallel and serial connections | 21.1 – 21.7 |
| T | 9/29 | Kirchhoff's rules, RC circuits | 21.8 – 21.9 |
| Th | 10/1 | Review for midterm 1 | |
| **T** | **10/6** | **Midterm Exam 1: Chapters 19, 20, 21** | |
| Th | 10/8 | Magnetic field, trajectory of charged particles, force on a wire | 22.1 – 22.4 |
| T | 10/13 | Biot-Savart law, examples. Ampère's law | 22.5 – 22.6 |
| Th | 10/15 | Ampère's law, examples. Forces and Torques | 22.7 – 22.8 |
| T | 10/20 | Faraday's law, motional emf, Lenz's law | 22.9 – 22.11 |
| Th | 10/22 | Faraday's law, examples | 23.1 – 23.3 |
| T | 10/27 | Self-induction, RL circuit, LC circuit | 23.4 – 23.7 |
| Th | 10/29 | Displ. current, Maxwell's equations, ELM waves | 24.1 – 24.3 |
| T | 11/3 | Doppler effect, Reflection and Refraction | 24.3 – 24.4, 25 |
| Th | 11/5 | Review for midterm 2 | |
| **T** | **11/10** | **Midterm Exam 2: Chapters 22, 23, 24** | |
| Th | 11/12 | Images formed by mirrors; Wave optics | 26.1-26.2, 27.1-27.3 |
| T | 11/17 | Wave properties of particles; Blackbody radiation | 28.1, 28.5, 28.7 |
| Th | 11/19 | Photoelectric effect; Early models for atomic structure | 28.2, 29.1 |
| T | 11/24 | Bohr's model (in more detail); Heisenberg uncertainty principle; Wave function | 29.1, 28.8, 29.2 |
| **Th** | **11/26** | **Thanksgiving** | |
| T | 12/1 | Hydrogen atom; Zeeman effect; Exclusion principle | 29.2-29.5 |
| Th | 12/3 | Some nuclear physics. Final review | |
| **Th** | **12/10** | **Due date for the written part of the Final Project** | |

Note:
This schedule is subject to change except for dates of exams.