

SYLLABUS
PHYS-263 GENERAL PHYSICS III,
WAVES, OPTICS, and MODERN PHYSICS

INSTRUCTOR: Dr. Catalina Cetina

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Office Hours: M 2 – 4 pm; R 10-11 am, 2-3 pm; F 1-2 pm

GENERAL COURSE INFORMATION

Course: General Physics III, Mechanics and Heat, 4 credits

CRN 33489, PHYS-263, Lecture MWF 12 - 12:50 pm SC-412

CRN 33490, PHYS-263D, Discussion M 1 - 1:50 pm SC-412

CRN 33491, PHYS-263L, Lab W 1 - 3:40 pm SC-412

Pre-requisite: PHYS-262 with grade C or better or department consent.

Course Description

Third of three related courses, along with PHYS-161 and PHYS-262. A calculus-based general physics course required for students majoring in engineering or one of the physical sciences.

This sequence is planned as a unified course of study with continuity of presentation across the semester boundaries. It is strongly recommended that students plan to complete the sequence in consecutive semesters. PHYS 263, Waves, Optics, and Modern Physics covers physical and geometrical optics, quantum mechanics, selected topics in nuclear physics, solid state physics, and related fields.

Course Outcomes

Upon course completion, a student will be able to:

- Demonstrate understanding of the distinction between Transverse and Longitudinal Waves and predict which will be supported in various media.
- Solve the differential wave equation for the simplest cases.
- Relate period, frequency, wavelength, and velocity for harmonic waves.
- Apply the concept of linear superposition to standing waves and mechanical resonance.
- Apply general concepts of mechanical waves to a variety of contexts such as musical instrument design, supersonic flight, ultrasonic testing of materials, etc.
- Demonstrate understanding of how electromagnetic waves are predicted by Maxwell's equations.
- Analyze experimental results and derive valid conclusions related to the wave properties of light.
- Improve mastery of skills related to Phasor Diagrams and AC Circuit Analysis.
- Analyze experimental results and derive valid conclusions related to the geometrical optics of lenses and mirrors which predate the wave picture of light.
- Explain the significance of the many new discoveries of modern physics at the turn of the 20th century which challenge prior classical ideas of particle, waves, and energy. Specifically, discoveries such as the photoelectric effect, X-rays, etc.
- Use prior application of wave theory together with statistical concepts to explain early quantum discoveries.
- Apply math techniques such as Separation of Variables and the solution of Boundary-Value problems to solutions of simple problems in wave theory and quantum mechanics.
- Describe how Relativity developed from a re-examination of the nature of space and time and lead to new connections between concepts of mass and energy.

- Solve simple problems related to Relativity.
- Apply the basic principles of modern physics to simple problems and models involving atomic structure, nuclear structure, and radiation.
- Demonstrate understanding of the various applications of Quantum Physics to medicine, industry, engineering.
- Demonstrate understanding of the applications of Nuclear Physics as it relates to the “energy resource problem”, alternative energy resources such as wind, tides, geothermal, biomass, etc. and the future of the “energy problem”.
- Demonstrate understanding of some basic ideas in Particle Physics and Cosmology.

In summary:

- Demonstrate a conceptual understanding of physical principles associated with waves, optics, and modern physics.
- Apply scientific methods to investigate physical concepts associated with waves, optics, and modern physics
- Solve physics problems involving waves, optics, and modern physics
- Communicate clearly the results of investigating physical concepts associate with waves, optics, and modern physics.

COURSE MATERIALS

Textbooks

University Physics with Modern Physics, H.D. Young & R.A. Freedman,
 OpenStax, University Physics, Vol 1&3 <https://openstax.org/details/books/university-physics-volume-1>
Lab Manual, in pdf on Bb site.

GRADING FORMULA

3 Tests	(1.5 h)	45%	15% each
Final Exam	(2 h)	20%	
HW Quizzes	(20 min)	15%	
Laboratory		20%	12% Weekly labs 8% Lab final

GRADING SCALE	A > 90%	B > 80%	C > 70%	D > 60%	F < 60%
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COURSE GUIDANCE

All students will have a positive experience and a successful class. Sustained, steady-pace study and participation are key. A significant commitment level and time investment is necessary and struggle is sometimes part of it. The instructor will offer guidance and support, but students must accept responsibility for their learning progress.

Course schedule (please see table on the last page)

It is a **tentative** schedule for the semester and it is subject to change with notice from the instructor. It is the responsibility of the student to maintain class attendance and stay informed.

Lectures set the structure of the course and thus you are expected to attend all lectures.

Familiarity with the material prior to class is strongly encouraged.

Lecture notes, available in pdf format on Bb, are designed only as a summary and guideline and are supposed to be supplemented by our own notes.

Discussions

It is beneficial for you to be familiar with the discussion problems before class. Print and bring to class. During the discussion periods you will be expected to work in small groups, consult each other, and work out the problem solution on the whiteboards.

The instructor is there to point you in the right direction—not to solve the activity problems for you. You are expected to stay the entire discussion period.

Homework/Quizzes

HW is assigned but not directly graded. It is tested through weekly quizzes. Therefore, the HW is “due” the day of the quiz testing the specific topic.

Work all the problems out on paper, as if you were turning them in. Keep your work organized in a loose-leaf notebook that will contain all HW, discussion activities, and lecture notes.

The “Examples” in the Young-Freedman and in the OpenStax textbooks are a very valuable resource and it is assumed you can work them out.

Tests will involve problem-solving, graphical interpretation, and conceptual questions. Problems similar to lecture examples, HW problems, and discussion activities, *may* appear on a test. The tests may contain both multiple-choice and show-your-work problems.

Tests will be closed-book, but a standard formula sheet will be provided.

None of the exam grades will be dropped.

Final Exam is comprehensive.

Final exam schedule: <http://cms.montgomerycollege.edu/EDU/Department2.aspx?id=48071>

Laboratory

You must achieve 60% or above in the lab to be eligible to pass the course.

Lab attendance is required unless specifically excused. More than one unexcused absence from lab could result in an automatic **F** for the course. There are no make-up labs but the open lab in SC-415 is always available for extra practice and to prepare for the lab final.

The lab final is scheduled during the last lab period of the semester. You will be expected to carry out an experiment, analyze data and report results. You will work individually and independently. The experiment will be based on an experiment you have carried out over the course of the semester.

Additional resources

Simulations: <http://phet.colorado.edu/en/simulations/category/physics>

MIT Open Courseware: <http://ocw.mit.edu/courses/physics/>

Tutorials: <http://www.khanacademy.org/science/physics>

FlipItPhysics: www.flipitphysics.com

Course access key: 4a3d1bf6

Please use your M-number as the unique identifier.

Package includes pre-lecture, check points, and exercises for Optics only.

Ackerman Learning Center, SW-109, 240-567-5200

<http://www.montgomerycollege.org/Departments/mathscrv/>.

Feel free to walk-in to the Math/Science Center to investigate any short-term tutoring needs you may have for this course. They are friendly and free!

CLASSROOM POLICIES See: **College-Wide Policies and Procedure Manual (CWPPM)****Standards of College Behavior** (Section III)

Please greet your colleagues and instructor when coming to or leaving the class.

Please behave courteously and avoid disrupting the class.

Attendance

See: *CWPPM, Academic Regulations, Class Attendance (Section 9.823)*.

Students are expected to attend all class sessions. "Excessive absence" is defined as one more absence than the number of times the class meets per week. In a Monday-Wednesday-Friday class, four absences would be considered excessive. If you miss a class session, it is your responsibility to find out what you have missed.

Academic Honesty (Section IV)

Anyone practicing academic dishonesty will incur severe penalties which may include anything from receiving a zero grade to receiving an "F" for the entire course.

Academic dishonesty includes but is not limited to the following:

- exchanging information during an examination;
- using unauthorized formula sheets or any other unauthorized materials during an examination;
- dishonestly obtaining, using or possessing copies of an examination or providing or receiving information contained therein;
- completing an examination in the name of someone else;
- plagiarizing (i.e. copying) any work;
- quoting or paraphrasing any work beyond textbook material without proper source citation;
- any other act or attempted deception or offer of favors designed to affect the evaluation of academic performance.

You will be asked to sign an honor pledge at the beginning of the semester and before the midterm and the final exams.

Communication

The official means of communication is the **MC e-mail account** and the **Open Forum** on the class Bb site. Please keep all communication at a relatively formal level and include a signature. Thanks.

Students are responsible for checking their MC e-mail account and Bb site for college and class information.

Important Student Information Link:

<http://cms.montgomerycollege.edu/mcsyllabus/>

In addition to course requirements and objectives that are in this syllabus, Montgomery College has information on its web site to assist you in having a successful experience both inside and outside of the classroom. It is important that you read and understand this information. The above link provides additional links for the following: Academic Calendar, ADA Information and Compliance, Alert Montgomery System, Code of Conduct, Combat to College, Counseling & Advising, Disability Support Services, Forms, Learning Centers and Academic Support Centers, Safety, Security & Emergency Operations Plan, Sexual Harassment or Discrimination.

If you have any questions, please bring them to your professor. By registering for this class and staying in this class, you are indicating that you acknowledge and accept these policies.

Course Schedule (subject to change)

Week	Date	YF ch	OS v.ch	Lecture /Discussion	Test/Quiz	Lab
1	M 1/21					
	W 1/23	15	1.16	Waves		
	F 1/25			Waves		
2	M 1/28			D Waves	Quiz 1	Standing waves
	W 1/30	16	1.17	Sound		
	F 2/08			Sound		
3	M 2/04			D Sound	Quiz 2	Acoustics
	W 2/06	32	2.16	E.mg. waves		
	F 2/08	33	3.1	Light		
4	M 2/11			D El.mg. waves/Light		Microwaves
	W 2/13				Test 1	
	F 2/15	34	3.2	Geometric Optics		
5	M 2/18			D Geometric optics	Quiz 3	Mirrors & thin lenses
	W 2/20	35	3.3	Interference		
	F 2/22			Interference		
6	M 2/25			D Interference	Quiz 4	Optical instruments
	W 2/27	36	3.4	Diffraction		
	F 3/01			Diffraction		
7	M 3/04			D Diffraction	Quiz 5	Double & single slit
	W 3/06			<i>Review</i>		
	F 3/08			<i>Review</i>		
<i>SPRING BREEAK</i>						
8	M 3/18				Test 2	Diffraction gratings
	W 3/20	37	3.5	Relativity		
	F 3/22			Relativity		
9	M 3/25			D Relativity	Quiz 6	Photoelectric effect
	W 3/27	38	3.6	Duality I		
	F 3/29			Duality I		
10	M 4/01			D Duality I	Quiz 7	Bohr spectra
	W 4/03	39	3.6	Duality II		
	F 4/05			Duality II		
11	M 4/08			D Duality II		e/m
	W 4/10				Test 3	
	F 4/12	40	3.7	QM		
12	M 4/15	41	3.8	Atomic Structure		Statistics
	W 4/17			D QM/Atomic Structure	Quiz 9	
	F 4/19	43	3.10	Nuclear Physics		
13	M 4/22			Nuclear Physics		Attenuation
	W 4/24			D Nuclear Physics	Quiz 10	
	F 4/26	44	3.11	Particle Physics		
14	M 4/29			D Particle Physics		Lab Final
	W 5/01			<i>Review</i>		
	F 5/03			<i>Review</i>		
15	M 5/06			<i>Review</i>		
16	M 5/13				Final exam	12:30 pm