DAWSON COLLEGE

PHYSICS
Science
Waves, Optics & Modern Physics
203-NYC-05 (all sections)
Fall 2015

Teachers

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Pre-requisites

Mechanics (203-NYA-05), Calculus I (201-NYA-05)

Co-requisites

Calculus II (201-NYB-05)

Ponderation

3-2-3 (3 hours of lecture, 2 hours of labs, and 3 hours of work outside class per week)

Course objectives

To analyze various situations or phenomena associated with waves, optics and modern physics using basic principles. This course is intended to introduce the student to a broad range of physical phenomena involving waves (mechanical waves, sound waves, and electromagnetic waves), geometrical and physical optics, matter waves, and quantum physics.

For detailed information regarding the objectives of this course and the specific performance criteria see the Science Program folder on FirstClass.

Course competencies

This course will allow the student to fully achieve the competency:
OOUT: To analyze various situations or phenomena associated with waves, optics and modern physics using basic principles.

1. To apply the basic principles of physics to oscillations and to waves and their propagation .
2. To apply the laws of geometrical optics.
3. To apply the characteristics of waves to light phenomena (physical optics).
4. To analyze a number of situations using concepts from modern physics: the development of quantum mechanics.
5. To analyze a number of situations using concepts from modern physics: the physics of the nucleus and radioactivity.
6. To verify experimentally some of the laws and principles associated with oscillatory motion, waves, optics and modern physics.

This course also contributes to the partial achievement the competency:
OOUU: To apply what the students have learned to one or more subjects in the sciences.

1. To identify the scientific aspects of a given topic from an interdisciplinary perspective
2. To transfer what they have learned to situations requiring the contribution of more than one discipline
3. To apply systematically an experimental method
4. To solve problems
5. To use data processing technologies
6. To reason with rigor
7. To communicate clearly and precisely
8. To show evidence of independent learning in the choice of documentation or laboratory instruments
9. To work as members of a team
10. To make connections between science, technology and the evolution of society
11. To identify the underlying values underlying their treatment of a topic
12. To place scientific concepts used in a historical context
13. To show attitudes appropriate for scientific work
14. To apply acquired knowledge and skills to new situations

Evaluation

The Institutional Student Evaluation Policy (ISEP) is designed to promote equitable and effective evaluation of student learning and is therefore a crucial policy to read and understand. The policy describes the rights and obligations of students, faculty, departments, programs, and the College administration with regard to evaluation in all your courses, including grade reviews and resolution of academic grievance. ISEP is available on the Dawson website.

There are two grading schemes. **Your final grade will be the higher of the two schemes.**

Assignments, quizzes and class tests[†]	55%	35%
Laboratory activities	15%	15%
Final examination	30%	50%

[†]Your teacher will provide a detailed breakdown of these components and a tentative test schedule during the first week of class.

In order to pass the course, students must show a basic understanding of the course material at the level covered in the lectures and in the lab. This is achieved by attaining a final grade of at least 60%, calculated according to the evaluation scheme above. **Note: course work not submitted by the due date may be penalized at the teacher's discretion.**

In the rare event that a student for valid reason (*e.g.* due to an intensive course, illness, *etc.*) is or anticipates to be absent during a laboratory experiment or a class test, the student **must**, where possible, inform the teacher and provide the necessary documents before the absence or, at the latest, on the day of their return. If the absence is excused, students will have the opportunity to complete the assessment.

All other assessments (readings, quizzes, lab activities, *etc.*) missed due to absence are:

- assigned a grade of zero where the absence is not excused;
- given zero weight in the calculation of the final grade where the absence is excused.

Reference materials

1. **Physics for Scientists and Engineers (with Enhanced WebAssign) by Serway & Jewett, 9th edition** or **Physics for Scientists and Engineers (with Mastering Physics) by Knight, 3rd edition**. Custom packages for Dawson College NYC are available at the bookstore which include an access code for the online homework system. Your teacher will tell you which textbook will be used in your section.
2. **Library copies:** Copies of the textbook are available on reserve in the Dawson Library.

Teaching methods

The material will be presented using a mix of active learning activities, lectures, in-class problem solving, laboratory experiments and demonstrations. Laboratory periods will be used for experiments as well as class tests and lectures.

Attendance & participation

Although class attendance is not compulsory, students should make every effort to attend all classes. In the event that a class is missed, the student is responsible for all material covered or assigned during that class. **Attendance at laboratory experiments and tests is compulsory.** Students must write the tests at the scheduled times except for unforeseen emergencies confirmed by proper documents. For additional information students should refer to the Institutional Student Evaluation Policy (ISEP section III-C) regarding attendance.

Literacy standards

It is expected that students will be able to comprehend the course material and express themselves appropriately as a normal part of their academic performance in the course. Marks may be deducted for inadequate communication skills.

Laboratory work

Experimentation is an essential part of science. Students will be expected to perform experiments and report on their results. Your teacher will provide you with instructions for lab experiments and activities (there is no manual to purchase). **Students must be present during the entire lab activity to receive credit.**

Student conduct

Everyone has the right to a safe and non-violent environment. Students are obliged to conduct themselves as stated in the Student Code of Conduct and in the ISEP section on the roles and responsibilities of students (ISEP section II-D). Disruptions or excessive noise will not be tolerated. Students who do not comply with these rules will be asked to leave the class and may be referred to Student's Services for disciplinary action. **Mutual respect is the key to a harmonious learning environment.**

Academic integrity

Cheating, copying, or any other form of academic dishonesty will not be tolerated. Students should acquaint themselves with the policy of the College on plagiarism and cheating. According to ISEP, the teacher is required to report to the Sector Dean all cases of cheating and plagiarism affecting a student's grade (ISEP section IV-C). The usual penalty for the first instance of cheating will be a grade of zero for the piece of work in question to all parties involved (under certain circumstances, even a first offence may be penalized by failure in the course). A second offence may result in the failure of the course. Students should note that using someone else's laboratory data without authorization from the student and the teacher is cheating.

Intensive course conflicts

If a student is attending an intensive course, the student must inform the teacher, within the first two weeks of class, of the specific dates of any anticipated absences.

Policy on religious observance

Students who intend to observe religious holidays must inform their teachers in writing as prescribed in the ISEP Policy on Religious Observance (ISEP Section III-D), within the first two weeks of the semester. Forms for this purpose are available from your teacher. Your teacher will inform you of any modifications to planned course activities resulting from the teacher's own religious commitments.

Course content

The material to be covered is contained in the following chapters and sections of **Physics for Scientists and Engineers by Serway & Jewett, 9th edition**.

Weeks	Topics	Chapter & Section
1–2	Periodic motion	Ch.15: 1–5; sections 6 and 7 qualitatively (quantitative optional for 6, 7)
2–4	Mechanical waves	Ch.16: 1–5 (6 optional)
4–6	Sound waves and hearing	Ch.17: 1 and 2 qualitatively; 3, 4
6–7	Superposition and standing waves	Ch.18: 1–5, 7; 8 qualitatively
8	Electromagnetic waves	Ch.34: 7 (EM spectrum)
8	Nature and propagation of light	Ch.35: all; Ch.38: 6 qualitatively
9	Interference	Ch.37: 1–3
10	Diffraction	Ch.38: 1, 2 (intensity optional), 3, 4, 7, 8 without derivations
11	Relativity	Ch.39: 1, 3, 4, 7, 8
12–13	Introduction to quantum mechanics	Ch.40: 1, 2, 4, 5, 7 (8 optional)
14	Atomic physics	Ch.42: 1–3 (9, 10 optional)
14–15	Nuclear physics	Ch.44: 1, 2, 4–6 (8 optional)
15	Applications of nuclear physics	Ch.45: (all optional)

The material to be covered is contained in the following chapters and sections of **Physics for Scientists and Engineers by Knight, 3rd edition**.

Weeks	Topics	Chapter & Section
1–2	Oscillations	Ch.14: 1–6 (Physical pendulum optional), 7–8 qualitatively
2–5	Traveling waves	Ch.20: all and additional notes (Doppler effect for light waves optional)
5–7	Superposition	Ch.21: 1-5 and 7, (section 6 optional)
7–9	Wave optics	Ch.22: 1–5 and additional notes (6 optional)
10	Ray optics	Ch.23: 1–3, 5
11	Relativity	Ch.36: 3, 6, 7, 9 and 10 (1, 2, 4, 5, 8 optional)
11	The foundations of modern physics	Ch.37: 1, 2 (3–8 qualitatively)
12	Quantization	Ch.38: all
13	Wave functions and uncertainty	Ch.39: 6
13	One-dimensional quantum mechanics	Ch.40: (all optional)
14–15	Nuclear physics	Ch.42: 1–3, 5, 6 (4 and 7 optional)

Comprehensive examination

Second-year students can opt to complete the independent study portion of their comprehensive examination in this course. (This option is not available in continuing education courses.) The project will count for 10% of the student's final grade, while the usual course mark will count for 90%. The following exceptions should be noted:

1. In the case where the student's course mark is less than 60%, the independent project will not count towards the final course grade;
2. In the case where the student's course mark is greater than 60%, the independent project will not lower the course grade below 60%;
3. Irrespective of the course grade, a project that successfully meets the independent project criteria will result in a passing grade for this component of the comprehensive examination.

Questions outside class

- All regular day program teachers will be available in their respective offices to their students during posted office hours. In the first week, your teacher will inform you of their schedule and will post it outside their office.
- Room 7A.1 is the physics study room. At scheduled times, a teacher or peer tutor will be on duty there to answer your questions. The schedule of teachers and peer tutors will be posted outside of 7A.1 in the 2nd or 3rd week of term.
- Many teachers in the Physics Department will communicate with their students using FirstClass. This software allows teachers and students to share information, use email and much more. You can access FirstClass via the MyDawson portal or using the following link:

  `https://fcws.dawsoncollege.qc.ca/`

  Also note that a free FirstClass app is available for iPhone/iPad, Android, and BlackBerry.