

PHY293H1F – WAVES AND MODERN PHYSICS
DEPARTMENT OF PHYSICS UNIVERSITY OF TORONTO
Course Syllabus : FALL 2018-19

This course is taught as two consecutive sections: Waves (Sep. 6 - Oct. 22) and Modern Physics (Oct. 22 - Dec. 4). The general course, tutorial and laboratory information is given on this page. The individual syllabi for the two sections are given on the following pages.

Course Website: on Quercus and <https://www.physics.utoronto.ca/students/undergraduate-courses/current/phy293h1> .

Course Coordinator:

Dr. Natalia Krasnopolskaia

Office: MP251 A

Office hours: Wednesday 12:30 pm - 1:30 pm; Friday 3:30 pm – 4:30 pm in MP 251 A.

Tel.: 416-978-8803

Email: natalia@physics.utoronto.ca

Please contact the course coordinator on matters relating to course administration, e.g. grading.

Lecturers:

Prof. Nicolas Grisouard

Office: MP703

Office Hours: Monday and Tuesday 5 pm – 6 pm in MP 703

Tel.: 416-978-6824

E-mail: nicolas.grisouard@physics.utoronto.ca.

Prof. Peter Krieger

Office: MP801

Office Hours: TBA

Tel.: 416-978 -950

E-mail: krieger@physics.utoronto.ca.

Tutorial Instructors:

Tutorial TA	Office	Phone	Email
Mr. Shayne Gryba	MP1104A	416-978-7009	sgryba@physics.utoronto.ca
Mr. Yi Fei Han	MP 903		yhan@physics.utoronto.ca
Mr. Gunjan Lakhani	MP 1305		glakhlan@physics.utoronto.ca
Mr. Andrei Vovk	MP 410	416-978-8944	andrei.vovk@mail.utoronto.ca

Marking Scheme:

Final Exam	40 %	2.5 hours
Two Midterm Tests	30 %	60 minutes each
Four Quizzes	10 %	20 minutes each
Laboratories	20 %	Four 3-hour sessions

Midterm Tests and Final Examination (dates of the tests are not yet confirmed)

- Term Test 1: Monday, October 15, 9:30 – 10:30 am; HA403, SF3202. The test covers material of the Waves component of the course.
- Term Test 2: Monday, November 19, 9:30 – 10:30 am; EX100. The test covers material of the Modern Physics component of the course.

- Final Exam: 2.5 hours in December, 2018 (date and time to be scheduled by Faculty during the December exam period).

There is no make-up test. Absence at the test must be supported by a petition submitted on line along with medical or other valid documentation. If the petition is approved by the Division of Engineering Science, a weight of the missed test will be transferred to the corresponding section of the exam.

Lectures:

3 hours/week, in MP 203. The first lecture is on Friday, Sep. 8.

Section	Monday	Tuesday	Friday
LEC0101	3 pm	3 pm	11 am
LEC0102	4 pm	4 pm	12 pm

WAVES SECTION

Lecturer: Prof. Nicolas Grisouard

TEXTBOOK: "Vibrations and Waves" by George C. King (Publisher: Wiley).

COURSE NOTES: Course notes will be posted to Course Materials on Quercus.

Lecture Date	Topic	Textbook Reference
September 7	Intro + Simple harmonic oscillators	Chapter 1
September 10	Simple harmonic oscillators: energy + intro to damping	Chapter 1
September 11	Over-, under- and critically-damped harmonic oscillators	Chapter 2
September 15	Damped harmonic oscillators: energy and Q-factor	Chapter 2
September 17	Driven oscillators and resonance	Chapter 3
September 18	Driven, damped harmonic oscillators: resonance curve, transients	Chapter 3
September 21	Power curve, LRC circuit	Chapter 3
September 24	Coupled pendulums; beating	Chapter 4
September 25	Coupled pendulums as an eigenvalue problem	Chapter 4
September 28	Examples of coupled oscillators	Chapter 4
October 1	Orthogonality of the normal modes; from two to n coupled oscillators	Chapter 4
October 2	The wave equation; standing waves on a taut string	Chapters 5,6
October 5	Orthogonality of the standing wave modes; initial value problems theory	
October 8	<i>Thanksgiving (no classes)</i>	
October 09	Initial value problems: examples and illustrations; energy	
October 12	Travelling waves as a superposition of modes; general solution	Chapter 5
October 15	Energy of traveling waves; reflection and transmission	Chapter 5
October 16	Dispersion of Waves	Chapter 8
October 19	Examples of dispersive behaviour	Chapter 8
October 22	Wave Packets	Chapter 8

Midterm Test 1 – Monday, October 15.

MODERN PHYSICS SECTION

Lecturer: Prof. Peter Krieger

TEXTBOOK: “Modern Physics (2nd edition)”, by Randy Harris (Pearson/Addison Wesley)

COURSE NOTES: Course notes will be posted on Quercus.

The lectures schedule will be known soon.

Lecture Date	Topic	Textbook Reference
October 23	Introduction to Modern Physics	Sections 1.1, 1.2, 2.1
October 26	Introduction to Special Relativity	Sections 2.1, 2.2
October 29	Lorentz transformations	Sections 2.3, 2.6
October 30	Paradoxes in SR, Relativistic Doppler shift	Sections 2.4, 2.5
November 2	The Twin paradox	Sections 2.4
November 5	Four-vectors, Lorentz invariants, Relativistic Energy and Momentum	Sections 2.7, 2.9, 2.10
November 6	Light cones, relativistic kinematics	Sections
November 9	Relativistic kinematics	Sections 2.7, 2.10
November 12	Introduction to quantum mechanics	Sections 3.1, 3.2
November 13	Photo-electric effect, X-ray production	Sections 3.2, 3.3
November 16	Compton scattering, inelastic processes	Sections 3.4, 3.5
November 19	Wave-particle duality of light	Sections 3.6, 4.1
November 20	More on wave-particle duality	Sections 4.1, 4.2
November 23	Matter Wave, Uncertainty principle	Sections 4.4, 4.5, 4.7
November 26	Atomic models	Section 4.6
November 27	The Schrödinger equation	Sections 4.3, 5.1, 5.2
November 30	Wave-functions, Infinite square well potential	Sections 5.2 – 5.5
December 3	Wave-functions and probability, stationary	Sections 5.8, 5.9
December 4	Interpretations of QM (time permitting)	Section 4.5

Midterm Test 2 – Monday, November 19.

Tutorials:

The first tutorial is on Tuesday, September 11, led by teaching assistants in rooms listed below. The 12 tutorials run from Sep 11 to Nov 29.

Section	Day	Time	Room	TA
TUT0101	Thu	4 - 5 pm	MY 420	Mr. Yi Fei Han
TUT0102	Thu	4 - 5 pm	BA2175	Mr. Shayne Gryba
TUT0103	Thu	3 - 4 pm	MY 420	Mr. Yi Fei Han
TUT0104	Thu	3 - 4 pm	MY 370	Mr. Gunjan Lakhani
TUT0105	Tue	10 -11 am	MY 350	Mr. Andrei Vovk
TUT0106	Tue	10 -11 am	SS 1088	Mr. Shayne Gryba
TUT0107	Tue	11 am - noon	MY 480	Mr. Gunjan Lakhani
TUT0108	Tue	11 am - noon	BA2159	Mr. Andrei Vovk

TUTORIAL AND QUIZZES SCHEDULE

- Suggested problems, not to be handed in, will be posted on Quercus and announced in class. Strategies for solving them will be discussed in the tutorials and solutions will be posted.

- Four quizzes, based on past suggested problems, will be given in tutorial. They will be graded by your tutor and handed back the following week.

Week # (week of)	Tutorial #	Notes
1 (Sep 3)		First lecture on Sep 7. No tutorials this week.
2 (Sep 10)	1	First tutorials: Sep 11 in TUT05 – 08; Sep 13 in TUTU01 – TUT04.
3 (Sep 17)	2	
4 (Sep 24)	3	Quiz 1 (TUT0105-08: Sep 25/ TUT0101-04: Sep 27).
5 (Oct 1)	4	
6 (Oct 8)	5	October 8 – Thanksgiving (no classes).
7 (Oct 15)	6	Term test 1 on Oct 15.
8 (Oct 22)	7	Part II starts on Oct 23. Quiz 2 (Oct 23/25) for Part I.
9 (Oct 29)	8	
10 (Nov 5)	9	Quiz 3 (Nov 6/8).
11 (Nov 12)	10	
12 (Nov 19)	11	Term test 2 on Nov 19.
13 (Nov 26)	12	Quiz 4 (Nov 27/29).
14 (Dec 3)		Last lecture on Dec 4. No tutorials this week.

Laboratories

The Lab Coordinator for this course is Dr. Natalia Krasnopolskaia (Office: MP251A, 416-978-8803, natalia@physics.utoronto.ca).

Laboratory web site is <http://www.physics.utoronto.ca/~phy293lab/phy293lab.htm> and Quercus.

- The lab experiments are booked by students. As such, the experiments do not necessarily follow the order of the content of the lectures and tutorials.
- For each student, one experiment is in Waves, and the other one is in Modern Physics.
- Each student performs experiments in four 3-hour sessions and submits a paperless lab report by uploading it to Blackboard. Students are working in pairs.

The laboratory experiments cover the following topics:

- Mechanical and Electromagnetic Waves, Wave Optics
- Classic Experiments in Measuring Fundamental Constants (e, e/m, R, h)
- Quantum Physics
- Particle Physics

The lab is scheduled once every two weeks on Wednesdays with starting dates indicated below:

Section	Lab Dates	Time	Room
PRA0101	2017/09/19 2017/10/03 2017/10/17 2017/10/31	9 am - noon	MP222
PRA0102	2017/09/12 2017/09/26 2017/10/10 2017/10/24	9 am - noon	MP222
PRA0103	2017/09/19 2017/10/03 2017/10/17 2017/10/31	2 pm – 5 pm	MP222
PRA0104	2017/09/12 2017/09/26 2017/10/10 2017/10/24	2 pm – 5 pm	MP222

Recommended Readings:

1. J.R. Taylor: An Introduction to Error Analysis: The Study of Uncertainties in Physics Measurements, 2nd ed., University Science Books. 1997.
2. P.R. Bevington, D.H. Robinson: Data Reduction and Error Analysis for the Physical Sciences, 3rd ed., McGraw Hill. 2003.

TA/Lab Demonstrator	Lab Section	e-mail address
Mr. Kenneth Jackson	PRA01, PRA02	kenneth.jackson@mail.utoronto.ca
Mr. Charles White	PRA01, PRA02	cwhite@physics.utoronto.ca
Mr. Arthur Pang	PRA03, PRA04	arthur.pang@mail.utoronto.ca
Mr. Matthew Taylor	PRA03, PRA04	mwtaylor@physics.utoronto.ca
Mr. Matthew Wilson	PRA01, PRA02	mwilson@physics.utoronto.ca
Mr. Charles Zhang	PRA03, PRA04	cha.zhang@utoronto.ca

Instructors Email Policy:

General questions that refer to physics being discussed in the course should be posted to the course discussion board on the Portal or Piazza – please check your utoronto email address for instructions on how to log in. We will generally provide feedback on these within 48 hours. Only if this fails to resolve your issue should you email one of the instructors directly for further clarification, or to set up an appointment to delve deeper into your question. Instructors **will not** answer administrative questions (about grades, due dates or material covered in tests of exams) by email. Answers to these can be found on the Portal or you can approach the instructor before/after a lecture.

Academic Integrity

Academic integrity is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the U of T degree that you earn will be valued as a true indication of your individual academic achievement, and will continue to receive the respect and recognition it deserves. Familiarize yourself with the University of Toronto's Code of Behaviour on Academic Matters (<http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>). It is the rule book for academic behaviour at the U of T, and you are expected to know the rules.

Tests and Exam

Midterm tests and the final exam must be done individually, involving no communication at all with your peers. It is strongly advised not to engage in any behaviour that might be construed by the invigilators for the tests/exam as an attempt to obtain information from another candidate or from another test/exam paper.

The University of Toronto treats cases of academic misconduct very seriously. All suspected cases of academic dishonesty will be investigated following the procedures outlined in the Code. The consequences for academic misconduct can be severe, including a failure in the course and a notation on your transcript. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact the course coordinator. If you are experiencing personal challenges that are having an impact on your academic work, please speak to the course coordinator or seek the advice of your college registrar.

Accommodations

If you have a learning need requiring an accommodation the University of Toronto recommends that students immediately register at Accessibility Services at <http://www.studentlife.utoronto.ca/as>.

Location: 4th floor of 455 Spadina Avenue, Suite 400

Voice: 416-978-8060

Fax: 416-978-5729

Email: accessibility.services@utoronto.ca

The University of Toronto supports accommodations of students with special learning needs, which may be associated with learning disabilities, mobility impairments, functional/fine motor disabilities, acquired brain injuries, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, psychiatric disabilities, communication disorders and/or temporary disabilities, such as fractures and severe sprains, recovery from an operation, serious infections or pregnancy complications.

Equity, Diversity and Excellence

At the University of Toronto, we strive to be an equitable and inclusive community, rich with diversity, protecting the human rights of all persons, and based upon understanding and mutual respect for the dignity and worth of every person. We seek to ensure to the greatest extent possible that all students enjoy the opportunity to participate as they see fit in the full range of activities that the University offers, and to achieve their full potential as members of the University community.

Our support for equity is grounded in an institution-wide commitment to achieving a working, teaching, and learning environment that is free of discrimination and harassment as defined in the Ontario Human Rights Code. In striving to become an equitable community, we will also work to eliminate, reduce or mitigate the adverse effects of any barriers to full participation in University life that we find, including physical, environmental, attitudinal, communication or technological.

Our teaching, scholarship and other activities take place in the context of a highly diverse society. Reflecting this diversity in our own community is uniquely valuable to the University as it contributes to the diversification of ideas and perspectives and thereby enriches our scholarship, teaching and other activities. We will proactively seek to increase diversity among our community members, and it is our aim to have a student body and teaching and administrative staffs that mirror the diversity of the pool of potential qualified applicants for those positions.

We believe that excellence flourishes in an environment that embraces the broadest range of people that helps them to achieve their full potential, that facilitates the free expression of their diverse perspectives through respectful discourse, and in which high standards are maintained for students and staff alike. An equitable and inclusive learning environment creates the conditions for our student body to maximize their creativity and their contributions, thereby supporting excellence in all dimensions of the institution.

Statement on Mental Health and Wellness

As a university student, you may experience a range of health and/or mental health issues that may result in significant barriers to achieving your personal and academic goals. The University of Toronto offers a wide range of free and confidential services and programs that may be able to assist you. We encourage you to seek out these resources early and often.

Student Life Website: <http://www.studentlife.utoronto.ca>

Health and Wellness Website: <http://studentlife.utoronto.ca/hwc>

If, at some point during the year, you find yourself feeling distressed and in need of more immediate support, visit the **Feeling Distressed Webpage**: <http://www.studentlife.utoronto.ca/feeling-distressed>, for more campus resources.

Immediate help is available 24/7 through **Good2Talk**, a post-secondary student helpline at 1-866-925-5454.

All students in the Faculty of Engineering have an Academic Advisor who can advise on academic and personal matters. You can find your department's Academic Advisor here:

<http://undergrad.engineering.utoronto.ca/advising-support-services/academic-advising/>