

**PHY293H1F – WAVES AND MODERN PHYSICS
DEPARTMENT OF PHYSICS UNIVERSITY OF TORONTO
FALL 2017-18**

Course Syllabus

This course is taught as two consecutive sections: Waves (Sep. 8 - Oct. 23) and Modern Physics (Oct. 24 - Dec. 5). 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 the Portal and <https://www.physics.utoronto.ca/students/undergraduate-courses/current/phy293h1> .

INSTRUCTORS

Prof. Nicolas Grisouard. Office: MP703, Tel.: 416 978 6824, E-mail: nicolas.grisouard@physics.utoronto.ca.
Prof. William Trischuk. Office: MP814, Tel.: 416 978 8095, E-mail: william@physics.utoronto.ca.

COURSE COORDINATOR

Dr. Natalia Krasnopolskaia. Office: MP251 A, Tel.: 416 978 8803, Email: natalia@physics.utoronto.ca.
Please contact the course coordinator for matters relating to course administration, such as grading and teaching assistants.

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

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.

COURSE MARKING SCHEME

- 10% Tutorial Quizzes (about 20 minutes each)
- 20 % Laboratories
- 30 % 2 Term Tests (60 minutes each)
- 40 % Final Examination (2.5 hours)

TESTS AND EXAM

- Term Test 1: Monday, October 16, 9:30 – 10:30 am; **EX 300, SF 2202.**
- Term Test 2: Monday, November 20, 9:30 – 10:30 am; **EX 100.**
- Final Exam: TBA (time to be scheduled by Faculty during the December exam period).

TUTORIALS

The first tutorial is on Tuesday, September 12, led by teaching assistants in rooms listed below. The 12 tutorials run from Sep 12 to Dec 30.

Section	Day	Time	Room	TA
TUT0101	Thu	4 - 5 pm	BA3012	Mr. Pranai Vasudev
TUT0102	Thu	4 - 5 pm	BA2159	Ms. Sana Ketabchi Haghighat
TUT0103	Thu	3 - 4 pm	WB342	Mr. Pranai Vasudev
TUT0104	Thu	3 - 4 pm	BA2139	Ms. Sana Ketabchi Haghighat
TUT0105	Tue	10 -11 am	BA3116	Mr. Zaheen Sadeq
TUT0106	Tue	10 -11 am	FG129	Mr. Andrei Vovk
TUT0107	Tue	11 am - noon	BA3116	Mr. Zaheen Sadeq
TUT0108	Tue	11 am - noon	BA2159	Mr. Andrei Vovk

Tutorial TA	Office	Phone	e-mail address
Sana Ketabchi Haghighat	MP920	416-978-1564	sketabch@physics.utoronto.ca
Pranai Vasudev	MP1011	416-978-5208	pranai.vasudev@mail.utoronto.ca
Zaheen Sadeq	MP1026	416-978-6185	sadeqz@physics.utoronto.ca
Andrei Vovk	MP410	416-978-8944	avovk@physics.utoronto.ca

TUTORIAL AND QUIZZES SCHEDULE

- Suggested problems, not to be handed in, will be posted on the Portal 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 4)		First day of class on Sep 8. No tutorial this week.
2 (Sep 11)	1	
3 (Sep 18)	2	
4 (Sep 25)	3	Quiz 1 (TUT0105-08: Sep 26/ TUT0101-04: Sep 28).
5 (Oct 2)	4	
6 (Oct 9)	5	October 9 – Thanksgiving (no classes).
7 (Oct 16)	6	Term test 1 on Oct 16.
8 (Oct 23)	7	Part II starts on Oct 24. Quiz 2 (Oct 24/26) for Part I.
9 (Oct 30)	8	
10 (Nov 6)	9	Quiz 3 (Nov 7/9).
11 (Nov 13)	10	
12 (Nov 20)	11	Term test 2 on Nov 20.
13 (Nov 27)	12	Quiz 4 (Nov 28/30).
14 (Dec 4)		Last lecture on Dec 5. No tutorial this week.

LABORATORIES

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

More information about the lab can be found on <http://www.physics.utoronto.ca/~phy293lab/phy293lab.htm> or the Portal. The lab is scheduled once every two weeks on Wednesdays with starting dates indicated below:

Section	Start Date	Time	Room
PRA0101	2015/09/13	9 am - noon	MP222
PRA0102	2015/09/20	9 am - noon	MP222
PRA0103	2015/09/13	2 pm – 5 pm	MP222
PRA0104	2015/09/20	2 pm – 5 pm	MP222

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. Still, 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

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.

WAVES SECTION

LECTURER: Prof. Nicolas Grisouard
 Office / Tel.: Room MP703 / 416 978 6824
 E-mail: nicolas.grisouard@physics.utoronto.ca
 Office hours: Mondays, Tuesdays, 6:10-7:00pm.

TEXTBOOK: The required textbook for the oscillations part of the course is Vibrations and Waves by George C. King (Publisher: Wiley). Copies will be available in the bookstore.

TENTATIVE COURSE OUTLINE

Lecture Notes will be posted to the Portal.

Lecture Date	Topic	Textbook Reference
September 8	Intro/Oscillations in Nature	
September 11	Simple Harmonic Oscillations	Sections 1.1, 1.2, 1.4
September 12	Damped Oscillations	Sections 2.1, 2.2
September 15	Energy and Q-value of Oscillators	Sections 2.3, 2.4
September 18	Forced Oscillations and Resonance	Sections 3.1, 3.2
September 19	Power transfer at resonance	Sections 3.3
September 22	The LRC electrical circuit	Section 3.4
September 25	Coupled Oscillations	Sections 4.1 – 4.4
September 26	Eigenmode Solutions, Orthogonality	Section 4.4
September 29	Initial Value Problems	<i>Off-script</i>
October 2	Motion on a String: the Wave Equation	Sections 5.1, 5.4, 6.1
October 3	Standing Waves on a String	Sections 6.1, 6.3
October 6	Normal Modes of a Vibrating String	Section 6.4
<i>October 9</i>	<i>Thanksgiving (no classes)</i>	
October 10	Travelling Waves	Sections 5.2, 5.3, 6.2
October 13	Reflection/Transmission of Waves	Sections 5.6, 5.7
October 16	Dispersion of Waves	Sections 8.2, 8.3
October 17	Wave Packets	Sections 8.4
October 20	Interference and diffraction (<i>time permitting</i>)	Section 7.1.1, 7.2.1, 7.2.3
October 23	Review (<i>time permitting</i>)	

Midterm Test 1 – Monday, October 16.

MODERN PHYSICS SECTION

LECTURER: Prof. William Trischuk
 Office / Tel.: MP814 / 416 978 8095
 E-mail: william@physics.utoronto.ca
 Office hours: By appointment – or announced in Class prior to term test/final

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

COURSE NOTES: Course notes will be posted on the Portal within a day after each lecture, earlier when possible.

TENTATIVE COURSE OUTLINE:

Lecture Notes will be posted on-line.

Lecture Date	Topic	Textbook Reference
October 24	Intro to Modern Physics	Chapter 1
October 27	Intro to Special Relativity	Sections 2.1, 2.2
October 30	Lorentz Transformations	Sections 2.3, 2.6
October 31	Paradoxes in SR, Relativistic Doppler Shift	Sections 2.4, 2.5
November 3	The Twin Paradox	Sections 2.4, 2.5
November 6	Four-vectors, Lorentz Invariants, Relativistic Energy & Momentum	Sections 2.7, 2.10
November 7	Light Cones, Relativistic Kinematics	Sections 2.9, 2.10
November 10	Intro to Quantum Mechanics	Section 3.1
November 13	Photo-electric effect, X-ray production	Sections 3.2, 3.3
November 14	Compton Scattering	Section 3.4
November 17	Compton Scattering, Inelastic Processes	Section 3.4, 3.5
November 20	Wave-Particle Duality of Light	Sections 3.6, 4.1
November 21	More on Wave-Particle Duality	Sections 4.1, 4.2
November 24	Matter Waves, Uncertainty Principle	Sections 4.4, 4.5, 4.7
November 27	Atomic Models	Section 4.6
November 28	Schrödinger Equation	Sections 4.3, 5.1, 5.2
December 1	Wave Functions, Infinite Square Well Potential	Sections 5.2, 5.3, 5.4, 5.5
December 4	Wave Functions and Probability: Stationary & Non-stationary States	Sections 5.8, 5.9
December 5	Interpretations of Quantum Mechanics	

Midterm Test 2 – Monday, November 20.