

PHYSICS (PHYS)

Updated March 28, 2025

Chair: B. Jamieson; Professors: C. Bidinosti, A. Frey, B. Jamieson, J. Martin, M. Martin; Associate Professors: R. Mammei; Assistant Professors: E. McDonough; Instructors: I. Burley, D. Campbell, E. Elhami, V. Milosevic-Zdjelar.

DEGREES/PROGRAMS OFFERED

3-Year BSc

3-Year BSc (Applied Physics Stream)

4-Year BSc

4-Year BSc (Radiation Therapy) – See Radiation Therapy section of Calendar.

Honours BSc

Honours BSc (Chemical Physics Stream)

Honours BSc (Computational Physics Stream)

Honours BSc (Mathematical Physics Stream)

Honours BSc (Medical Physics Stream)

Minor

INTRODUCTION

The University of Winnipeg has an internationally recognized Physics Department, which offers an excellent learning atmosphere, fostered by small class sizes and individual attention from professors. Our curriculum combines foundational theoretical and experimental physics courses with new cutting-edge topical courses, such as Physical Computing, Quantum Computing, and Medical Imaging. Physicists are among the most sought-after STEM practitioners for their ability to understand the fundamental concepts underlying highly applied tasks across academic disciplines and industries and their ability to solve problems end-to-end in new and creative ways. Our graduates have a solid foundation in general physics, mathematics, statistics, data science, scientific writing, and experimental techniques enabling them to be successful in a variety of STEM fields as well as graduate school/medical schools.

Our professors' research spans a broad range of topics – from digital agriculture and robotics to subatomic physics (especially neutron and neutrino particles) and material science to the use of magnetic resonance imaging (MRI) in diagnosing disease, to the inner workings of black holes, higher-dimensional cosmology, superstrings, and quantum gravity. Students can participate in these research activities, and many find paid summer employment with the various research groups.

Where can you go with Physics?

About half of our students continue their research activities in some of the top graduate schools in North America, such as Cornell, the University of British Columbia, McGill, Waterloo, McMaster, and the University of Toronto. Several of our students continue into the field of medicine: some in medical school with clinical and/or research specializations; or as medical or health physicists in the US and Canada at institutions such as CancerCare Manitoba; or as medical radiologic technologists; or as a medical radiation technologist; or to graduate school to become pharmacists. Physicists are renowned for their problem solving and computing skills. Many of our students capitalize on the skills learned in our program at local and international companies. Our students are hired by places such as AGCO, JCA Technologies, Pluto Ventures, Ubisoft, NVIDIA, Blue Origin, Boeing, 3M, Price Industries, and Cubresa Inc, in roles ranging from Computational Fluid Dynamics (CFD) Analyst to Aerospace Engineer to Data Scientist.

Your Physics Degree Options

We offer many Honours degrees to match your interests, which all include a capstone honours thesis project (**PHYS-4001(6)**), which gives you practical experience in research. The **Honours BSc in Physics** provides excellent training both for postgraduate studies in Physics and for entry into technical workplaces. The **Chemical Physics Honours BSc** focuses on the intersection of Physics with Chemistry and is ideal for students interested in the physics of matter. If you want to pursue a career in computing, the **Computational Physics Honours BSc** will give you a strong background in scientific and mathematical computing applicable to careers in data science, artificial intelligence, finance, and even gaming. The **Mathematical Physics Honours BSc** is a solid basis for continuing studies in theoretical physics or analytically-oriented careers. If you are interested in medical school or other careers in the health sciences, the **Medical Physics Honours BSc** is for you.

Students pursuing the **Integrated Stream BEd** degree can use the **3-Year BSc** in Physics for the Teachable Major, and we strongly recommend the **Minor in Physics** for the Teachable Minor (Senior Years Stream). **PHYS-1005(6)** Concepts in Science is specially designed to provide the background needed to teach sciences in Elementary/Middle Years. The **3-Year BSc (Applied Physics Stream)** is ideal if you want a grounding in Physics and are interested in Engineering as a career. The course options for this degree allow you to aim toward a wide variety of Engineering programs.

Students pursuing any 3-year, 4-year, or Honours BSc in Physics also can take a **Business Stream**. Students must complete the requirements of a Physics BSc degree (see below) and the set of core courses indicated in the "Science with a Business Stream" section of the Calendar. Physics students may also be eligible to participate in work-integrated learning through the **Co-op Program**. (See "Cooperative Education" section of the Calendar.)

Come talk to us and find out more about where you can go with Physics!

GENERAL INFORMATION

Prerequisites

Note that prerequisites may be waived in some circumstances; please consult the Department Chair.

Notes on Specific Courses and their Applicability

PHYS-1301(6) Introduction to Physics does not involve Calculus and is offered for pre-medical, pre-dental, and arts students. It can also serve as the first course toward a degree in Physics; students who take PHYS-1301 and decide to major in Physics should speak with the department chair.

PHYS-1701(6) Astronomy, **PHYS-2705(6)** Cosmology, **PHYS-2777(3)** The Study of Time, and **PHYS-2812(3)** The Physics of Music meet the Science Requirement and are intended for liberal arts students who desire a minimally mathematical approach to the understanding of science.

PHYS-2102(3) and **PHYS-2103(3)** - Scientific Computing and Numeric and Symbolic Computing - provide an introduction to the use of computers in science, and should be useful to anyone interested in gaining practical experience with a variety of programming languages.

PHYS-2602(3) Quantum Computing provides an introduction to the new field of quantum computers with a minimum of prerequisites. **PHYS-2803(3)** Physical Computing gives students hands-on experience building and controlling hardware. These courses have minimal prerequisites.

GENERAL 3-YEAR BSc DEGREE REQUIREMENTS

ADMISSION REQUIREMENT	Students must consult with a Department advisor in planning their course of study.
GRADUATION REQUIREMENT	90 credit hours
RESIDENCE REQUIREMENT	
Degree:	Minimum 30 credit hours.
Major:	Minimum 18 credit hours.
GENERAL DEGREE REQUIREMENT	
Humanities:	Minimum 12 credit hours in Humanities.
Writing:	Minimum 3 credit hours of Academic Writing.
Indigenous:	3 credit hours in designated indigenous requirement courses
Maximum Introductory Courses:	Students may use a maximum of 42 credit hours at the 1000 level. Of these, a maximum of 6 credit hours may be below the 1000 level. As a result, students must take a minimum of 48 credit hours at the 2000-level or above in order to not exceed the maximum number of introductory courses.
Distribution:	Minimum three (3) credit hours from each of five (5) different subjects.

GENERAL 4-YEAR BSc DEGREE REQUIREMENTS

ADMISSION REQUIREMENT	Students must consult with a Department advisor in planning their studies.
GRADUATION REQUIREMENT	120 credit hours; that is, 90 credit hours meeting the requirements for the 3-Year BSc plus 30 additional credit hours.
RESIDENCE REQUIREMENT	
Degree:	Minimum 60 credit hours.
Major:	Minimum 30 credit hours.
GENERAL DEGREE REQUIREMENT	
Humanities:	Minimum 12 credit hours.
Writing:	Minimum 3 credit hours of Academic Writing.
Indigenous:	3 credit hours in designated indigenous requirement courses
Maximum Introductory Courses:	Students may use a maximum of 42 credit hours at the 1000 level. Of these, a maximum of 6 credit hours may be below the 1000 level. As a result, students must take a minimum of 78 credit hours at the 2000-level or above in order to not exceed the maximum number of introductory courses.
Distribution:	Minimum three (3) credit hours from each of five (5) different subjects.

GENERAL HONOURS BSc DEGREE REQUIREMENTS

ADMISSION REQUIREMENT	Students must have completed 30 credit hours. Students must consult and have the approval of the Department Chair or the Chair's designate when planning their studies.
GRADUATION REQUIREMENT	120 credit hours

Graduation GPA Requirement: To graduate with a BSc (Honours), students must have a minimum GPA of 3.0 on all major (Physics) courses which will be calculated on all course attempts in the major, and a minimum GPA of 2.75 on all non-major courses which will be calculated as for the general degree.

RESIDENCE REQUIREMENT

Degree: Minimum 60 credit hours.
Major: Minimum 30 credit hours, including minimum 18 credit hours at upper level (3000/4000) of which a minimum of 12 credit hours are at the 4000 level.

GENERAL DEGREE REQUIREMENT

Humanities: 12 credit hours
Writing: Minimum 3 credit hours of Academic Writing.
Indigenous: 3 credit hours in designated indigenous requirement courses
Maximum Introductory Courses: Students may use a maximum of 42 credit hours at the 1000 level. Of these, a maximum of 6 credit hours may be below the 1000 level. As a result, students must take a minimum of 78 credit hours at the 2000-level or above in order to not exceed the maximum number of introductory courses.
Distribution: Minimum three (3) credit hours from each of five (5) different subjects.

REQUIREMENTS FOR A 3-YEAR BSc IN PHYSICS

MAJOR REQUIREMENT

Single Major: Minimum of 45 credit hours as per the courses listed below.

Required Courses (36 credit hours):

MATH-1101(6) Introduction to Calculus
OR MATH-1103(3) Introduction to Calculus I
AND MATH-1104(3) Introduction to Calculus II
PHYS-1101(6) Foundations of Physics
PHYS-2105(3) Mathematical Physics I
PHYS-2106(3) Mathematical Physics II
PHYS-2200(3) Electricity and Magnetism
PHYS-2302(6) Modern and Thermal Physics
PHYS-3301(6) Quantum Mechanics
PHYS-3901(3) Intermediate Physics Laboratory

Plus a minimum of 6 credit hours from:

PHYS-2202(3) Optics and Waves
PHYS-3202(3) Intermediate Mechanics
PHYS-3403(3) Thermal and Statistical Physics

Plus a minimum of 3 credit hours from:

Any other PHYS course excluding **PHYS-1005(6)** Concepts in Science and **PHYS-1301(6)** Introduction to Physics.

Recommended: Students are advised to include courses in the areas of Calculus and Differential Equations as part of their degree program. Students are advised to consult with the Department Chair before entering Year 2 of their studies.

Combined Major: Minimum of 48 credit hours from two (2) different majors with not less than 18 credit hours from each major subject.

Prescribed courses: Required courses depend on the second major area and will be determined in consultation with the department.

REQUIREMENTS FOR A 3-YEAR BSc (APPLIED PHYSICS STREAM)

MAJOR REQUIREMENT

Single major: Minimum of 45 credit hours as per the courses listed below.

Required Courses (33 credit hours):

MATH-1101(6) Introduction to Calculus
OR MATH-1103(3) Introduction to Calculus I
AND MATH-1104(3) Introduction to Calculus II
PHYS-1101(6) Foundations of Physics
PHYS-2105(3) Mathematical Physics I
PHYS-2106(3) Mathematical Physics II
PHYS-2200(3) Electricity and Magnetism
PHYS-2202(3) Optics and Waves
PHYS-2302(6) Modern and Thermal Physics
PHYS-3901(3) Intermediate Physics Laboratory

Plus a minimum of 6 credit hours from:

- PHYS-2102(3)** Scientific Computing **OR** **PHYS-2112(3)** Scientific Computing with Python
(A student cannot use both of these courses to satisfy major requirements in Physics)
PHYS-2103(3) Numeric and Symbolic Computing
PHYS-2110(3) Statics
PHYS-2803(3) Physical Computing: Interacting with the Real World

Plus a minimum of 6 credit hours from:

- PHYS-3202(3)** Intermediate Mechanics
PHYS-3301(6) Quantum Mechanics
PHYS-3403(3) Thermal and Statistical Physics

REQUIREMENTS FOR A 4-YEAR BSc IN PHYSICS

MAJOR REQUIREMENT

Single Major: Minimum of 66 credit hours as per the courses listed below.

Required Courses (48 credit hours):

- MATH-1101(6)** Introduction to Calculus
OR **MATH-1103(3)** Introduction to Calculus I
AND **MATH-1104(3)** Introduction to Calculus II
PHYS-1101(6) Foundations of Physics
PHYS-2105(3) Mathematical Physics I
PHYS-2106(3) Mathematical Physics II
PHYS-2200(3) Electricity and Magnetism
PHYS-2202(3) Optics and Waves
PHYS-2302(6) Modern and Thermal Physics
PHYS-3202(3) Intermediate Mechanics
PHYS-3301(6) Quantum Mechanics
PHYS-3403(3) Thermal and Statistical Physics
PHYS-3901(3) Intermediate Physics Laboratory
PHYS-4901(3) Advanced Physics Laboratory

Plus a minimum of 6 credit hours from:

- PHYS-3203(3)** Advanced Mechanics
PHYS-4201(6) Electrodynamics
PHYS-4602(3) Advanced Quantum Mechanics

Plus a minimum of 12 credit hours from:

- PHYS-2102(3)** Scientific Computing **OR** **PHYS-2112(3)** Scientific Computing with Python
(A student cannot use both of these courses to satisfy major requirements in Physics)
PHYS-2103(3) Numeric and Symbolic Computing
PHYS-2803(3) Physical Computing: Interacting with the Real World
OR any 3000 or 4000 level PHYS course

If necessary, alternate Mathematics or Physics courses can be substituted with written permission from the Department of Physics.

Students must complete a special registration form available from the Department Chair before registering for the 66th credit hour.

Combined Major: Minimum of 60 credit hours from two (2) different majors with not less than 24 credit hours from each major subject.

Prescribed courses: Required courses depend on the second major area and will be determined in consultation with the department.

REQUIREMENTS FOR A 4-YEAR BSc (RADIATION THERAPY)

Radiation Therapy is a new program. Please see the "Radiation Therapy" section of the Course Calendar.

REQUIREMENTS FOR AN HONOURS BSc IN PHYSICS

HONOURS REQUIREMENT

Single Honours: Minimum of 90 credit hours as per the courses listed below.

Required Courses (72 credit hours):

- MATH-1101(6)** Introduction to Calculus
OR **MATH-1103(3)** Introduction to Calculus I
AND **MATH-1104(3)** Introduction to Calculus II
MATH-1201(3) Linear Algebra I

MATH-2102(3)	Differential Equations I
PHYS-1101(6)	Foundations of Physics
PHYS-2105(3)	Mathematical Physics I
PHYS-2106(3)	Mathematical Physics II
PHYS-2200(3)	Electricity and Magnetism
PHYS-2202(3)	Optics and Waves
PHYS-2302(6)	Modern and Thermal Physics
PHYS-3202(3)	Intermediate Mechanics
PHYS-3203(3)	Advanced Mechanics
PHYS-3301(6)	Quantum Mechanics
PHYS-3403(3)	Thermal and Statistical Physics
PHYS-3901(3)	Intermediate Physics Laboratory
PHYS-4001(6)	Honours Thesis
PHYS-4201(6)	Electrodynamics
PHYS-4602(3)	Advanced Quantum Mechanics
PHYS-4901(3)	Advanced Physics Laboratory

Plus a minimum of 6 credit hours from:

PHYS-2102(3) Scientific Computing **OR** **PHYS-2112(3)** Scientific Computing with Python

(A student cannot use both of these courses to satisfy major requirements in Physics)

PHYS-2103(3) Numeric and Symbolic Computing

PHYS-2803(3) Physical Computing: Interacting with the Real World

OR any 3000 or 4000 level PHYS course

In addition to the above, students must select a further 6 credit hours in Mathematics and 6 credit hours from Biology and/or Chemistry excluding **BIOL-1102(6)** Biology and Human Concerns and **CHEM-2801(6)** Chemistry and Society.

If necessary, alternate Mathematics or Physics courses can be substituted with written permission from the Department of Physics.

REQUIREMENTS FOR AN HONOURS BSc (CHEMICAL PHYSICS STREAM)

HONOURS REQUIREMENT

Single Honours: Minimum of 96 credit hours as per the courses listed below.

Required Courses (84 credit hours):

CHEM-1111(3)	Introduction to the Chemical Properties of Matter
CHEM-1112(3)	Basic Principles of Chemical Reactivity
CHEM-2102(3)	Thermodynamics and Kinetics
CHEM-2103(3)	Atoms, Molecules and Spectroscopy
CHEM-2401(3)	Inorganic Chemistry I
CHEM-3101(3)	Physical Chemistry of Condensed Phases
CHEM-3102(3)	Quantum Chemistry and Spectroscopy
CHEM-4101(3)	Quantum Chemistry

MATH-1101(6) Introduction to Calculus

OR **MATH-1103(3)** Introduction to Calculus I

AND **MATH-1104(3)** Introduction to Calculus II

MATH-1201(3) Linear Algebra I

MATH-2102(3) Differential Equations I

PHYS-1101(6) Foundations of Physics

PHYS-2105(3) Mathematical Physics I

PHYS-2106(3) Mathematical Physics II

PHYS-2200(3) Electricity and Magnetism

PHYS-2302(6) Modern and Thermal Physics

PHYS-3301(6) Quantum Mechanics

PHYS-3403(3) Thermal and Statistical Physics

PHYS-3901(3) Intermediate Physics Laboratory

PHYS-4001(6) Honours Thesis

PHYS-4201(6) Electrodynamics

PHYS-4602(3) Advanced Quantum Mechanics

Plus a minimum of 3 credit hours from:

CHEM-2202(3) Organic Chemistry I

CHEM-2302(3) Quantitative Chemical Analysis

Plus a minimum of 9 credit hours from:

PHYS-2102(3) Scientific Computing **OR** **PHYS-2112(3)** Scientific Computing with Python

(A student cannot use both of these courses to satisfy major requirements in Physics)

PHYS-2103(3) Numeric and Symbolic Computing

PHYS-2202(3) Optics and Waves

PHYS-2803(3) Physical Computing: Interacting with the Real World

OR any 3000 or 4000 level PHYS course

If necessary, alternate Mathematics or Physics courses can be substituted with written permission from the Department of Physics.

REQUIREMENTS FOR AN HONOURS BSc (COMPUTATIONAL PHYSICS STREAM)

HONOURS REQUIREMENT

Single Honours: Minimum of 90 credit hours as per the courses listed below. To satisfy general requirements for an Honours degree, a minimum of 30 credit hours must be at the upper level (3000/4000) from the courses listed below, with a minimum of 12 credit hours at the 4000 level.

Required Courses (69 credit hours):

MATH-1101(6)	Introduction to Calculus
OR MATH-1103(3)	Introduction to Calculus I
AND MATH-1104(3)	Introduction to Calculus II
MATH-1201(3)	Linear Algebra I
MATH-2102(3)	Differential Equations I
PHYS-1101(6)	Foundations of Physics
PHYS-2102(3)	Scientific Computing OR PHYS-2112(3) Scientific Computing with Python
(A student cannot use both of these courses to satisfy major requirements in Physics)	
PHYS-2103(3)	Numeric and Symbolic Computing
PHYS-2105(3)	Mathematical Physics I
PHYS-2106(3)	Mathematical Physics II
PHYS-2200(3)	Electricity and Magnetism
PHYS-2302(6)	Modern and Thermal Physics
PHYS-2803(3)	Physical Computing: Interacting with the Real World
PHYS-3202(3)	Intermediate Mechanics
PHYS-3301(6)	Quantum Mechanics
PHYS-3403(3)	Thermal and Statistical Physics
PHYS-3901(3)	Intermediate Physics Laboratory
PHYS-4001(6)	Honours Thesis
With either	
ACS-1903(3)	Programming Fundamentals I and
ACS-1904(3)	Programming Fundamentals II
OR	
ACS-1905(3)	Programming Fundamentals and
ACS-2947(3)	Data Structures and Algorithms

Plus a minimum of 9 credit hours from:

PHYS-2202(3)	Optics and Waves
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OR any 3000 or 4000 level PHYS course

Plus a minimum of 12 credit hours from:

MATH-3701(3)	Numerical Methods
ACS-2906(3)	Computer Architecture and System Software
ACS-2913(3)	Software Requirements Analysis and Design
ACS-2947(3)	Data Structures and Algorithms
ACS-3913(3)	Software Design and Architecture
ACS-3931(3)	Principles of Operating Systems
ACS-3941(3)	Implementation Issues in Object Oriented Languages
ACS-3947(3)	Algorithm Design
ACS-4306(3)	Applied Parallel Programming
ACS-4953(3)	Introduction to Machine Learning*

*This course requires the permission of the ACS department.

If necessary, alternate Mathematics or Physics courses can be substituted with written permission from the Department of Physics.

REQUIREMENTS FOR AN HONOURS BSc (MATHEMATICAL PHYSICS STREAM)

HONOURS REQUIREMENT

Single Honours: Minimum of 93 credit hours as per the courses listed below.

Required Courses (81 credit hours):

MATH-1101(6)	Introduction to Calculus
OR MATH-1103(3)	Introduction to Calculus I
AND MATH-1104(3)	Introduction to Calculus II
MATH-1201(3)	Linear Algebra I
MATH-2102(3)	Differential Equations I
MATH-2103(3)	Differential Equations II
MATH-2105(3)	Intermediate Calculus I
MATH-2106(3)	Intermediate Calculus II
MATH-2203(3)	Linear Algebra II
PHYS-1101(6)	Foundations of Physics
PHYS-2105(3)	Mathematical Physics I
PHYS-2106(3)	Mathematical Physics II
PHYS-2200(3)	Electricity and Magnetism
PHYS-2202(3)	Optics and Waves
PHYS-2302(6)	Modern and Thermal Physics

PHYS-3202(3)	Intermediate Mechanics
PHYS-3203(3)	Advanced Mechanics
PHYS-3301(6)	Quantum Mechanics
PHYS-3403(3)	Thermal and Statistical Physics
PHYS-3901(3)	Intermediate Physics Laboratory
PHYS-4001(6)	Honours Thesis
PHYS-4201(6)	Electrodynamics
PHYS-4602(3)	Advanced Quantum Mechanics

Plus a minimum of 12 credit hours from:

MATH-3101(6)	Introduction to Mathematical Analysis
MATH-3103(3)	Methods in Advanced Calculus
MATH-3104(3)	Methods in Partial Differential Equations
MATH-3202(3)	Group Theory
MATH-3402(3)	Combinatorics
MATH-3701(3)	Numerical Methods
MATH-4101(3)	Complex Analysis
MATH-4403(3)	Set Theory
MATH-4601(3)	Introduction to Topology and Analysis

OR any 3000 or 4000 level PHYS course

If necessary, alternate Mathematics or Physics courses can be substituted with written permission from the Department of Physics.

REQUIREMENTS FOR AN HONOURS BSc (MEDICAL PHYSICS STREAM)

HONOURS REQUIREMENT

Single Honours: Minimum of 90 credit hours as per the courses listed below.

Required Courses (78 credit hours):

BIOL-1112(6)	Human Anatomy and Physiology
STAT-1501(3)	Elementary Biological Statistics I
MATH-1101(6)	Introduction to Calculus
OR MATH-1103(3)	Introduction to Calculus I
AND MATH-1104(3)	Introduction to Calculus II
MATH-1201(3)	Linear Algebra I
MATH-2102(3)	Differential Equations I
PHYS-1101(6)	Foundations of Physics
PHYS-2105(3)	Mathematical Physics I
PHYS-2106(3)	Mathematical Physics II
PHYS-2200(3)	Electricity and Magnetism
PHYS-2202(3)	Optics and Waves
PHYS-2302(6)	Modern and Thermal Physics
PHYS-3202(3)	Intermediate Mechanics
PHYS-3301(6)	Quantum Mechanics
PHYS-3403(3)	Thermal and Statistical Physics
PHYS-3901(3)	Intermediate Physics Laboratory
PHYS-4001(6)	Honours Thesis
PHYS-4201(6)	Electrodynamics
PHYS-4602(3)	Advanced Quantum Mechanics
PHYS-4901(3)	Advanced Physics Laboratory

Plus a minimum of 6 credit hours from:

PHYS-2502(3)	Radiation and the Environment
PHYS-2503(3)	Medical Imaging
PHYS-3220(3)*	Medical Physics and Physiological Measurement
STAT-2001(3)	Elementary Biological Statistics II

Plus a minimum of 6 credit hours from:

PHYS-2102(3)	Scientific Computing
OR PHYS-2112(3)	Scientific Computing with Python
(A student cannot use both of these courses to satisfy major requirements in Physics)	
PHYS-2103(3)	Numeric and Symbolic Computing
PHYS-2803(3)	Physical Computing: Interacting with the Real World

OR any 3000 or 4000 level PHYS course

*This course is taught through the University of Manitoba.

If necessary, alternate Mathematics or Physics courses can be substituted with written permission from the Department of Physics.

REQUIREMENTS FOR A MINOR IN PHYSICS

Degree:	Students completing any undergraduate degree program are eligible to complete the Minor.
Minor:	18 credit hours in PHYS, with a minimum of 12 credit hours above the 1000-level.
Residence Requirement:	Minimum 12 credit hours in PHYS.
Required Courses:	PHYS-1101(6) Foundations of Physics OR PHYS-1301(6) Introduction to Physics PHYS-2105(3) Mathematical Physics I and 9 credits from the following: PHYS-2106(3) Mathematical Physics II

PHYS-2200(3) Electricity and Magnetism
PHYS-2202(3) Optics and Waves
PHYS-2302(6) Modern and Thermal Physics

With permission of the Physics Department Chair, a student may substitute PHYS-2102(3) Scientific Computing, PHYS-2103(3) Numeric and Symbolic Computing, PHYS-2112(3) Scientific Computing with Python, or PHYS-2803(3) Physical Computing: Interacting with the Real World for the above elective courses.

Restrictions:

Students cannot declare the same subject as a Major and a Minor.

COURSE LISTINGS

PHYS-1005(6)	Concepts in Science	PHYS-2812(3)	The Physics of Music
PHYS-1101(6)	Foundations of Physics	PHYS-3103(3)	Special Topics in Physics
PHYS-1301(6)	Introduction to Physics	PHYS-3202(3)	Intermediate Mechanics
PHYS-1701(6)	Astronomy	PHYS-3203(3)	Advanced Mechanics
PHYS-2001(3)	Directed Studies in Physics	PHYS-3301(6)	Quantum Mechanics
PHYS-2102(3)	Scientific Computing	PHYS-3403(3)	Thermal and Statistical Physics
PHYS-2103(3)	Numeric & Symbolic Computing	PHYS-3901(3)	Intermediate Physics Laboratory
PHYS-2105(3)	Mathematical Physics I	PHYS-4001(6)	Honours Thesis
PHYS-2106(3)	Mathematical Physics II	PHYS-4201(6)	Electrodynamics
PHYS-2110(3)	Statics	PHYS-4302(3)	Condensed Matter Physics
PHYS-2112(3)	Scientific Computing with Python	PHYS-4303(3)	Subatomic Physics
PHYS-2200(3)	Electricity and Magnetism	PHYS-4501(6)	Introduction to General Relativity
PHYS-2202(3)	Optics and Waves	PHYS-4602(3)	Advanced Quantum Mechanics
PHYS-2302(6)	Modern and Thermal Physics	PHYS-4901(3)	Advanced Physics Laboratory
PHYS-2502(3)	Radiation and the Environment		
PHYS-2503(3)	Medical Imaging		
PHYS-2602(3)	Quantum Computing		
PHYS-2705(6)	Cosmology: Science Fact to Science Fiction	PHYS-1502(3)	Energy and the Environment
PHYS-2777(3)	The Study of Time	PHYS-4502(3)	Applications of General Relativity
PHYS-2803(3)	Physical Computing: Interacting with the Real World		

EXPERIMENTAL COURSES

COURSE DESCRIPTIONS

All course descriptions for all undergraduate programs can now be found in the back portion of the print Undergraduate Academic Calendar. They are also available in one large PDF in the "Academic Calendar" section of the University website:
<http://uwinnipeg.ca/academics/calendar/index.html>