

PHYSICS (PHYS)

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See Radiation Therapy section of Calendar.

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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-

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.

■ 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.

■ 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.

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

Required Courses (36 credit hours):

■ -1101(6) Introduction to Calculus
■ -1103(3) Mi to o (s)-1111.55(ul)-J /TT1(s)-11.5

Plus a minimum of 6 credit hours from:

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

Plus a minimum of 6 credit hours from:

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



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


Required Courses (48 credit hours):

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

Plus a minimum of 6 credit hours from:

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

Plus a minimum of 12 credit hours from:

- **-2102(3)** Scientific Computing  ■ **-2112(3)** Scientific Computing with Python
(A student cannot use both of these courses to satisfy major requirements in Physics)
 - **-2103(3)** Numeric and Symbolic Computing
 - **-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.

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

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

Plus a minimum of 6 credit hours from:

■	-2102(3)	Scientific Computing	■	-2112(3)	Scientific Computing with Python
(A student cannot use both of these courses to satisfy major requirements in Physics)					
■	-2103(3)	Numeric and Symbolic Computing			
■	-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 **BD -1102(6)** Biology and Human Concerns and **■ -2801(6)** Chemistry and Society.

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

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

Required Courses (84 credit hours):

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



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):

- -1101(6) Introduction to Calculus
- -1103(3) Introduction to Calculus I
- -1104(3) Introduction to Calculus II
- -1201(3) Linear Algebra I
- -2102(3) Differential Equations I
- -1101(6) Foundations of Physics
- -2102(3) Scientific Computing ■ -2112(3) Scientific Computing with Python

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

- -2103(3) Numeric and Symbolic Computing
- -2105(3) Mathematical Physics I
- -2106(3) Mathematical Physics II
- -2200(3) Electricity and Magnetism
- -2302(6) Ir:(puw w 3.4)6c1/ur:(p l)2Tws9IEay9.6 (r 3000(5 d(0.32C24r16 17w 24. 0 J/TT00T80)64(16/T06(16.92 (A04 ref00v3.BT.000es Tf0 59 (-)

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: