



PHYS-104 – Introduction to Physics 2

University Arts and Science

Effective Term & Year: Fall 2022

Course Outline Review Date: 2027-03-01

Program Area: Math and Sciences

Description:

This course builds on PHYS 103. Electric fields and electric potentials are calculated from a variety of continuous distributions of electric charge using Coulomb's Law and Gauss' Law. The principles of electrostatic equilibrium and dynamic equilibrium in conductors are used to discuss capacitors and resistors, and to calculate the effective capacitance or resistance for circuits. Kirchhoff's loop rules are used to analyze more sophisticated circuits. Magnetic fields are calculated from distributions of electric current using Ampère's law; and the force from a magnetic field on a current carrying wire or moving charge is calculated. Electromotive force is calculated using Faraday's law of induction, and is applied to generators, transformers and inductors. Maxwell's equations are introduced and used to explain electromagnetic waves. Special relativity is introduced.

Calculus is used throughout this course: including introductions to vector fields, line integrals, surface flux integrals, gradients, and differential equations.

Program Information:

This course is required for majors in Math, Physics, Engineering and Chemistry. It is usable for Associate of Science and Arts.

Delivery Methods: On-campus (Face-to-Face)

Credit Type: College of the Rockies Credits

Credits: 3

Course type/s: Lab Sciences, Sciences

Instructional Activity and Hours:

Activity	Hours
Classroom, Directed Studies or Online Instruction	45
Seminar/Tutorials	
Laboratory/Studio	45
Practicum/Field Experience	
Co-op/Work Experience	
Other	
Total	90

Course Requisites:

- Complete all of the following
 - Completed the following:
 - [PHYS103](#) – Introduction to Physics 1 (3)
 - Completed or concurrently enrolled in:
 - [MATH104](#) – Integral Calculus (3)

Flexible Assessment: Yes

In some cases students may be able to apply for recognition of prior learning outside the classroom. This flexible assessment process provides equivalent course credit. It is a rigorous process that may include external evaluation, worksite assessment, demonstration, standardized test, self-assessment, interview, products/portfolio, and challenge exam, or other measures as appropriate. Tuition fees apply. Contact an education advisor for more information.

Course Transfer Credit:

For information about receiving transfer credit for courses taken at either British Columbia or Alberta institutions, please see <https://www.bctransferguide.ca/> or <https://transferalberta.alberta.ca> . For more transfer credit information, please visit <https://www.cotr.bc.ca/Transfer>

All requests for course transfer credit from institutions in British Columbia or elsewhere should go to the College of the Rockies Enrolment Services office.

Textbook Resources:

Textbook selection varies by instructor and may change from year to year. At the Course Outline Effective Date the following textbooks were in use:

Halliday, David, Resnick, Robert, and Walker, Jearl. *Fundamentals of Physics*. 10th ed. Wiley, 2013.

Please see the instructor's syllabus or check COTR's online text calculator <https://textbook.cotr.bc.ca/> for a complete list of the currently required textbooks.

Learning Outcomes:

Upon the successful completion of this course, students will be able to

- apply the concept of a vector field to electric and magnetic fields;
- calculate the electric field for a system of discrete or continuous static charges;
- describe the concept of flux and calculate the Electric or Magnetic flux through a specified surface with a high degree of symmetry;
- apply Gauss's law to calculate the electric field when there is a high degree of symmetry;
- use a line integral of the electric field to calculate the electric potential; use the gradient to find the electric field given the electric potential;
- derive capacitance and resistance and calculate effective capacitance or resistance arranged in series or parallel or more complicated configurations;
- use Kirchhoff's laws to calculate the currents in simple circuits with capacitors, resistors, and inductors;
- use Kirchhoff's laws to derive differential equations for RC, LR, and LC circuits, and then use integral calculus to model the behavior of the currents in these circuits;
- calculate the force on a moving electric charge or current configuration in a magnetic field;
- use the Biot-Savart law and Ampère's circuit law to calculate the magnetic field generated by current from straight wires, solenoids and tori;
- use Faraday's law of induction to calculate the EMF and inductance; and
- complete simple calculations in the special theory of relativity

Course Topics:

- Coulomb's law and electric fields
- Flux, Gauss's Law and its relationship to the divergence theorem
- Electric potential as a line integral of the electric field; the electric field as the gradient of the electric potential
- Capacitance
- Current, resistance, circuits. Kirchhoff's laws
- Magnetic fields. The Biot-Savart law. Ampère's circuit law

- Induction and inductance. Faraday's law
- Maxwell's equations
- Modern physics: relativity and quantum theory

See instructor's syllabus for the detailed outline of weekly readings, activities and assignments.

Evaluation and Assessments

Assessment Type: On-Campus (face-to-face)

Assessment Type	% of Total Grade
Labs	20%
Assignments/Quizzes	20%
Midterms	30%
Final Exam	30%
Total	100%

Grade Scheme

A+	A	A-	B+	B	B-	C+	C	C-	D	F
>=90	89-85	84-80	79-76	75-72	71-68	67-64	63-60	59-55	54-50	<50

Evaluation Notes: A grade of "D" grants credit, but may not be sufficient as a prerequisite for sequential courses.

Evaluation Notes Comments:

Please see the instructor syllabus for specific classroom policies related to this course, such as details of evaluation, penalties for late assignments, and use of electronic aids.

Exam Attendance:

Students must attend all scheduled exams at the appointed time and place. Instructors may approve an alternate exam to accommodate an illness or personal crisis. Department heads will consider other written requests. Any student who misses a scheduled exam without prior approval will receive a "0" on the exam.

Academic Policies:

College of the Rockies policies related to courses can be found at <https://cotr.bc.ca/about-us/college-policies/> and include the following:

- Policy 2.4.3 Students with Documented Disabilities

- Policy 2.4.4 Student Conduct (plagiarism, other cheating, behavioral misconduct)
 - Policy 2.5.8 Academic Performance
 - Policy 2.5.3 Grade Appeal
 - Policy 2.4.9 Student Concerns Re Faculty
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Course Changes:

The College of the Rockies updates course outlines regularly to meet changing educational, employment and marketing needs. The instructor will notify students in writing of any updates to this outline during the semester. The instructor reserves the right to revise, add or delete material while meeting the learning outcomes of this course outline.