

PHYSICS

Physics is the study of how the world works. It encompasses everything from subatomic particles to electronic devices to the structure of galaxies and the evolution of the universe. It also includes the study of the forces and fields that govern the physical behaviour of everything around us.

The appeal of physics is more than just the joy of understanding the world we live in, however. Physics has also led to the development of amazing technologies that we take for granted: devices like smart phones, GPS units, MRI scanners and countless others. These innovations exist because someone—a person like you—studied physics and figured out something new about how our universe works.

Here at KPU we offer a BSc Major in Physics for Modern Technology (<https://calendar.kpu.ca/programs-az/science-horticulture/physics/physics-modern-technology-bs/>) that emphasizes both aspects of physics: the fundamental study of how the world works as well as the technological applications of physics.

Who Studies Physics?

Physics appeals to students who are interested in learning about the laws of nature and the relationship between energy and matter. Students pursuing a career in physics should be comfortable with mathematical concepts and how to apply them, able to utilize logic in solving problems, and have an interest in or knowledge of computer programming. The Physics for Modern Technology program will appeal to students who also want to learn about the applications of physics to modern technology and who plan to enter the workforce after completing their undergraduate degree.

Career Opportunities

Graduates of our Physics for Modern Technology program will be equipped to work in a variety of areas including (but not limited to):

- Green energy technology
- Industrial process control
- Electronics
- Robotics
- Technical sales
- Teaching

Physics covers a range of specialized fields. Students who wish to work or study in one of these fields may need to pursue additional education or graduate studies. These specialized fields include:

- Astrophysics
- Atomic and Molecular Physics
- Condensed Matter Physics
- Geophysics
- Materials Physics
- Nuclear and Particle Physics
- Optics
- Physics Education

Programs

- Bachelor of Science, Major in Physics for Modern Technology (<https://calendar.kpu.ca/programs-az/science-horticulture/physics/physics-modern-technology-bs/>)

Courses

Visit the BC Transfer Guide - [bctransferguide.ca](https://www.bctransferguide.ca) (<https://www.bctransferguide.ca/>) - for information about course transfer in B.C.

PHYS 1100 4 credits

Introductory Physics

Students in this survey course will study kinematics and dynamics in one and two dimensions, energy and momentum conservation, electricity and magnetism, waves, and geometric optics. In the lab students will also study basic techniques of measurement, including the use of computers and report writing. Note: This is a preparatory course for students who have not passed Principles of Physics 12.

Level: UG

Prerequisite(s): Level C1 as defined in the Math Alternatives Table (<https://calendar.kpu.ca/course-information/mathematics-alternatives-table/>).

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), PW_3 (<https://calendar.kpu.ca/courses-az/#pathwaytext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1101 4 credits

Physics for Life Sciences I

Students will study work, energy, power, efficiency, and heat; kinematics and dynamics of rotation; fluids; oscillations, waves, and sound. Students will study relevant examples and applications of each course topic in the areas of medical and life sciences. Students will participate in laboratory activities that emphasize data collection and analysis. Students with credit for PHYS 1120 may not take this course for further credit.

Level: UG

Prerequisite(s): PHYS 1100 or Principles of Physics 12 (with a P)

Co-requisite(s): MATH 1120 or 1130 or 1140

Credit Exclusion: PHYS 1120

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1102 4 credits

Physics for Life Sciences II

Students will learn about optics and optical instruments; electrostatic forces and fields; magnetic forces and fields; electromagnetic induction; electric circuits; atomic structure, nuclear physics and radioactivity. Students will study relevant examples and applications of each course topic in the areas of medical and life sciences. Students will participate in laboratory activities that will emphasize data collection and analysis. Students with credit for PHYS 1220 may not take this course for further credit.

Level: UG

Prerequisite(s): PHYS 1101 or PHYS 1120

Co-requisite(s): MATH 1220 or 1230 or 1240

Credit Exclusion: PHYS 1220

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1120 4 credits

Physics for Physical and Applied Sciences I

Students will learn about statics, dynamics, oscillations, mechanical waves and sound. They will use computers extensively in the lab for data collection and analysis. Students with credit for PHYS 1101 may not take this course for further credit.

Level: UG

Prerequisite(s): PHYS 1100 or Principles of Physics 12 (with a C)

Co-requisite(s): MATH 1120 or 1130

Credit Exclusion: PHYS 1101

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1141 3 credits

Engineering Mechanics

Students will study the statics of particles and rigid bodies. They will apply vector analysis to three-dimensional static-equilibrium problems and analyze the internal forces in rigid structures. They will use differential and integral calculus, in addition to Newton's laws, to study the kinematics and dynamics of particles. Students will focus on the analysis of practical mechanics problems in two and three dimensions. Note: This is an Engineering course. Students may earn credit for only one of PHYS 1141 or PHYS 1170 as they are equivalent courses.

Level: UG

Prerequisite(s): PHYS 1120

Co-requisite(s): MATH 1220

Cross-listing: PHYS 1170

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1170 3 credits

Mechanics I

Students will study the statics, kinematics and dynamics of particles and rigid bodies. They will apply vector analysis to three-dimensional static-equilibrium problems, and differential and integral calculus to dynamics problems, as well as make use of Newton's laws and the concepts of impulse, momentum, work and energy. Students will focus on the analysis of practical mechanics problems in two and three dimensions. Note: This is an Engineering course. Students may earn credit for only one of PHYS 1141 or PHYS 1170 as they are equivalent courses.

Level: UG

Prerequisite(s): PHYS 1120

Co-requisite(s): MATH 1220

Cross-listing: PHYS 1141

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1220 4 credits

Physics for Physical and Applied Sciences II

Students will learn about optics, modern physics, electricity and magnetism. They will use computers extensively in the lab for data collection and analysis. Students with credit for PHYS 1102 may not take this course for further credit. Note: Students who intend to go on in the physical or applied sciences must take MATH 1220 to ensure transfer credit.

Level: UG

Prerequisite(s): PHYS 1120 or 1101

Co-requisite(s): MATH 1220 or 1230

Credit Exclusion: PHYS 1102

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1400 3 credits

Energy, Environment, Physics

Students will learn the basic principles of environmental physics. Students will build, analyze, and critique physical models of environmental processes. Students will apply environmental physics concepts to topical problems such as consumer energy use, renewable energy resources, carbon footprint, water use, waste, and global warming.

Level: UG

Prerequisite(s): Level C1 as defined in the Math Alternatives Table (<https://calendar.kpu.ca/course-information/mathematics-alternatives-table/>)

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1401 1 credit

Environmental Physics Lab

Students will conduct laboratory investigations related to environmental physics concepts such as: energy use, electrical power generation, fluid statics and dynamics. Students will use computers to obtain and analyze data, and to write reports.

Level: UG

Prerequisite(s): Level C1 as defined in the Math Alternatives Table (<https://calendar.kpu.ca/course-information/mathematics-alternatives-table/>)

Attributes: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 1600 3 credits

Introduction to Modern Technology

Students will learn to work with microcontroller chips which are at the heart of many modern technological devices. Students will program a microcontroller to develop a device (e.g. a calculator or a simple robot) to function as intended. Students will learn the basics of the C programming language as well as skills such as simple circuit design, data acquisition, digital input and output (DIO), analog-to-digital conversion (ADC), pulse width modulation (PWM), and timing.

Level: UG

Prerequisite(s): PHYS 1100 or Principles of Physics 12 (with a C)

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 2010 3 credits**Modern Physics**

Students will study the basic postulates and results of the Special Theory of Relativity and Quantum Mechanics. Students will review the experimental evidence for quantization. Students will use the Schrödinger Equation to obtain wavefunctions for a variety of situations, including the Hydrogen atom. Students will also be introduced to solid state physics with an emphasis on electronic devices.

Level: UG

Prerequisite(s): (PHYS 1102 or PHYS 1220) and (MATH 1220 or 1230)
 Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 2030 3 credits**Classical Mechanics**

Students will study intermediate topics in Classical Mechanics that rely heavily on mathematical skills developed in introductory calculus courses. Students will study topics such as time, position and velocity dependent forces, damped and forced vibrations, inertial and non-inertial frames of reference, the Kepler problem, and fluid mechanics. Students will extend the concepts learned in PHYS 1120.

Level: UG

Prerequisite(s): PHYS 1120 or (PHYS 1101 with a B)
 Co-requisite(s): MATH 1152 or MATH 2321 or MATH 2821
 Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 2040 3 credits**Thermal Physics**

Students will learn about the thermal properties of matter, and mechanisms of heat transfer. Students will study heat engines and refrigeration, phase changes, and the laws of thermodynamics. Students will also study environmental applications of thermal physics and applications in green energy technology.

Level: UG

Prerequisite(s): (PHYS 1102 or PHYS 1220) and (MATH 1220 or MATH 1230)
 Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 2100 3 credits**Experimental Physics**

Students will learn how physical and statistical principles are applied in designing experiments and analyzing their results. They will use analogue and digital electronics, electronic instrumentation, and computers in the acquisition of experimental data. Students will perform experiments in classical mechanics, fluid dynamics, optics, thermodynamics, electronics, and/or modern physics.

Level: UG

Prerequisite(s): (PHYS 1102 or PHYS 1220) and (MATH 1220 or MATH 1230)
 Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 2330 3 credits**Intermediate Mechanics**

This course extends the concepts covered in PHYS 1120. Students will study the general motion of particles and rigid bodies, inertial and non-inertial frames of reference, the harmonic oscillator, and central forces.

Level: UG

Prerequisite(s): PHYS 1120 or (PHYS 1101 with a B or better)
 Co-requisite(s): MATH 2321
 Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 2420 3 credits**Intermediate Electricity and Magnetism**

Students will learn the principles of electricity and magnetism at an intermediate level. Topics covered are: electrostatic forces and fields, electric potential, capacitance and dielectrics, DC and AC circuits, magnetic fields, magnetic properties of materials, an introduction to semiconductor devices and Maxwell's equations.

Level: UG

Prerequisite(s): (PHYS 1220 or PHYS 1102) and (MATH 1220 or MATH 1230)
 Co-requisite(s): MATH 2321 or MATH 2721 or MATH 1152
 Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 2600 3 credits**Electronics**

Students will learn about direct current (DC) and alternating current (AC) circuits. Students will build, and study the behaviour of circuits containing resistors, capacitors, inductors, diodes, operational amplifiers, and transistors. Students will work with programmable microcontrollers using the C language to utilize microcontroller fundamentals such as digital input and output (DIO), analog-to-digital conversion (ADC), and timing to apply them to circuit design and data acquisition.

Level: UG

Prerequisite(s): PHYS 1220 and (PHYS 1600 or APSC 1299) and MATH 1220
 Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 2610 3 credits**Sensors and Actuators**

Students will be introduced to components of measurement systems using a variety of sensors, with emphasis on the practical use of associated signal measurement equipment. Students will also learn the theory of operation of sensors, actuators, and transducers and use these components to build working systems.

Level: UG

Prerequisite(s): (PHYS 1600 or APSC 1299) and PHYS 2100
 Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 3610 3 credits

Introduction to Control

Students will learn different techniques to analyze linear systems, such as electromechanical, hydraulic and thermal systems. They will learn about the applications of the Laplace transform, matrix formulations and block diagrams in control systems. Students will be introduced to classic control systems, such as on-off control and proportional-integral-derivative (PID) control. Students will learn the basics of programmable logic controllers (PLCs) and design on-off controllers using PLCs. They will learn the essential components of pneumatic systems and build circuits using pneumatic equipment and simulators.

Level: UG

Prerequisite(s): PHYS 2030, 2600, and one of the following: MATH 2721 or 3421.

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 3620 3 credits

Process Control

Students will learn the concepts and principles of control theory. They will learn how to apply techniques such as frequency response analysis and root locus analysis to the design of feedback control systems. Students will learn to design and build proportional-integral-derivative (PID) controllers using analogue and digital components to control electric motors. They will learn about liquid level control systems and work with laboratory models to learn about pump and valve sizing. Students will analyze industrial case studies.

Level: UG

Prerequisite(s): PHYS 3610

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 3700 3 credits

Signal and Image Processing

Students will learn about the noise characteristics of components, sensors, and systems, as well as signal recovery techniques. They will also learn about the acquisition, processing and analysis of images for scientific and industrial applications. Students will develop and work with instrumentation and software for signal and image processing in the laboratory. Students will apply statistical analysis throughout, both for theory and for analysis.

Level: UG

Prerequisite(s): PHYS 2420 AND PHYS 2610

Attribute: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 3710 3 credits

Applied Optics & Optoelectronics

Students will study the physics of light and its technological applications. They will learn the concepts behind a variety of optical instruments and get hands-on experience with designing and building them. They will learn about light propagation, diffraction, interference and polarization and how these phenomena are used for imaging, measurement, sensing and communications. Finally they will investigate how light is generated and how it can be detected to allow optical systems to be interfaced to, and controlled by, electronic systems.

Level: UG

Prerequisite(s): PHYS 2100 and PHYS 2420.

Attribute: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 3900 3 credits

Project in Physics & Technology

Students will work as part of a team on a project in an area of physics and/or instrumentation. Students will review the current literature in their chosen area and design and carry out experiments or computer simulations to achieve their project goals. Students will deliver their findings as a formal report. They will also make formal and informal presentations at various stages of the project.

Level: UG

Prerequisite(s): PHYS 2100 and (PHYS 2600 or 2610) and (PHYS 2010, 2030, 2040 or 2420)

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 3950 3 credits

Work Experience - Part I

Students will apply their previous learning to a real world situation during a work experience term that has been approved by, and with supervision from, Physics faculty. Students will prepare a plan of the work to be performed. Students will work full-time for seven weeks and will write a report at the end of that period.

Level: UG

Prerequisite(s): Approval of Physics work experience committee AND completion of at least 9 PHYS credits at the 3000 level.

Attribute: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 3951 3 credits

Work Experience - Part II

Students will continue to apply their previous learning to a real world situation during a work experience term that has been approved by, and with supervision from, Physics faculty. Students will work full-time for at least seven weeks and will prepare a final report and a presentation at the conclusion of the placement. Students will use the report and presentation to demonstrate the understanding they have gained of the applicability and relevance of their studies to modern technology.

Level: UG

Prerequisite(s): Approval of Physics work experience committee AND completion of at least 9 PHYS credits at the 3000 level

Attribute: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 4010 3 credits

Quantum Mechanics

Students will learn the experimental basis and basic postulates of Quantum Mechanics. Topics include spin-1/2 systems, state vectors, wave functions, the Schrodinger Equation, entanglement and interference.

Level: UG

Prerequisite(s): PHYS 2010 and one of (a) MATH 2721 and MATH 2821, or (b) MATH 3120 and MATH 3322

Attribute: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 4199 3 credits**Senior Project I**

Students will learn and use project management tools to develop a project proposal and schedule for their senior project. The topic, scope and goals of the senior project will be defined by the student with consultation from faculty (and industry representatives where applicable). The project proposal and schedule will be implemented in the subsequent senior project course, PHYS 4299.

Level: UG

Prerequisite(s): All of (a) PHYS 3900 and (b) 6 credits from courses in PHYS at the 3000 level or higher

Attribute: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 4299 3 credits**Senior Project II**

Students will carry out their senior project as proposed in PHYS 4199. Students will present their results and findings in a formal report and oral presentation.

Level: UG

Prerequisite(s): PHYS 4199

Attribute: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 4600 3 credits**Programming for Instrumentation**

Students will learn programming languages and techniques relevant to industrial instrumentation. Students will learn about important programming patterns, environments, algorithms and professional best-practices in programming style, documentation and user interface development. It is recommended to take CPSC 1103 as an elective before enrolling in this course.

Level: UG

Prerequisite(s): Two of the following: PHYS 2100, PHYS 2600, PHYS 2610

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)

PHYS 4700 3 credits**Solid State Physics: Theory and Practice**

Students will learn about the crystallographic, electronic, thermal, and magnetic properties of semiconductors, metals, superconductors, and magnetic materials, as well as important applications of those materials. Students will learn about the theory and practice of important experimental techniques used by solid state physicists by performing experiments in the laboratory and by analysing case studies.

Level: UG

Prerequisite(s): PHYS 4010

Attributes: ASTR (<https://calendar.kpu.ca/courses-az/#astrtext>), SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>), QUAN (<https://calendar.kpu.ca/courses-az/#quantext>)

PHYS 4900 3 credits**Special Topics**

Students will apply key understandings and skills developed during the Physics for Modern Technology program (or equivalent) to practical problems of interest. The topic area for this course will vary with each offering.

Level: UG

Prerequisite(s): 45 credits from courses at the undergraduate level, including 9 credits from courses in PHYS at the 2000 level or higher

Attribute: SCIH (<https://calendar.kpu.ca/courses-az/#courseattributestext>)