PHYSICS (PHYS)

This is a list of the Physics (PHYS) courses available at KPU.

For information about transfer of credit amongst institutions in B.C. and to see how individual courses transfer, go to the BC Transfer Guide bctransferguide.ca

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.

Prerequisites: Level C1 as defined in the Math Alternatives Table
Attributes: QUAN, PATH-3

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.

Prerequisites: PHYS 1100 or Principles of Physics 12 (with a P)
Co-requisites: MATH 1120 or 1130 or 1140
Attributes: QUAN

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.

Prerequisites: PHYS 1101 or PHYS 1120
Co-requisites: MATH 1220 or 1230 or 1240
Attributes: QUAN

PHYS 1112 **3 Credits**
Reel Physics
Students will study a wide range of physical concepts in the context of popular culture. They will investigate the often-incorrect portrayal of basic physics in varied source material (movies, television, and print media). Students will critically view source materials and determine when the physics has been correctly or incorrectly portrayed.

NOTE: This is an introductory course in physics intended for students not specializing in science or applied science, but will utilize basic arithmetic skills. No prior study of physics is required.

Attributes: QUAN

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.
Prerequisites: PHYS 1100 or Principles of Physics 12 (with a C)
Co-requisites: MATH 1120 or 1130
Attributes: QUAN

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.

Prerequisites: PHYS 1120
Co-requisites: MATH 1220
Attributes: QUAN

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.

Prerequisites: PHYS 1120
Co-requisites: MATH 1220
Attributes: QUAN

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.

Prerequisites: PHYS 1120 or 1101
Co-requisites: MATH 1220 or 1230
Attributes: QUAN

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.

Prerequisites: Level C1 as defined in the Math Alternatives Table
Attributes: QUAN

PHYS 1401 **1 Credits**
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.

Prerequisites: Level C1 as defined in the Math Alternatives Table
Attributes: QUAN

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.

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

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.

Prerequisites: (PHYS 1102 or PHYS 1220) and (MATH 1220 or 1230)
Attributes: QUAN

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.

Prerequisites: PHYS 1120 or (PHYS 1101 with a B)
Co-requisites: MATH 1152 or MATH 2321 or MATH 2821

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.

Prerequisites: (PHYS 1102 or PHYS 1220) and (MATH 1220 or MATH 1230)

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.

Prerequisites: (PHYS 1102 or PHYS 1220) and (MATH 1220 or MATH 1230)

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.

Prerequisites: PHYS 1120 or (PHYS 1101 with a B or better)
Co-requisites: MATH 2321
Attributes: QUAN

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.

Prerequisites: (PHYS 1220 or PHYS 1102) and (MATH 1220 or MATH 1230)
Co-requisites: MATH 2321 or MATH 2721 or MATH 1152
Attributes: QUAN

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.

Prerequisites: PHYS 1220 and (PHYS 1600 or APSC 1299) and MATH 1220

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.

Prerequisites: (PHYS 1600 or APSC 1299) and PHYS 2100

PHYS 3202 **3 Credits**
Biophysics
Students will study the biomechanics of the skeletal system, the strength of materials as it applies to the human body, the fluid dynamics of the circulatory system, diffusion and Brownian motion, thermoregulation of the body, the optics and neurophysics of vision, the acoustics of the ear and the human voice, electrical models of nerve conduction, and radiation dosimetry.

Prerequisites: (PHYS 1101 or 1120) and (MATH 1120 or 1130)
Note: PHYS 1220 is recommended
Co-requisites: BIOL 1210
Attributes: QUAN

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.

Prerequisites: PHYS 2030, 2600, and one of the following: MATH 2721 or 3421.

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.

Prerequisites: PHYS 3610

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.

Prerequisites: PHYS 2420 AND PHYS 2610

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.

Prerequisites: PHYS 2100 and PHYS 2420.

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.

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

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.

Prerequisites: Approval of Physics work experience committee AND completion of at least 9 PHYS credits at the 3000 level.

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.

Prerequisites: Approval of Physics work experience committee AND completion of at least 9 PHYS credits at the 3000 level

PHYS 4010 **3 Credits**
Quantum Mechanics
Students will learn the experimental basis and basic postulates of Quantum Mechanics. Topics include spin-1/2 systems, statevectors, wavefunctions, the Schrodinger Equation, entanglement and interference.
Prerequisites: PHYS 2010 and one of (a) MATH 2721 and MATH 2821, or (b) MATH 3120 and MATH 3322

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.

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

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.

Prerequisites: PHYS 4199

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.

Prerequisites: Two of the following: PHYS 2100, PHYS 2600, PHYS 2610

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.

Prerequisites: PHYS 4010
Attributes: QUAN

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.

Prerequisites: 45 credits from courses at the undergraduate level, including 9 credits from courses in PHYS at the 2000 level or higher