

# HONOURS BSC PHYSICS AND BASC ELECTRICAL ENGINEERING

## Physics

Why is our world the way it is? How can we understand and explain what we observe around us, from the smallest sub-atomic particles to the largest galaxies? How can we apply this understanding to manipulate our world? Studying physics gives insight into the fundamental laws of nature.

But an education in physics gives so much more. The rigorous training our students receive in analyzing and understanding complex problems is valuable in many future careers. While many of our graduates have established careers in universities and in the high tech sector as research and development scientists, others have used their physics degrees as a springboard to careers in finance, administration, medicine, management or education. The range of career opportunities is perhaps wider than for any other students with a science education.

Physicists have revolutionized the way we live our lives, with groundbreaking discoveries and new technologies, transferable to other fields such as biology or finance. Our professors and graduates are an important part of this chain. Many of our professors have also been recognized for their teaching and are seen as world-class researchers in their fields of expertise.

The research conducted by the professors in the Department of Physics is concentrated in several sub-specialties, including the physics of biological and complex systems, condensed matter physics, photonics and the physics of geomaterials. Depending upon your choice of program, you have the opportunity to take courses and participate in research projects in these specialized areas.

In addition to the Honours BSc in Physics, we offer three other Honours BSc programs. The first is in physics-mathematics, which provides enriched mathematics training within a physics program. The second is the option in photonics, which gives students a solid training in physics and a more applied and industry-related training in photonics. The third is the option in biological physics, which teaches students to apply a rigorous education in physics to various areas of life sciences. We also offer a Major in Physics that can form the core of an Honours BSc when combined with a major or a minor in another discipline in the Faculty of Science, or in another faculty. Finally, starting in fall 2016, we will offer a five-year integrated program in physics (BSc) and electrical engineering (BAsc), jointly with the School of Electrical Engineering and Computer Science (SEECs). This unique program will offer a full education in physics and electrical engineering. Graduates will be sought after by industry and academia, as they will have the capacity to develop technology from a basic physics idea to the final product.

The Department of Physics also has strong graduate programs, leading to an MSc or PhD. They give students the opportunity to work on cutting edge science in a research group led by one or more department professors.

## Electrical Engineering

Electrical engineering is at the heart of today's exciting advances in technology. With five technical specializations—communications,

systems, electronics, microwave and photonic, and power and sustainable energy—our curriculum will enable you to influence how the world communities communicate, generate sustainable energy and heal diseases. As an electrical engineer, you will work with other engineers or scientists on emerging technologies.

The option of Engineering Management will prepare you with necessary skills to pursue entrepreneurial activities and start your own technology-related business. The double degree program—BAsc in Electrical Engineering and BSc in Computing Technology—will put you at the intersection of the two areas that propel the waves of technological development.

This program is offered in English and in French. Some advanced course are only offered in English.

## Program Requirements

The French immersion stream is available with this program.

Co-operative education is available with this program.

### Compulsory First-Year Courses:

CHM 1311	Principles of Chemistry	3 Units
GNG 1103	Introduction to Engineering Design	3 Units
GNG 1106	Fundamentals of Engineering Computation	3 Units
ITI 1100	Digital Systems I	3 Units
MAT 1320	Calculus I	3 Units
MAT 1322	Calculus II	3 Units
MAT 1341	Introduction to Linear Algebra	3 Units
PHY 1121	Fundamentals of Physics I	3 Units
PHY 1122	Fundamentals of Physics II	3 Units

### Compulsory Second-Year Courses:

CEG 2136	Computer Architecture I	3 Units
ELG 2136	Electronics I	3 Units
ELG 2137	Circuit Theory II	3 Units
ELG 2138	Circuit Theory I	3 Units
ENG 1112	Technical Report Writing	3 Units
GNG 2101	Introduction to Product Development for Engineers and Computer Scientists	3 Units
MAT 2322	Calculus III for Engineers	3 Units
MAT 2384	Ordinary Differential Equations and Numerical Methods	3 Units
PHY 2311	Waves and Optics	3 Units
PHY 2323	Electricity and Magnetism	3 Units
PHY 2333	Mechanics	3 Units
PHY 2361	Modern Physics	3 Units

### Compulsory Third-Year Courses:

CEG 3136	Computer Architecture II	3 Units
ELG 3106	Electromagnetic Engineering	3 Units
ELG 3125	Signal and System Analysis	3 Units
ELG 3126	Random Signals and Systems	3 Units
ELG 3136	Electronics II	3 Units
ELG 3137	Fundamentals of Semiconductor Devices	3 Units
ELG 3155	Introduction to Control Systems	3 Units
ELG 3175	Introduction to Communication Systems	3 Units
ELG 3316	Electric Machines and Power Systems	3 Units

3 course units of complementary studies electives <sup>1</sup> 3 Units

**Compulsory Fourth-Year Courses:**

ELG 2911 Professional Practice in Information Technology and Engineering 3 Units

PHY 3341 Theoretical Physics 3 Units

PHY 3350 Thermodynamics 3 Units

PHY 3355 Statistical Thermodynamics 3 Units

PHY 3370 Introductory Quantum Mechanics 3 Units

ELG 4912 Electrical Engineering Design Project: Part I 3 Units

ELG 4913 Electrical Engineering Design Project: Part II 3 Units

3 course units from: 3 Units

HIS 2129 Technology, Society and Environment Since 1850

PHI 2394 Scientific Thought and Social Values

6 course units in electrical engineering (ELG) or computer engineering (CEG) at the 4000 level to be selected from the list below according to the chosen option 6 Units

3 optional course units in mathematics (MAT) at the 2000, 3000 or 4000 level, excluding MAT 2379 <sup>2</sup> 3 Units

**Compulsory Fifth-Year Courses:**

PHY 4006 Physics Research Project 6 Units

PHY 4370 Quantum Mechanics 3 Units

PHY 4382 Introduction to Solid State Physics 3 Units

12 course units in electrical engineering (ELG) or computer engineering (CEG) at the 4000 level to be selected from the list below according to the chosen option 12 Units

6 optional course units in physics (PHY) at the 4000 or 5000 level <sup>3</sup> 6 Units

3 course units of complementary studies elective <sup>1</sup> 3 Units

One option from the following:

**Option 1: Communications**

ELG 4118 Wave Propagation and Antennas

ELG 4139 Electronics III

ELG 4156 Linear Systems

ELG 4176 Communication Systems

ELG 4177 Digital Signal Processing

ELG 4179 Wireless Communication Fundamentals

**Option 2: Systems Engineering**

CEG 4158 Computer Control in Robotics

ELG 4137 Principles and Applications of VLSI Design

ELG 4156 Linear Systems

ELG 4157 Modern Control Engineering

ELG 4159 Integrated Control Systems

ELG 4177 Digital Signal Processing

**Option 3: Electronics**

ELG 4115 Microwave Circuits

ELG 4117 Optoelectronics and Optical Components

ELG 4137 Principles and Applications of VLSI Design

ELG 4139 Electronics III

ELG 4176 Communication Systems

ELG 4177 Digital Signal Processing

**Option 4: Microwave and Photonic Engineering**

ELG 4115 Microwave Circuits

ELG 4117 Optoelectronics and Optical Components

ELG 4118 Wave Propagation and Antennas

ELG 4139 Electronics III

ELG 4178 Optical Communications and Networking

ELG 4179 Wireless Communication Fundamentals

**Option 5: Power and Sustainable Energy**

ELG 4125 Electric Power Transmission, Distribution and Utilization

ELG 4126 Sustainable Electrical Power Systems

ELG 4139 Electronics III

ELG 4157 Modern Control Engineering

ELG 4159 Integrated Control Systems

ELG 4179 Wireless Communication Fundamentals

**Total: 159 Units**

Note(s)

1

For a complete list of course units of complementary studies electives, consult the Faculty of Engineering's website.

2

One of these courses is recommended: (MAT 2141 or MAT 2342) or (MAT 2371 or MAT 2377).

3

Students in the Power and Sustainability Option must take PHY 4324, which may need to be taken in the winter of the fourth year.