HONOURS BSC IN PHYSICS / BASC IN 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 courses 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:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 1311</td>
<td>Principles of Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>GNG 1103</td>
<td>Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>GNG 1106</td>
<td>Fundamentals of Engineering Computation</td>
<td>3</td>
</tr>
<tr>
<td>ITI 1100</td>
<td>Digital Systems I</td>
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<tr>
<td>MAT 1320</td>
<td>Calculus I</td>
<td>3</td>
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<tr>
<td>MAT 1322</td>
<td>Calculus II</td>
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<tr>
<td>MAT 1341</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>PHY 1121</td>
<td>Fundamentals of Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHY 1122</td>
<td>Fundamentals of Physics II</td>
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Compulsory Second-Year Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>CEG 2136</td>
<td>Computer Architecture I</td>
<td>3</td>
</tr>
<tr>
<td>ELG 2136</td>
<td>Electronics I</td>
<td>3</td>
</tr>
<tr>
<td>ELG 2137</td>
<td>Circuit Theory II</td>
<td>3</td>
</tr>
<tr>
<td>ELG 2138</td>
<td>Circuit Theory I</td>
<td>3</td>
</tr>
<tr>
<td>ENG 1112</td>
<td>Technical Report Writing</td>
<td>3</td>
</tr>
<tr>
<td>GNG 2101</td>
<td>Introduction to Product Development and Management for Engineers and Computer Scientists</td>
<td>3</td>
</tr>
<tr>
<td>MAT 2322</td>
<td>Calculus III for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>MAT 2384</td>
<td>Ordinary Differential Equations and Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>PHY 2311</td>
<td>Waves and Optics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 2323</td>
<td>Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHY 2333</td>
<td>Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 2361</td>
<td>Modern Physics</td>
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Compulsory Third-Year Courses:

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<tbody>
<tr>
<td>CEG 3136</td>
<td>Computer Architecture II</td>
<td>3</td>
</tr>
<tr>
<td>ELG 3106</td>
<td>Electromagnetic Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ELG 3125</td>
<td>Signal and System Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ELG 3126</td>
<td>Random Signals and Systems</td>
<td>3</td>
</tr>
<tr>
<td>ELG 3136</td>
<td>Electronics II</td>
<td>3</td>
</tr>
<tr>
<td>ELG 3137</td>
<td>Fundamentals of Semiconductor Devices</td>
<td>3</td>
</tr>
<tr>
<td>ELG 3155</td>
<td>Introduction to Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>ELG 3175</td>
<td>Introduction to Communication Systems</td>
<td>3</td>
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ELG 3316  Electric Machines and Power Systems  3 Units
3 course units of complementary studies electives  3 Units

Compulsory Fourth-Year Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ELG 2911</td>
<td>Professional Practice in Information Technology and Engineering</td>
<td>3 Units</td>
</tr>
<tr>
<td>PHY 3341</td>
<td>Theoretical Physics</td>
<td>3 Units</td>
</tr>
<tr>
<td>PHY 3350</td>
<td>Thermodynamics</td>
<td>3 Units</td>
</tr>
<tr>
<td>PHY 3355</td>
<td>Statistical Thermodynamics</td>
<td>3 Units</td>
</tr>
<tr>
<td>PHY 3370</td>
<td>Introductory Quantum Mechanics</td>
<td>3 Units</td>
</tr>
<tr>
<td>ELG 4912</td>
<td>Electrical Engineering Design Project: Part I</td>
<td>3 Units</td>
</tr>
<tr>
<td>ELG 4913</td>
<td>Electrical Engineering Design Project: Part II</td>
<td>3 Units</td>
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3 course units from:

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>HIS 2129</td>
<td>Technology, Society and Environment Since 1800</td>
</tr>
<tr>
<td>PHI 2394</td>
<td>Scientific Thought and Social Values</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>PHY 4006</td>
<td>Physics Research Project</td>
</tr>
<tr>
<td>PHY 4370</td>
<td>Quantum Mechanics</td>
</tr>
<tr>
<td>PHY 4382</td>
<td>Introduction to Solid State Physics</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course Code</th>
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</thead>
<tbody>
<tr>
<td>ELG 4912</td>
<td>Electrical Engineering Design Project: Part I</td>
</tr>
<tr>
<td>ELG 4913</td>
<td>Electrical Engineering Design Project: Part II</td>
</tr>
</tbody>
</table>

6 optional course units in physics (PHY) at the 4000 or 5000 level  6 Units

3 course units of complementary studies elective  3 Units

One option from the following:

**Option 1: Communications**

<table>
<thead>
<tr>
<th>Course Code</th>
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</thead>
<tbody>
<tr>
<td>ELG 4115</td>
<td>Microwave Circuits</td>
</tr>
<tr>
<td>ELG 4117</td>
<td>Optoelectronics and Optical Components</td>
</tr>
<tr>
<td>ELG 4118</td>
<td>Wave Propagation and Antennas</td>
</tr>
<tr>
<td>ELG 4139</td>
<td>Electronics III</td>
</tr>
<tr>
<td>ELG 4178</td>
<td>Optical Communications and Networking</td>
</tr>
<tr>
<td>ELG 4179</td>
<td>Wireless Communication Fundamentals</td>
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</table>

**Option 2: Systems Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>CEG 4158</td>
<td>Computer Control in Robotics</td>
</tr>
<tr>
<td>ELG 4137</td>
<td>Principles and Applications of VLSI Design</td>
</tr>
<tr>
<td>ELG 4156</td>
<td>Linear Systems</td>
</tr>
<tr>
<td>ELG 4157</td>
<td>Modern Control Engineering</td>
</tr>
<tr>
<td>ELG 4159</td>
<td>Integrated Control Systems</td>
</tr>
<tr>
<td>ELG 4177</td>
<td>Digital Signal Processing</td>
</tr>
</tbody>
</table>

**Option 3: Electronics**

<table>
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<tr>
<td>ELG 4137</td>
<td>Principles and Applications of VLSI Design</td>
</tr>
<tr>
<td>ELG 4139</td>
<td>Electronics III</td>
</tr>
<tr>
<td>ELG 4176</td>
<td>Communication Systems</td>
</tr>
<tr>
<td>ELG 4177</td>
<td>Digital Signal Processing</td>
</tr>
</tbody>
</table>

**Option 4: Microwave and Photonic Engineering**

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<td>Principles and Applications of VLSI Design</td>
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<td>ELG 4139</td>
<td>Electronics III</td>
</tr>
<tr>
<td>ELG 4176</td>
<td>Communication Systems</td>
</tr>
<tr>
<td>ELG 4177</td>
<td>Digital Signal Processing</td>
</tr>
</tbody>
</table>

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.