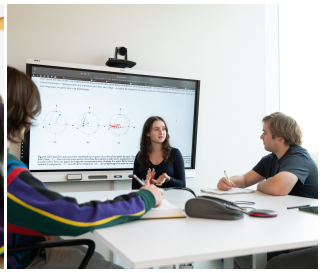
Co-op Program

QUANTUM INFORMATION SCIENCE



The Université de Sherbrooke's bachelor's degree in quantum information science combines scientific and technical coursework with professional development, internships and capstone projects. This interdisciplinary science program provides an innovative, professional course of study that will prepare students to solve the complex problems of a society in the midst of a technological revolution.

Students will not only master foundational quantum programming concepts and applications, but also develop and hone the professional skills they need to work in the quantum computing industry. With a wide range of subjects covered in the program (algorithms and data structures, quantum information and computing, computing solution design and management, etc.) and a broad skillset developed through capstone projects (critical thinking, science communication skills, entrepreneurial mindset, etc.), students will be able to easily enter a rapidly changing job market.

WHAT OUR STUDENTS CAN DO FOR YOU

Analyze

- Analyze needs, study solutions and solve problems via quantum and classical computing
- Carry out data modelling and processing
- Characterize and mitigate quantum computing errors
- Conduct literature reviews and write reports

Design

- Design functions and algorithms
- Create digital models and simulations
- Translate problems into mathematical language
- Formalize and use data structures
- Develop, design and test computing solutions
- Development
- Program quantum computers with Python
- Develop quantum algorithms
- Manage code with Git and GitHub
- Use object-oriented programming
- Use dynamic programming

Work Professionally

- Collaborate and work as a team
- Communicate effectively with various audiences, including the general public, about quantum science
- Manage projects with an entrepreneurial attitude
- Create a professional development plan and pursue continuous learning opportunities
- Adhere to the guiding ethical principles for the sciences and this profession, accounting for diversity, equity and inclusion
- Develop healthy, supportive habits

KNOWLEDGE AND SKILLS

Term	Description
S-1	Becoming familiar with computing software; introduction to graph theory; linear algebra; introduction to computing solution analysis, development and design; designing functions in programs; data modelling and processing; programming in Python; basic principles of quantum computing.
S-2	Understanding data structures in classical computing; modelling and solving combinational and sequential logic problems; programming in Python using software linked to a quantum computing platform; using Git and GitHub; understanding Dirac's formalism; applying the postulates of quantum mechanics
S-3	Becoming familiar with probability calculations; differential equations in physics, applying mathematical methods to theoretical physics; design strategies for algorithm creation; combinatorial analysis; dynamic programming; problem solving through classical and quantum computing; developing quantum algorithms; defining, implementing and executing design processes
S-4	Becoming familiar with theoretical computer science models; assessing design quality; applying the design process to a standardized, documented framework; statistical physics; Ising model; Markov chain; quantum information processing; quantum error correction; quantum algorithms; quantum communication protocols; scientific communication and outreach; mobilizing and sharing knowledge
S-5	Using quantum information to solve problems in various fields; variational algorithms; quantum error characterization and mitigation; digital simulations; optimization methods and the Metropolis algorithm; stochastic methods; project management; developing an entrepreneurial attitude
S-6	Classes chosen based on intended career; specialized project in quantum sciences (quantum chemistry, machine learning, etc.)

ORGANIZATION OF STUDY (S) AND WORK TERM (W)

1st year			2nd year			3rd year			4th year
FALL	WIN	SUM	FALL	WIN	SUM	FALL	WIN	SUM	FALL
S-1	S-2	W-0	S-3	S-4	W-1	S-5	W-2	W-3	S-6