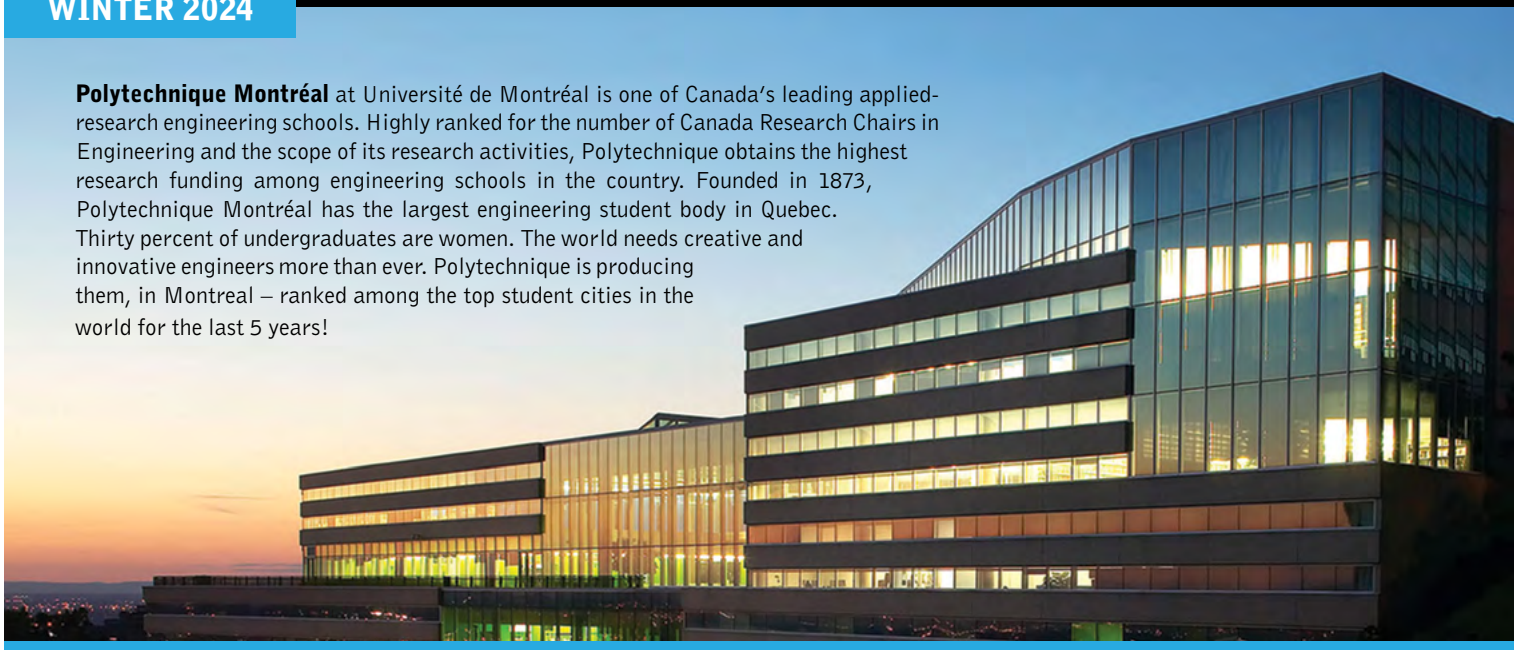
RESEARCH INTERNSHIP PROGRAM

POLYTECHNIQUE MONTRÉAL

TECHNOLOGICAL UNIVERSITY

WINTER 2024



Polytechnique Montréal at Université de Montréal is one of Canada's leading applied-research engineering schools. Highly ranked for the number of Canada Research Chairs in Engineering and the scope of its research activities, Polytechnique obtains the highest research funding among engineering schools in the country. Founded in 1873, Polytechnique Montréal has the largest engineering student body in Quebec. Thirty percent of undergraduates are women. The world needs creative and innovative engineers more than ever. Polytechnique is producing them, in Montreal – ranked among the top student cities in the world for the last 5 years!

RESEARCH INTERNSHIP PROGRAM

A research internship is an integral part of an international student's academic program at the home institution. Every year, Polytechnique's research units welcome over 250 students from other universities wishing to put into practice the technical and scientific knowledge acquired in their studies. The research conducted, respectful of the health and safety measures issued by the Public Health Agency, and supervised by a Polytechnique professor, emanates from a real societal or industrial need, and is carried out in the lab or *in situ*.

ELIGIBILITY CRITERIA

- Enrolled in one of Polytechnique Montréal's partner universities
- Be officially nominated by your home university before applying to this program. In case of doubt, please contact your International Relations Office or your Internship Office
- Completed at least two years of an engineering undergraduate program or at least one year of a graduate program (Master or Ph.D.) according to the projects' university cycle requirements
- Enrolled in a full-time program and will continue to be enrolled after your internship
- Minimum GPA of 2.75 out of 4 (or equivalent)
- Meet the required skills for the internship
- Be fluent in English or in French (no language test required)

DURATION

The recommended duration of the internship is 4 months, with 5 possible starting dates between January and March. Once the admission to the program has been confirmed, no change in the duration or the dates can be made. Please confirm the research duration with your home university Program Coordinator before applying. Note that it is a full-time research internship (7 hours a day, 35 hours a week).

Outstanding candidates may receive one of the 25 scholarships annually available !

Maximum amount of the scholarship: 6,000 CAD for 4 months (prorated at 1 500 CAD/month).

APPLICATION PROCEDURE

Click ***here*** to browse the list of research projects offered by area(s) of expertise and/or university cycle, and apply by **August 21, 2023**. Note that an online conference call may be organized for final selection.

LIST OF RESEARCH PROJECTS

AEROSPACE ENGINEERING

1	Computational Fluid Dynamics Simulation of Industrial Gas-liquid Flows
2	How long to cool a bottle of wine?
3	Understanding the hydrodynamics of particle swarms through simulation
4	Additive manufacture of adaptive structures for aerospace and biomedical applications
5	Advanced additive manufacturing of multifunctional composite
6	Digital twin for hydroelectric generating unit
7	Elastic reconfiguration of a plate in a wind tunnel
8	High Performance Bio-sourced Polymer Composite Materials
9	Machine-Learning Accelerated Structural Optimization

BIOMEDICAL ENGINEERING

10	Accelerating cellular measurements with microfluidic-imaging devices
11	Detection-Reaction of intelligent body weight support integrating inertial motion units
12	Developing new tools to study molecular interactions
13	Development of a conversational agent for HIV patients
14	In situ bioelectrospinning
15	In situ bioelectrospinning coaxial system
16	In situ cell bioelectrospinning
17	Observing nanoparticle cell interactions via 3D microscopy

CHEMICAL ENGINEERING

18	3D printing of energetic materials
19	Additive Manufacturing of Energetic Materials
20	Biosensors using Auxetic Patterns
21	Co-axial non toxic collagen/PCL electrospinning
22	Curved Neural Probes
23	Dairy waste to valued green products in a rotating reactor
24	Effects on ecosystems from microplastic and additives exposure
25	Electrified catalytic partial oxidation (CPOX) of natural gas
26	Flexible neurpmorphic devices
27	Hydrogels for epidermal electronics
28	Hydrogels for in-ear electroencephalogram (EEG) application
29	Lactose to lactic acid conversion in a fluidized bed reactor
30	Self-healable, stretchable and conductive polymers for wearable electronics
31	Surface and interface engineering of materials
32	Vortex identification in mixing applications

CIVIL, GEOLOGICAL AND MINING ENGINEERING

33	Grading effects on critical strength of granular materials
34	UHPFRC : From material development to structural applications

COMPUTER ENGINEERING AND SOFTWARE ENGINEERING

35	A unified mapping infrastructure for multi-robot deployment and management
36	AIOps for Digital Twin Applications
37	Automated Auditing of Smart Contracts
38	Current Challenges in Robotic Perception
39	Design of a robust ground station and multi-robot user interface
40	Mutation Testing for Detecting Faults in Federated Learning Applications
41	Quantum Machine Learning for Software Engineering Tasks
42	Solving combinatorial optimization problems using quantum-inspired approaches
43	The CogniFly Project
44	The Portiloop: a deep-learning tool for closed-loop brain stimulation

ELECTRICAL ENGINEERING

45	A.I.-control of neural interfaces
46	Binarized neural networks : implementation, optimization and explanation
47	Secure Communications in LEO Mega-Constellations
48	Metasurfaces for Deep Space Networks
49	Neuroprosthesis to reverse hand/arm paralysis after spinal cord injury

ENGINEERING PHYSICS

50	Depth-resolved Raman spectroscopy imaging for intraoperative breast cancer detection
51	Development of blood-based cancer detection tests using Raman spectroscopy
52	Mid-infrared lasers using the 2D semiconductor black phosphorus
53	Optical nose on chip
54	Optimality in photonic design
55	Semiconductors in the strong light-matter coupling regime

MATHEMATICS AND INDUSTRIAL ENGINEERING

56	Achieving carbon neutrality with robust environmental assessments
57	Development of an open STEP-NC-ready digital controller for CNC machine
58	How environmentally-friendly is biking, taking into account calories from diets?
59	Human-centric Smart Manufacturing Workcell for Industry 5.0 Application
60	Investigating the environmental impact of oil extraction with satellite data

MECHANICAL ENGINEERING

61	An Impact Rig for Replicating Fall Conditions in Elderly
62	Analysis of Manufacturing Process and Machine Interaction
63	Deep learning algorithms for predicting flows through porous media
64	Design and fabrication of multistable, origami-inspired structures
65	Design and prototyping of a lower limb robotic exoskeleton
66	Design of a control system for a pediatric exoskeleton robot
67	Development of an instrumented pediatric elbow and shoulder orthosis
68	Development of iterative linear solvers for sparse matrices and GPUs
69	Development of Robotic Force-Torque Sensor
70	Gaze control of asistive robots
71	Gaze Estimation-Based Assistive Robotic Arm Interface
72	Haptic feedback and programming of integrated activities with rehabilitation robot
73	Numerica; Modeling the Transport of Sediments in Rivers
74	Optimizing the functionality of soft robots through mechanical instabilities
75	Robotics of intelligent body weight support integrating inertial motion units
76	Tunable stiffness orthopedic brace for adolescent idiopathic scoliosis
77	Upper-Limb Rehabilitation of Patients with Neuromotor Deficits
78	Validation of a temperature history model in Greenland
79	Virtual Reality for the Study of Human Neuromuscular System

For any questions regarding your application, please contact: Polytechnique Montréal International • *point@polymtl.ca*

POLYTECHNIQUE MONTRÉAL
2024 WINTER RESEARCH INTERNSHIP PROGRAM

INSTRUCTIONS FOR OUR PARTICIPATING UNIVERSITIES' PROGRAM COORDINATORS

Procedures for applicants

Applicants must submit their candidacy electronically through our Application Platform by **August 21, 2023**. Each candidate will be required to create a MoveOn account, with a valid email address and password. After submission, an automatic confirmation message will follow. Be mindful that this message might be placed under spam or junk mails by certain mailing services.

Period of the Research Internship Program

On their application form, applicants will have to choose their period of internship among the five following options:

- 2024-01-08 to 2024-05-06
- 2024-01-15 to 2024-05-13
- 2024-01-29 to 2024-05-27
- 2024-02-12 to 2024-06-10
- 2024-02-26 to 2024-06-24

Candidates must discuss beforehand about these different dates with their research supervisors.

Requested Documents

Bellow are the requested documents to be provided by your nominated candidates to support their application to our Program. Please make sure they fulfill all the instructions below, and more specifically those in blue. If your institutional documents do not meet POLY-MTL requirements, please confirm the requested information on a separate letter to be joined by your students in their application files.

REQUESTED DOCUMENTS

1. **Academic transcript**
   Please provide your latest official academic transcript clearly stating your cumulative GPA or cumulative average. A letter from your institution is required if the official academic transcript template does not include the GPA or the cumulative average.

2. **Proof of Full-time Enrolment**
   The proof of full-time enrolment is a letter in English from your home institution, on official letterhead, dated within the last six months, clearly confirming that the candidate is currently enrolled in a FULL-TIME program and will continue to be enrolled after the internship. A letter from your institution is required if your proof of full-time enrolment template does not meet the above requirement. (Maximum one page). Note: copies of academic transcript, a student card or a letter of admission are not acceptable.

3. **Letter(s) of Motivation**
   The letter of motivation is a letter in English addressed to the project supervisor with the title of the project, in which the candidate specifies his/her interest and skills in respect to the project. If the candidate chooses two (2) research projects, he/she must provide a letter of motivation for each project. Maximum one page/each.

4. **Passport**
   Valid Passport with photo. Note: national identity cards, driver's licence, permanent residence card, work permits, student cards, health cards, birth certificates or baptism certificates are not accepted. If the passport is expired, the selected candidate must send his/her new passport by February 15, if possible (before we send his/her invitation letter).

5. **CV / Resume**

6. **Internship report**
   If available, a copy of an internship report performed in the past.

   Note: Make sure that all your documents, including those delivered by the home university and government, are written in either French or English. Should this not be the case, a separate certified translation will be required.