GLOBAL ENGINEERING CERTIFICATE HANDBOOK

Global Engineering Initiative Venture

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1.0 GETTING STARTED

Welcome to the Global Engineering (GE) Certificate program! GE is a movement that is seeking to create more globally aware leaders within the engineering profession who have a strong foundation in technical skills and who are able to apply those skills in interdisciplinary environments to tackle the complex problems of the 21st century. The GE certificate is the culmination of numerous collaborations across Canada between university engineering programs and Engineers Without Borders Canada in order to complement the existing engineering education system. This document will outline what the GE certificate is and how to go about getting it.

1.1 WHAT IS THE GLOBAL ENGINEERING CERTIFICATE?

The GE certificate is an opportunity to recognize the hard work that you put into broadening your horizons and looking beyond the technical element of your education. It offers a supplementary element to your education that can give you a competitive edge in the marketplace when you begin looking for jobs. But most importantly, it encourages the development of a generation of engineers who will be equipped with the skills and experience to tackle some of the big challenges facing society today in a way that will create sustainable, meaningful, and appropriate change.

1.2 WHAT ARE THE ENTRANCE REQUIREMENTS?

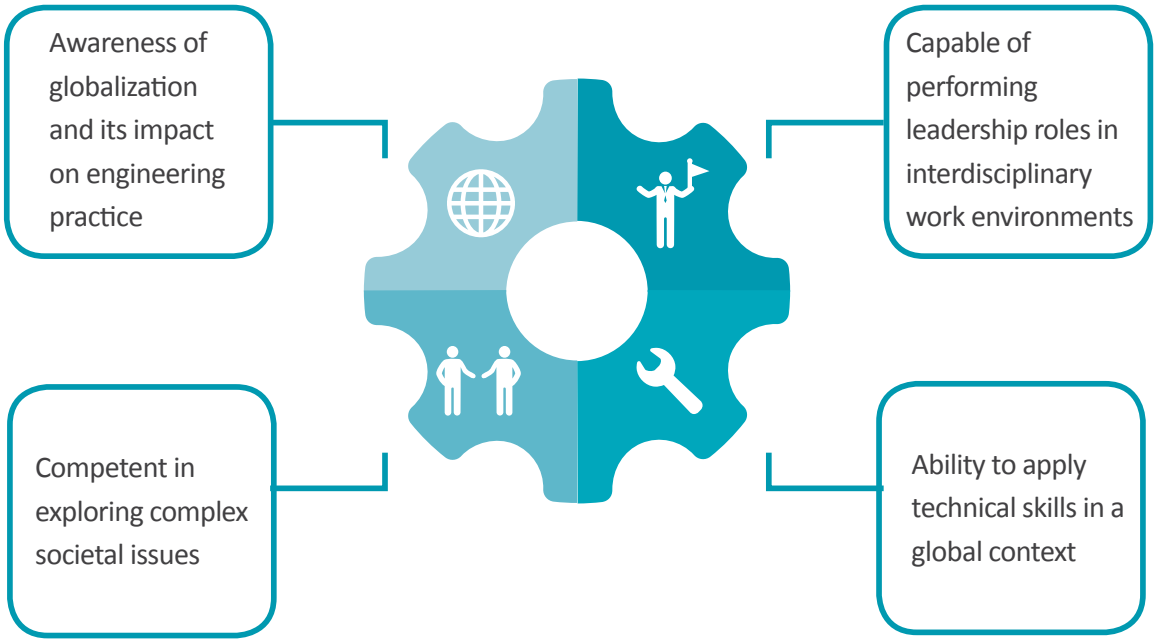
The GE certificate is open to any students currently enrolled in an engineering undergraduate program. You must complete and submit all of the certificate requirements by the first submission deadline after the completion of your degree program.

2.0 CERTIFICATE OVERVIEW

In order to receive your GE certificate, you must demonstrate that you understand the underlying concepts of global engineering more broadly and the process by which those concepts can be implemented. The following section outlines the core learning outcomes in addition to the specific components you'll need to complete prior to being able to apply for your GE certificate.

2.1 KEY LEARNING OUTCOMES

The key learning outcomes for the GE certificate are:



2.2 CERTIFICATE COMPONENTS

The certificate requirements blend theoretical and practical experience in the various GE learning outcomes. The following components must be completed in order to qualify for the conferral of a GE certificate.

- Introduction to Global Engineering course
- Discipline-specific course covering GE topics
- Project-based course activity
- Experiential GE practice

Each component is further described in the following.

2.2.1 INTRODUCTION TO GLOBAL ENGINEERING COURSE

In order to build your GE foundation, you're required to take an intro to GE course. Currently MUN offers ENGI 8151: Technology, Sustainable Society and International Development and Engineers Without Borders offers an online course program that covers this component.

Submissions for this section include proof of course completion (transcript or otherwise) and the essay assignment described in section 3.0.

2.2.2 DISCIPLINE-SPECIFIC COURSE COVERING GE TOPICS

Following the completion of your intro to Global Engineering course, you are required to take a course specific to your discipline that covers topics related to those discussed in the intro to GE course and the key learning outcomes summarized in section 2.1. This course should explore how your specific discipline engages with GE concepts historically, presently, or into the future. It can take either a broad, high level view or a narrow focus on a particular topic or technology within your discipline. The specific course that you select to fulfil this component of the certificate requirements should be approved by the GE certificate administrator when you submit your course selections and syllabi with your enrollment information.

Submissions for this section include proof of course completion (transcript), a copy of the syllabus for the course, and reflection activity described in section 3.0.

2.2.3 PROJECT-BASED COURSE ACTIVITY

In order to begin practicing GE concepts, you are required to complete a term project for an engineering course in a way that explores one or more of the topics discussed in the intro to GE course. The project should be for an engineering course and should be a collaborative/team project. The integration of GE concepts does not necessarily have to be relevant to the entire project and can be specific to only a particular section or component of the project. However, it should comprise at least ten hours of engagement and work to produce the components that are specifically related to GE concepts.

Submissions for this section include proof of course completion (transcript) and a submission of your project either in whole or in part such that it can be evaluated for its relevance to the key GE learning outcomes. In extenuating circumstances, credit for this component can be given for course projects completed individually or projects in courses outside of engineering. Please contact the certificate administrator with a description of your situation.

2.2.4 EXPERIENTIAL GE PRACTICE

It is one thing to be well-versed in the topics of GE in the classroom. It is a completely different thing to engage with the topics of GE in practice and to apply the skills required in the real world! The final component of the GE certificate requirements is to accrue 120 hours of direct application of GE skills in GE fields.

The experience described can come from a numerous and diverse sources but should ultimately tie back to the key learning outcomes for the GE certificate and the topics discussed in the intro to GE course. Examples of relevant experience include: reviewing international procurement strategies for a company you worked for during a work term, performing a sustainability audit of a project, volunteering with an organization addressing poverty locally or globally, travelling abroad to work with an international company. If you are uncertain whether your experience fits within the expectations of this component of the requirements, please don't hesitate to contact the certificate administrator to confirm.

Submission requirements for this section include a summary spreadsheet of your hours accrued with different organizations in different positions, two (2) reference letters, and three reflections responding to the reflection questions provided in section 3.0.

2.3 TIMELINE OF CERTIFICATE COMPLETION

The following section provides important information on the timeline of program enrollment, portfolio submission, and certificate completion. Please review this timeline carefully as there are some steps which are mandatory and some which are only recommended. Following aspects of the timeline which are recommended will provide the greatest engagement with the learning outcomes but are not required for successful completion of the GE certificate.

2.3.1 ENROLLMENT

Enrollment in the GE certificate is recommended prior to beginning the various components of the GE program in order to provide the framing and introduction to the overarching program which will allow you to tailor your experience so as to best engage with the learning outcomes. Enrollment is open to any student currently completing an engineering undergraduate degree at a Canadian university accredited by the Canadian Engineering Accreditation Board. To enroll, go to the GE certificate website (http://globalengineeringinitiative.com/) and click on the "Enroll" link to sign up!

As the certificate program is being implemented at multiple universities across Canada, we do not have an exhaustive list of all courses that may match the requirements for the courses that must be completed towards the GE certificate. This particularly applies for the discipline-specific and project-based courses. As such, once you have enrolled in the GE certificate program please complete the course summary tracking sheet found in Appendix B including a copy of the course syllabus for the courses you have either already completed or are planning to complete for the various course-based requirements of the GE certificate program. The GE certificate administrator will review your submission as soon as possible and contact you regarding whether or not the courses identified meet the course requirements.

2.3.2 CERTIFICATE COMPONENT COMPLETION

Once you have enrolled and your course selections have been approved by the GE certificate administrator, you are free to complete the required components of the GE certificate program. Completion of the courses and practical experience is according to your own schedule in a manner that makes appropriate sense for you. All documents must be submitted by the first submission deadline after the completion of your degree.

2.3.3 PORTFOLIO SUBMISSION

Your completed portfolio including all components described in section 3 must be submitted to the GE certificate administrator prior to your convocation from your engineering undergraduate degree.

Portfolio components can also be uploaded on an ongoing basis to the GE certificate as you complete them. This is recommended as it will provide the GE certificate administrator the chance to evaluate your submissions as you complete them and provide any feedback necessary if it appears you are off track.

2.3.4 PORTFOLIO EVALUATION AND CERTIFICATE CONFERRAL

Following the submission of your completed portfolio (or continuously if you submit your portfolio components piecemeal), the GE certificate administrator will evaluate your portfolio based on the criteria described in section 3 and the evaluation rubric presented in Appendix A. Ultimately your portfolio is a reflection of the degree to which you engaged with the key learning outcomes of the GE certificate in section 2.1 and should show a high level of reflection upon and understanding of the core concepts that form the foundation of Global Engineering.

If any components of your portfolio do not meet the acceptance criteria identified in the marking rubric, the GE certificate administrator will contact you and ask for revisions or further elaboration as appropriate. Once your portfolio has been reviewed and approved by the GE certificate administrator, the certificate will be made available and you will be successfully acknowledged as a GE certificate holder!

3.0 CERTIFICATE PORTFOLIO REQUIREMENTS

The following section summarizes the documents which must be submitted in summary of your completion of the components described above in addition to several additional assignments. Evaluation criteria is provided in addition to the criteria by which students are granted certificates.

3.1 SUBMISSIONS

The following items comprise your completed portfolio package:

- Transcript or other proof of course completion indicating a minimum B grade (75%)
- Course syllabi for courses completed
- Course summary tracking spreadsheet
- Intro to GE essay
- Discipline specific reflection
- Project-based documentation
- Experiential GE practice tracking spreadsheet
- Two (2) reference letters
- Three (3) experiential GE practice reflections

Each of these items is described in greater detail below.

3.1.1 TRANSCRIPT OR OTHER PROOF OF COURSE COMPLETION AND SYLLABI

Proof of registration and completion of the three theoretical course requirements is required. Transcripts must indicate that the courses were successfully completed. Please highlight the courses being submitted in fulfilment of your theoretical components. In addition, please include a copy of the syllabus for the course that you are submitting as fulfillment of your discipline-specific course requirement.

3.1.2 COURSE SUMMARY TRACKING SPREADSHEET

The spreadsheet found in Appendix B is to be filled out indicating the courses completed in fulfillment of the theoretical components of the GE certificate requirements. This form is to be completed and submitted as soon as possible following your enrollment in the GE certificate in order for the GE administrator to assess whether the course you have selected fulfil the requirements or if an alternate course should be pursued.

3.1.3 INTRO TO GE ESSAY

In order to reflect upon your understanding of Global Engineering and how it applies to the engineering profession and your own practice within it, please complete a 1500 word essay that identifies a key trend related to Global Engineering that you think will impact 21st society. Discuss the impact that you think that this trend will have on society over the next century and how you think the engineering profession will interact with this trend as it continues evolving. Examples of trends you could discuss include:

- Global climate change,
- Ocean acidification,
- Quantum computing,
- The rise of middle-income countries, particularly Brazil, Russia, India, and China
- Utilization of alternative energy sources
- A different topic of personal interest that relates to your understanding of global engineering

Essays should focus on following the trend's progression through time providing the historical context that has led us to the current point in time, an overview of the current state we exist in, and a projection of where we are headed. Essays will be evaluated on the depth of thought and research offered in the chosen topic, focusing on learning outcomes 1 and 3. Essays should not be longer than 2000 words.

3.1.4 DISCIPLINE SPECIFIC REFLECTION

For the discipline-specific course, please complete a 1-2 page reflection addressing the following questions from your own perspective and experience.

- What motivated you to enter into your chosen discipline? What experiences and values led you to choose that particular field of study?
- How do you plan to apply the concepts of Global Engineering within your chosen discipline and future career?
- What factors can you think of that might limit your ability to live your passion create a meaningful impact within your chosen discipline? How might you overcome those challenges?

Reflections will be evaluated based on the depth of thought and reflection and are specifically related to learning outcomes 3 and 4.

3.1.5 PROJECT-BASED DOCUMENTATION

In order to review that the project-based component has been fulfilled, please submit a copy or section of your project that represents how your project utilizes GE concepts. This could include a report or section of a larger report, poster presentation, or whatever other format your project takes on.

In the case that your project does not easily fit into a portfolio, please contact the certificate administrator (eg. if your final submission consisted primarily of a piece of hardware with no substantive report or presentation affiliated with it). The project-based component of the certificate program is targeted at learning outcomes 2 and 4.

3.1.6 EXPERIENTIAL GE PRACTICE TRACKING SPREADSHEET

Please complete the spreadsheet found in Appendix C detailing your various roles and responsibilities in completing your 120 hours of experiential GE practice. As described in section 2.2.4 this experience can come from your work or volunteer experience, but must be directly related to the application of topics discussed in the intro to GE course and the key learning objectives of the certificate program.

The full 120 hours does not have to come from a single organization or experience. In fact, having a diversity of experience is encouraged and will be beneficial in deepening your GE experience. However, only those hours that directly relate to the key learning outcomes should be counted towards the 120 hours of practical experience. For instance if you spent a summer working at a company and were asked to spend one week examining sustainable sourcing practices the company could use for a particular material but the rest of the work term would not be considered as working towards the GE learning outcomes, then please only count those hours that were spent on GE related work. The experiential GE practice may touch on all of the learning outcomes but should definitely have relevance to learning outcome 2.

3.1.7 TWO (2) REFERENCE LETTERS

In support of your experiential GE practice, you are required to submit two reference letters from referees at the organization(s) that you completed your experiential practice. At least one of these letters should come from an individual

who was in a supervisory role relative to you while the other one can come from a supervisor, co-worker, or other source. The only overriding criteria is that both referees should have experience with the specific work you completed related to the GE learning outcomes. Referees are asked to address three specific questions related to your work which can be found in the letter to referees in Appendix D. Please provide your referees with a copy of this letter when you ask them for a reference letter to ensure that they address the specific questions being asked of them.

Reference letters will not be actively evaluated per se, but will be utilized to indicate the appropriateness of the practical experience hours as representative of work that falls within the GE realm. Reference letters will also be shared with applicants in their portfolio review and support the provision of feedback on portfolios to help applicants in their ongoing learning and growth.

3.1.8 THREE (3) EXPERIENTIAL GE PRACTICE REFLECTIONS

The experiential GE practice is meant to challenge you to engage with the concepts covered throughout the GE certificate in the "real world". In order to show us how that went, please write up three separate reflections of 1-2 pages each addressing three of the five reflection questions provided below.

1) How has your relationship to leadership within groups and on projects changed over the course of your experience? Have the roles that you take within teams changed or been refined over the course of your engineering degree?

2) Describe a situation where you have had to work in an interdisciplinary space with different individuals approaching the same situation from very different lenses. How did you work in this situation? How was it different from more monodisciplinary situations you have been in?

3) Describe a situation where you felt that a solution was implemented that didn't ultimately address the challenge from a long-term or globalized context. An example might be being involved in a "dig and dump" site clean-up where contaminated soil was sent to a landfill instead of using more sustainable clean-up practices such as in-situ remediation. What were the main factors that led to the adoption of the solution that was adopted? How could the decision-making framework be changed to more holistically evaluate options and develop the most GE solution?

4) Identify a situation where the solution to a problem is technically simple but the

situation is confounded by social factors. An example might be the route selection for a new transit corridor where there is a clear technical, environmental, and feasibility option but which the local community is vehemently opposed to. How did you address this situation? Describe what you were able to do and what the ultimate outcome was.

5) Identify one task or process that you routinely engaged in during your practical experience that you think will change significantly in the next 10-20 years as a result of a global trend either in terms of human resources, technology, environmental constraints, or otherwise. An example might be that the popularization of 3D printing will allow consultants to bid on projects by submitting a rough model that is “sent” to the client and printed in house. What do you think will be some of the implications of this change on other tasks and processes? How could this change be capitalized upon?

Reflections will be evaluated based on the effective implementation and exploration of GE topics within a “real-world” context.

APPENDIX A: EVALUATION RUBRIC FOR COMPLETED PORTFOLIO

STUDENT:

UNIVERSITY:

DISCIPLINE:

*Click blue cells to type

Component	Submitted	Satisfactory	Comments
Transcript or other proof of course completion and course-specific syllabus			
Course summary tracking spreadsheet			
Intro to GE essay			
Discipline specific reflection			
Project-based documentation			
Experiential GE practice tracking spreadsheet			
Two (2) reference letters			
Three (3) experiential GE practice reflections			

APPENDIX B: COURSE SUMMARY TRACKING SPREADSHEET

STUDENT:

UNIVERSITY:

DISCIPLINE:

*Click blue cells to type

	Course Title	Comments
Intro to GE course		
Discipline-specific course		
Project-based course		

Please attach a copy of the syllabus for each course.

APPENDIX C: EXPERIENTIAL GE PRACTICE TRACKING SPREADSHEET

EXPERIENTIAL GE PRACTICE TRACKING SPREADSHEET

*Click blue cells to type

STUDENT:

UNIVERSITY:

DISCIPLINE:

Organization	Roles	Key responsibilities as they relate to GE	Number of hours	Reference name and contact information

APPENDIX D: LETTER TO REFEREES

Dear sir or madam,

This letter is on behalf of the Global Engineering (GE) certificate team. The Global Engineering certificate is a program to encourage and recognize supplementary education on the part of engineering students in topics that broaden their appreciation and understanding of the complex, global systems within which the modern engineer increasingly operates. Topics covered in the GE certificate program include globalization, leadership, interdisciplinarity, complexity, and the application of technical skills in global, social contexts.

You have been asked to act as a referee for a student applying for the GE certificate and this letter provides some framing for what we are looking for in a reference letter. In particular, your reference letter should address the following questions:

- How has the applicant applied leadership skills in their work, particularly in interdisciplinary situations?

- If possible, please describe a situation where the applicant has been required to combine technical skills to address a primarily social problem. How did they go about developing a solution? What challenges did they face and how did they address them?

- Please describe a situation where the applicant has been required to complete a task which you believe fell outside of their comfort zone. How did they deal with it and what was the outcome?

Thank you very much for your time and effort. The GE certificate program is aimed at supporting the development of a more globally aware engineering profession that is ready to tackle some of the complex challenges we face as a globalized society. We thank you for contributing to that.

Kind regards,

The Global Engineering Certificate team