**Global Engineering Certificate**

**Completion requirements and portfolio submission instructions**

March 2019

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**Global Engineering Certificate Introduction & Key Learning Outcomes**

Thanks for your interest in the Global Engineering Certificate (GEC) program! Global Engineering is a movement seeking to create more globally aware leaders within the engineering profession who have a strong foundation in technical skills and are able to apply those skills in interdisciplinary environments to tackle the complex problems of the 21st century system. This document will outline what the GEC is and how to go about getting it.

The GEC is an opportunity to gain recognition for the hard work that you put into broadening your horizons and looking beyond the technical element of your education. It signals your interest and experience in this key aspect of engineering to potential employers. 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.

In order to receive your GEC, you must demonstrate that you understand the underlying concepts of Global Engineering broadly and the process by which those concepts can be implemented.

The key learning outcomes for the GEC are:

1. **Awareness of globalization and its impact on engineering practice**
2. **Capability of practicing leadership and interdisciplinary skills**
3. **Competency in exploring complex social issues**
4. **Ability to apply technical skills in a global context**

For complete details on the program learning outcomes, including specific learning outcomes associated with each requirement, please see *Appendix E*.

The certificate requirements blend theoretical and practical experience in the various Global Engineering learning outcomes. The components described below must be completed and submitted in a portfolio to globalengineeringinitiative@gmail.com **by May 1 of your year of graduation** in order for you to qualify a GEC.

After submission, your portfolio will be evaluated based on the program learning outcomes and criteria described below. Your portfolio should demonstrate your engagement with the learning outcomes and 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 criteria or demonstrate sufficient engagement with the program learning outcomes (see *Appendix E*), the GEC Lead at your school will contact you and ask for revisions as appropriate.

Once your portfolio has been reviewed and approved, the certificate will be awarded. Our aim is for you to hear back from us about the certificate **by May 31.**

**GEC Requirements & Portfolio - overview**

1. **Courses**

|  |  |
| --- | --- |
| *Requirements: You need to complete* | *Portfolio: You need to submit* |
| * 1. Introduction to Global Engineering or equivalent
	2. A discipline-specific course covering global engineer topics
	3. Project-based course or activity that explores one or more of the topics from the Introduction to Global Engineering course
 | * + - Transcripts or official record of completed courses with minimum grade of 75%
		- Project documentation or a copy of the project
 |

1. **Co-curricular/experiential activities**

|  |  |
| --- | --- |
| *Requirements: You need to complete* | *Portfolio: You need to submit* |
| * 1. 120 hours of practical experience where you use Global Engineering skills in the real-world. (see below for examples of activities that fulfill this requirement).
 | * + - Detailed log demonstrating 120 hours of experiential Global Engineering practice
		- Reference letters (one (1) or two (2), depending on how you complete your hours)
 |

1. **Written assignments**

|  |  |
| --- | --- |
| *Requirements: You need to complete* | *Portfolio: You need to submit* |
| * 1. Introduction to Global Engineering essay (1500 words)
	2. Discipline-specific reflection (500-1000 words)
	3. Three (3) experiential global education practice reflections (500-1000 words each)
 | * + - All five (5) written reflections
 |

**GEC Requirements – what you need to complete**

1. **Courses**

For a general description of the required courses, see below. See *Appendix A* for a list of courses that fulfill these requirements at your school.

* 1. **Introduction to Global Engineering course**

In order to build your Global Engineering foundation, you’re required to take an intro to Global Engineering course. Your local EWB chapter will have done an audit to ensure your program has a course that meets this requirement.

* 1. **Discipline-specific course covering Global Engineering 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 Global Engineering course and the certificate’s key learning outcomes. This course should explore how your specific discipline engages with Global Engineering 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. Your local EWB chapter will have done an audit to identify the course(s) that meet(s) this requirement.

* 1. **Project-based course activity**

In order to begin practicing Global Engineering 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 Global Engineering course. The project should be for an engineering course and should be a collaborative/team project. The integration of Global Engineering 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/work to produce the components that are specifically related to Global Engineering concepts.

The project-based component of the certificate program is targeted at learning outcomes ***2-Capability of practicing leadership and interdisciplinary skills*** and ***4-Ability to apply technical skills in a global context***.

In extenuating circumstances, credit for this component can be given for course projects completed individually or projects in courses outside of engineering. If you need to explore this option, please contact the GEC Lead at your school (see *Appendix A* for contact information).

1. **Co-curricular/experiential activities**

It is one thing to be well-versed in the topics of Global Engineering in the classroom. It is completely different to engage with the topics of Global Engineering in practice and to apply the skills required in the real world! The GEC requires that you accrue 120 hours of direct application of Global Engineering skills in Global Engineering fields.

Your experience can come from diverse sources but needs to tie back to the key learning outcomes for the GEC and the topics discussed in the intro to Global Engineering 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.

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 Global Engineering 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 Global Engineering related work.

The experiential Global Engineering practice may touch on all of the learning outcomes but should definitely have relevance to learning outcome ***2-Capability of practicing leadership and interdisciplinary skills***

If you are uncertain whether your experience fits within the expectations of this component of the requirements, please contact the GEC Lead at your school to confirm (see *Appendix A* for contact information).

1. **Written assignments**
	1. **Introduction to Global Engineering essay (1500 words)**

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 write 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.

If you have a class assignment that meets the criteria for the Intro to Global Engineering essay, you may use that assignment in your portfolio.

Essays will be evaluated on the depth of thought and research offered in the chosen topic, focusing on learning outcomes ***1-Awareness of globalization and its impact on engineering practice*** and ***3-Competency in exploring complex social issues****.* Maximum length is 2000 words.

* 1. **Discipline-specific reflection (500-1000 words)**

Please complete a 500-1000 word 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?

If you have a class assignment that fulfills the criteria for discipline-specific reflection, you may use that assignment in your portfolio.

Reflections will be evaluated based on the depth of thought and reflection and are specifically related to learning outcomes ***3-Competency in exploring complex social issues*** and ***4-Ability to apply technical skills in a global context***.

* 1. **Three (3) experiential global education practice reflections (500-1000 words each)**

The experiential Global Engineering practice is meant to challenge you to engage with the concepts covered throughout the Global Engineering certificate in the “real world”. To show us how that went, please write up three (3) separate reflections of 500-1000 words each addressing three of the five reflection questions provided below.

* 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?
* 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?
* 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 Global Engineering solution?
* 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.
* 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 Global Engineering topics within a “real-world” context.

**GEC portfolio – what you need to submit**

REMINDER: Your completed portfolio including all components must be submitted by May 1 of your year of graduation.

The following items must be included in your portfolio:

1. **Courses**
* **Transcripts (student copies acceptable) or other official record of 3 completed courses (Intro to Global Engineering, Discipline-based, Project-based) with minimum grade of 75% + completed course tracking spreadsheet (Appendix B) outlining which courses meet which requirements.**
* **Project-based documentation**

In order to confirm that the project-based component has been fulfilled, please submit a copy or section of your project that illustrates how your project utilizes Global Engineering concepts. This could include a report or section of a larger report, poster presentation, or other format your project takes on. The key is to submit your project either in whole or in part such that it can be evaluated for its relevance to the key Global Engineering learning outcomes.

In the case that your project does not easily fit into a portfolio (eg. if your final submission consisted primarily of a piece of hardware with no substantive report or presentation affiliated with it), please contact the GEC Lead at your school to confirm (see *Appendix A* for contact information).

1. **Co-curricular/experiential activities**
* **Completed spreadsheet (Appendix C) detailing your various roles and responsibilities in completing your 120 hours of experiential Global Engineering practice**.

As described above, 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 Global Engineering 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, but only those hours that directly relate to the key learning outcomes should be counted.

* **Reference letter(s)**

Reference letter #1 from an individual who supervised your Global Engineering practice. Only this one reference letter is required if you completed all your hours at one organization. Two reference letters are required if you completed your hours at more than one organization. Reference letter #2 can be from a supervisor, co-worker, or other source.

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 give your referees a copy of this letter when you ask them for a reference so that they address the questions asked of them.

Reference letters will used to confirm the appropriateness of the practical experience hours as representative of work that falls within the Global Engineering realm. Reference letters are also intended to facilitate your receiving feedback that supports your ongoing learning and growth.

1. **Written assignments**

See above for instructions.

* **Introduction to Global Engineering essay (1500 words)**
* **Discipline-specific reflection (500-1000 words)**
* **Experiential global education practice reflection #1 (500-1000 words)**
* **Experiential global education practice reflection #2 (500-1000 words)**
* **Experiential global education practice reflection #3 (500-1000 words)**

**GEC portfolio – how to submit**

Please compile your documents into **one complete pdf file** and email to globalengineeringinitiative@gmail.com.

**APPENDIX A: School specific information**

**Memorial University of Newfoundland**

GEC Lead: Nathan Power <nfpower@mun.ca>

Courses that fulfill GEC requirements:

|  |  |  |
| --- | --- | --- |
|  | Course Number | Course Name |
| * 1. **Introduction to Global Engineering course**
 | Engineering 8151 | **Technology, Society, and Sustainable Development** |
| * 1. **Discipline-specific course covering Global Engineering topics**
 | Process 6651 | **Sustainable Engineering in Processing Industries** |
| Naval 7000 | **Ocean Systems Design** |
| Electrical 7856 | **Renewable Energy Systems** |
| Civil 6749 | **Construction Planning Equipment and Methods** |
| Mechanical 8984 | **Sustainable Energy Systems** |
| * 1. **Project-based course activity**
 |  |  |

**University of British Columbia**

GEC Lead: Alex Gonzalez <ge.ubc.ewb@gmail.com>

Courses that fulfill GEC requirements:

|  |  |  |
| --- | --- | --- |
|  | Course Number | Course Name |
| * 1. **Introduction to Global Engineering course**
 | APSC 262 | **Technology and Society II** |
| APSC 263 | **Technology and Development** |
| APSC 461 | **Global Engineering Leadership** |
| CIVL 200 | **Engineering and Sustainable Development** |
| * 1. **Discipline-specific course covering Global Engineering topics**
 | CHBE 484 | **Green Engineering Principles and Applications for Process Industries** |
| CHBE 485 | **Air Pollution Prevention and Control** |
| CIVL 202 | **Civil Engineering II** |
| CIVL 305 | **Environmental Impact Studies** |
| CIVL 408 | **Geo-Environmental Engineering** |
| MINE 486 | **Mining and the Environment** |
| * 1. **Project-based course activity**
 | APSC 462 | **Global Engineering Leadership Practicum** |
| APSC 486 | **New Venture Design** |
| APSC 496 | **Interdisciplinary Design Project** |
| Capstone Projects |  |

**APPENDIX B: Course Tracking Spreadsheet**

*Please include this form with your transcript*

|  |  |
| --- | --- |
| Name |  |
| University |  |
| Discipline |  |
| **GEC Course requirement:** | **Course taken to fulfill requirement (include course number and name):** |
| Introduction to Global Engineering or equivalent |  |
| Discipline-specific course covering global engineer topics |  |
| Project-based course or activity that explores one or more of the topics from the Introduction to Global Engineering course |  |

**APPENDIX C: Experiential Global Engineering practice tracking spreadsheet**

|  |  |
| --- | --- |
| Student |  |
| University |  |
| Discipline |  |
|  |
| Organization | Role(s) | 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 Certificate (GEC) team. The GEC 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 modern engineers increasingly operate. Topics covered in the Global Engineering 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 GEC and this letter provides some framing for what we are looking for in a reference letter. To help us in our assessment of the student’s Global Engineering experience, we asking that your letter kindly 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 Global Engineering 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

**APPENDIX E: GEC Learning Outcomes**

**Program-level Learning Outcomes**

* Awareness of globalization and its impact on engineering practice
* Competent in exploring complex societal issues
* Capable of performing leadership roles in interdisciplinary work environments
* Ability to apply technical skills in a global context

**Introductory Course Learning Outcomes**

* Be able to perform a critical analysis of engineering practice in a globalized world
* context.
* Be able to form opinions on how technology contributes to changes in society and vice-
* versa.
* Demonstrate knowledge of the historic and present role of engineers in global systems
* Possess a functional understanding of globalization and development as complex
* systems,
* Understand the role of engineering in systemic change
* Be aware of systemic failures in technical and societal systems
* Be able to evaluate and make decisions on technology, policy, and processes as leverage
* points for systemic change.

**Discipline-specific Course Learning Outcomes**

* Be equipped with a foundation to apply their technical skills in a global context
* Develop knowledge of the role of electrical/civil/chemical/mechanical engineers in
* global systems
* Understand system level design to develop appropriate engineering projects in a
* globalized context.
* Possess competency in exploring complex disciplinary technical problems
* Have knowledge of appropriate discipline specific tools for the engineering design in
* different international contexts.

**Interdisciplinary Project Learning Outcomes**

* Practice their awareness of globalization and its impact on engineering projects
* Demonstrate leadership and interdisciplinary team skills
* Practice and apply disciplinary technical skills in a Global Engineering project
* Demonstrate effective communications
* Develop an understanding the dynamics present within a team, risk management,
* diagnosing common project problems
* Knowledge of Global Engineering Projects, and common attributes of successful and
* unsuccessful projects.

**Co-curricular Experience Learning Outcomes**

* Develop leadership skills including communication, listening, global collaboration, and
* ethics; an ability to participate in, foster and motivate teams, and a willingness to seize
* new opportunities.
* Demonstrate the ability to develop and iterate on plans based on identified goals and
* objectives, and to foster innovation.
* Demonstrate ability to monitor and reflect on personal leadership and progress.
* Deepen understanding and appreciation of the complexity and value found in
* connections with team members.
* Participate in building a community for Global Engineering leaders to connect and learn
* together.
* Develop the Core Competencies of a leader

Students will demonstrate:

* Commitment
	+ having the energy, ability, and determination to serve a group and its goals
* Congruence
	+ understanding the connection between own values and those of the group
* Emotional Intelligence
	+ being self-aware of the values, attitudes, and beliefs that motivate him/her to act and commit
* Collaboration
	+ working with others towards a common goal while sharing responsibility,
	+ accountability, and knowledge
	+ having the ability to increase group effectiveness by capitalizing on and
	+ nurturing various perspectives, viewpoints, and talents, and using these
	+ various perspectives, viewpoints, and talents to the benefit of the group
	+ as a whole
* Common Purpose
	+ reevaluating and adjusting strategy and goals based on the changing
	+ needs of the individual/group
* Community
	+ having the ability to recognize the systemic lens of contributions to the
	+ group/organization on a local to international level
* Change
	+ demonstrating the importance of making a better society and world for
	+ oneself and others
	+ demonstrating individuals and communities are capable of working
	+ together to create change