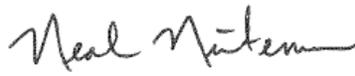


George Fox University, College of Engineering
Grand Challenges Scholar Program - Proposal

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Grand Challenge Scholar Program Vision:

George Fox University is a Christ-centered community which prepares students spiritually, academically, and professionally to think with clarity, act with integrity, and serve with passion. The vision of the College of Engineering is for our students to become world change agents who creatively integrate the fundamentals of engineering and a robust liberal arts foundation into their future careers in the engineering workforce, entrepreneurial activities, global and social enterprises, and applied research. For this reason, we are excited to embrace a systematic program which will empower our students to address The National Academy of Engineering's fourteen Grand Challenges, which represent some of the most important and complex issues facing our world in the 21st century. Solving these grand challenges will require the best efforts of our faculty and students as they apply their knowledge, expertise and creativity, with a variety of other experts in global and social issues. Already, our faculty and students are addressing many of these challenges through our curricular programs, research efforts, Servant Engineering and Senior Design projects. We introduced George Fox engineering students to the Grand Challenges during the 2014-2015 academic year through our freshman course sequence in Engineering Principles, as well as through our engineering student advisory board. For the 2015-2016 academic year, our goal is to summon our students to action by implementing a Grand Challenge Scholar Program. The vision of the George Fox College of Engineering Grand Challenge Scholar Program is to teach, shape, and send our students out as change agents, prepared to lead the charge in addressing the Grand Challenges.

Selection of GC Scholar Apprentices:

To apply for the Grand Challenge Scholar Program at George Fox, students must meet the following criteria by the designated application deadlines in the fall or spring semester (Oct. 15 and Feb. 15, respectively):

- 1) Be at least a sophomore¹ engineering or computer science major in the College of Engineering at George Fox University with a cumulative GPA of 3.2 (Note: students with GPA's below 3.2 may still apply for provisional acceptance via a petition process);
- 2) Submit a completed Plan of Study which includes a personal essay, a recommendation letter from the proposed GC Faculty Mentor, and a proposed GC Curricular Plan encompassing the five required GC curricular components (see Appendix A).

The GC Steering Committee² will review all applications each semester and recommend students for admission to the program, based on space (up to a maximum of 20 students can be enrolled in the program at any time). Applications will be processed and the accepted students will be notified no later than Nov. 1 (fall applications) and Mar. 1 (spring applications).

¹ Sophomore standing is defined as enrolled in sophomore-level or higher engineering or computer science courses as listed on the appropriate official curriculum map.

² The GC Steering Committee will consist of the GCSP Director, the Dean of Engineering, the Engineering Projects Director, one tenured faculty member from each of the three departments in the College of Engineering, and at least one other tenured faculty member from both the College of Arts and Sciences and the College of Business.

Program Continuance and Completion:

To remain in the program a GC Scholar Apprentice must maintain a 3.2 GPA and meet at least once a semester with their GC Faculty Mentor and the GC Director to review their progress and Curricular Plan. By May 1 of each academic year, each GC Scholar Apprentice must submit a progress report to their GC Faculty Mentor to be forwarded to the GC Steering Committee, outlining their accomplishments for the past academic year and a detailed plan for the upcoming academic year.

At the completion of all activities outlined in their Curricular Plan and required by the GC Program (and no later than the twelfth week of their final semester), each GC Scholar Apprentice must:

- 1) submit their ePortfolio to the GC Steering Committee through their GC Faculty Mentor (see Appendix B);
- 2) submit a letter of recommendation from their GC Faculty Mentor to the GC Steering Committee confirming that they have satisfactorily completed the program requirements;
- 3) complete a capstone presentation to present and share information about their scholarship and project experiences. The presentations will be given at the annual Spring Engineering Expo which occurs in the final week of the spring semester and is attended by current students, faculty and administrators as well as prospective high school students, alumni, industrial advisory board members, and senior design project sponsors.

Upon successful completion of these activities, the GC Scholar Apprentice will be named a George Fox College of Engineering Grand Challenge Scholar (GFCEGCS).

The Five Grand Challenges Curricular Components:

Each GC Scholar Apprentice must develop a Curricular Plan which satisfactorily addresses each of the following components:

- 1) **Research Experience** – Each GC Scholar Apprentice must participate in an approved team or independent senior capstone research or design project (e.g. GEED 490, or ENGR 481 & 482), **or** independent Richter, Holman, Industry sponsored (or other) research project related to a GC theme or problem.
- 2) **Interdisciplinary Curriculum** – Each GC Scholar Apprentice must satisfactorily complete the following courses:
 - a. the integrated interdisciplinary freshman Engineering Principles curriculum (ENGR 151*, 152*) along with the corresponding integrated mathematics (MATH 201,202, 301) and science (CHEM 211, PHYS 211, PHYS 212) courses; *CSIS 201 and CSIS 202 for Computer Science majors
 - b. an approved set of four Social Science and Humanities electives (or independent study course) related to student's focus Grand Challenge;
 - c. **one** of the following courses:
 - i. BUSN 360 Business Law, or
 - ii. ECON 340 Public Economics, or
 - iii. SOCI 373 Social Theory, or
 - iv. INTL 230 Introduction to International Affairs

3) **Entrepreneurship** – Each GC Scholar Apprentice must fulfill **one** of the following entrepreneurship components:

- a. Identify and complete a GC-related entrepreneurial project* in ENGR 381 and 382, or ENGR 481 and 482; or
- b. Complete the Entrepreneurship I and II courses (ENTR 300 and 400); or
- c. Participate in George Fox's University Innovation Fellows Program (UIF) leadership circle (via Stanford Epicenter, for one academic year).

* An entrepreneurial project must utilize the Business model canvas (BMC) which includes developing a value proposition, customer identification, cost structure, and the development of a minimum viable product (MVP).

4) **Global Dimension** – Each GC Scholar Apprentice must satisfactorily complete **one** of the following:

- a. a George Fox University Juniors Abroad* or International May Serve trip**;
- b. an [approved international study program](#);
- c. an internship with a significant global focus;
- d. a research experience with a significant global focus; or
- e. complete INTL 200 (Cultural Geography/Global Relations) **and** one of the following courses:

ECON 370 (Global Political Economy), ECON 461 (International Trade), GBSN 300 (Global Business), SOCI 300 (Cultural Anthropology), PSCI 380 (American Foreign Policy), INTL 440 (World Religions), HIST 340 (History of the Middle East), PSCI 460 (Peace Theory), PSCI 253 (Introduction to Comparative Politics).

* An existing travel-subsidized course (GEED 365) that offers a variety of cross-cultural study tours designed to enhance the intercultural and international awareness of the student and to gain appreciation for various cultural perspectives different from the students' own. Each individual course includes in-depth study from a variety of perspectives, such as the fine arts, religion, language, natural or behavioral science or history. The course includes class meetings followed by travel to various locations throughout the world where students interact with the local culture through informal and formal contacts. (<http://www.georgefox.edu/off-campus/juniors-abroad/>)

** May Serve is a three- to four-week-long ministry, missions and awareness trip during which students work with the people and culture of a specific country. (<http://www.georgefox.edu/off-campus/may-serve.html>)

For each of these options, students must submit a justification for how their selection will help them cultivate an enhanced global awareness in their chosen field.

- 5) **Service Learning** – Each GC Scholar Apprentice must satisfactorily complete the Servant Engineering I and II curriculum, ENGR 381, 382*

* In the Servant Engineering sequence, students apply their knowledge and design skills gained through the coursework to a variety of service engineering projects. Students will work in conjunction with not-for-profit organizations or individuals with a specific need to develop significant engineering solutions solely for the purpose of serving others.

Curricular Connectivity:

It is the GC Scholar Apprentice’s responsibility to document how their GC Curricular Plan demonstrates intellectual and thematic connectivity across the five curricular components and a Grand Challenge theme or problem.

GC Faculty Mentor:

Each GC Scholar Apprentice must have a GC Faculty Mentor to counsel and direct the completion of their Curricular Plan. At the completion of the Plan of Study, the Mentor must write a letter of recommendation to the GC Steering Committee in support of their application to be named a George Fox College of Engineering Grand Challenge Scholar. The letter must accompany the Apprentice’s final report. Faculty members from any of the engineering disciplines or computer science may serve as GF Faculty Mentors.

Summary of GC Curricular Components and GFU Requirements

GC Curricular Components	GFU Requirements	
Research Experience	GEED 490 course senior capstone research project, or independent Richter, Holman, Industry sponsored (or other) research project - related to a GC theme or problem.	
Interdisciplinary Curriculum	ENGR 151*, 152* MATH 201, 202, 301 and CHEM 211, PHYS 211, 212 *CSIS201 and 202 for CSIS majors	An approved set of four Social Science and Humanities electives (or independent study course) related to student's focus Grand Challenge, plus One of the following courses: <ul style="list-style-type: none"> • BUSN 360 (Business Law) • ECON 340 (Public Economics) • SOCI 373 (Social Theory) • INTL 230 (Introduction to International Affairs)
Entrepreneurship	GC-related entrepreneurial project in ENGR 381 and 382, or ENGR 481 and 482	
	Or	
	Complete the Entrepreneurship I and II courses (ENTR 300,400)	
	Or Participate in George Fox's University Innovation Fellows Program (UIF)	
Global Dimension	George Fox University Juniors Abroad or Int'l May Serve Program	
	Or	
	Approved International Study Program	
	Or	
	Internship with significant global focus	
	Or INTL 200 (Cultural Geography/Global Relations) and one of the following courses: <ul style="list-style-type: none"> • ECON 370 (Global Political Economy) • ECON 461 (International Trade) • GBSN 300 (Global Business) • SOCI 300 (Cultural Anthropology) • PSCI 380 (American Foreign Policy) • INTL 440 (World Religions) • HIST 340 (History of the Middle East) • PSCI 460 (Peace Theory) • PSCI 253 (Introduction to Comparative Politics) 	
<i>For the selected Global Dimension option a justification must be submitted explaining how the proposed study program/internship/research experience/two courses will help cultivate an enhanced global awareness in the chosen field.</i>		
Service Learning	ENGR 381 and ENGR 382 Servant Engineering I and II	

Assessment and Tracking of GC Scholar Apprentices:

- a) National Level – The GC Director will participate in the electronic community and attend workshops and GCSP summits, as budgets permit. In addition an annual report of programmatic accomplishments will be submitted to the GCSP.
- b) Institutional Level – The GC Director and GC Steering Committee will establish the GC Curriculum, select students on a semester basis, communicate with students on a semester basis (one required meeting and e-mails), and monitor student progress with the assistance of GC Faculty Mentors (one per GC scholar). At the end of each academic year, during their graduation check, students who have successfully completed the program will be approved the director. In addition, the GC Director will compile the names and accomplishments of students who receive the Grand Challenge Scholar designation upon graduation and convey the information to the national steering committee as part of the required annual report. The GC Steering Committee will also assist with longitudinal tracking of GC Scholars in cooperation with the national steering committee and NAE through web-based surveys.

Promotion of Early Student Engagement in GC-Related Activities:

To promote early student engagement in GC-related activities, the GC Program will be introduced to all freshman engineering majors in the required freshman Engineering Principles (ENGR 151, 152) courses and in CSIS 201 and CSIS 202 for all freshman computer science majors. Also, recruiting materials for future and current students will be developed for dissemination and web-publication on the George Fox College of Engineering Grand Challenge Scholars Program website (<http://www.georgefox.edu/ceng/gcscholars>).

Appendix A - Grand Challenge Scholar Program (GCSP) Plan of Study Form

Student Name: _____ Major: _____

Faculty Mentor: _____ Completed Credit Hours _____

Select the Grand Challenge theme(s) of interest for your Plan of Study from the following list:

Energy and Environment

- Make solar energy economical
- Provide energy from fusion
- Develop methods for carbon sequestration
- Manage the nitrogen cycle
- Provide access to clean water

Health

- Advance health informatics
- Engineer better medicines

Security

- Prevent nuclear terror
- Secure cyberspace
- Restore urban infrastructure

Learning and Computation

- Reverse engineer the brain
- Enhance virtual reality
- Advance personalized learning
- Engineer the tools of scientific discovery

List one or more potential research projects and explain briefly how they align with your selected Grand Challenge theme(s).

Identify which mechanism you are likely to use to implement your Grand Challenge research project (senior design, independent research, summer research, internship).

Identify which interdisciplinary course (see list) you will take in addition to the integrated math and science curriculum, and describe how that course aligns with your Grand Challenge theme.

Describe the entrepreneurship components of your proposed research project and/or confirm that you will be taking ENPR 300 and 400 to fulfill this GC program component.

Identify how you plan to include a global dimension in your Plan of Study that aligns with your selected Grand Challenge theme. The global dimension component can be fulfilled by selecting a Grand Challenge research project with a significant global perspective, participating in a study abroad program, or by selecting at least 6 semester-hours of global perspective courses (see suggested list).

Describe a proposed service learning experience in your Plan of Study that aligns with your Grand Challenge theme. Identify the specific service learning activity and expected learning outcomes, and explain how this activity aligns with your Grand Challenge theme.

Attach the following documents to your GCSP Plan of Study:

- ✓ Personal essay addressing the question, "Why do you want to be a Grand Challenge Scholar?"
- ✓ Current transcript(s)
- ✓ Faculty Mentor letter of recommendation

Appendix B - Grand Challenge Scholar Program (GCSP) ePortfolio Guide

Each Grand Challenge Scholar Program (GCSP) student must work with their faculty mentor and the GCSP Director to complete an ePortfolio providing evidence of satisfactory achievement of the five GCSP components. Students must submit the final ePortfolio as a continuous single .pdf file to the GCSP Director and Steering Committee for approval. All ePortfolios must contain the following sections in the noted order:

1. **Cover Page:** Include the University name, your name and major, selected GCSP theme and research project title, the name of your faculty mentor, and the date of submission.
2. **Research Report:** Include a research report that describes your project objective, methodology, and outcomes. At a minimum, your report must include the following sections: Introduction and Background, Methodology, Results, Discussion, Conclusions, Future Recommendations, and References.
3. **Interdisciplinary Component:** Document how you achieved the interdisciplinary component of your Plan of Study. For courses, include a syllabus and example course materials that illustrate how your interdisciplinary learning experience relates to your GCSP theme. Include evidence of any strong thematic interdisciplinary outcomes from your research project.
4. **Entrepreneurship Component:** Document how you achieved the entrepreneurship component of your Plan of Study. For courses, include a syllabus and example course materials that illustrate how your entrepreneurship learning relates to your GCSP theme. Include evidence of any entrepreneurship component in your research project, such as taking your project idea to market and/or developing a business model canvas, launching a Kickstarter or Indiegogo campaign, etc.
5. **Global Dimension Component:** Document how you achieved the global dimension component of your Plan of Study. For courses, include a syllabus and example course materials that illustrate how your global dimension learning relates to your GCSP theme. Include evidence of any strong thematic global dimension in your research project and/or a study abroad experience.
6. **Service Learning Component:** Document how you achieved the service learning component of your Plan of Study. Provide evidence of what you learned through your service activity and show how this experience relates to your GCSP theme.
7. **Overall GCSP Outcome Evaluation:** Reflect on your overall GCSP experience. Discuss how your research project, study abroad, service learning experiences, and coursework helped you achieve the GCSP goals in each five components. Cite specific examples and evidence included in your portfolio demonstrating your achievement of the GCSP goals. Discuss the connectivity across the five components addressing your Grand Challenge theme. Note any components not well achieved by your experience in the GCSP. State your overall opinion of your GCSP experience and how the GCSP could be improved.