

Miami University

# Grand Challenge Scholars Program Proposal

College of Engineering and Computing

Approved by

Marek Dollár, Ph.D., D.Sc.

Dean, College of Engineering and Computing

Submitted by

Douglas Troy, Ph.D.

Graduate Program Director

College of Engineering and Computing

106 Benton Hall

Miami University

Oxford, OH 45056

513-529-0350

## Contents

1. Vision.....	2
1.1 Introduction.....	2
1.2 Vision for a Grand Challenge Scholars Program.....	2
1.3 Existing and planned GC-related activities.....	6
1.4 Program administration.....	9
1.5 Program funding.....	9
2. Grand Challenge Scholar Selection and Support .....	9
2.1 Anticipated number of students involved.....	9
2.2 Selection of a diverse cohort of students .....	9
2.3 Selection and training of faculty mentors .....	11
2.4 Assisting students with completing the GCSP requirements .....	11
3. Execution and Completion of the Five Grand Challenge Components .....	12
3.1 Learning Outcomes .....	12
3.2 GCSP Curriculum Framework .....	12
4. Assessment and Tracking of Grand Challenge Scholars.....	13
4.1 Assessment and tracking.....	13
4.2 Promotion of early student engagement in GC-related activities.....	13
4.3 Fostering intramural and extramural networking among GC scholars .....	14
Appendix A Faculty Research in the Grand Challenges .....	16
Appendix B Application Form .....	18
Appendix C Example Plan of Study.....	19

## 1. Vision

### 1.1 Introduction

[Miami University](#) is a public residential university with faculty who are dedicated to learning and discovery. The main campus in Oxford, Ohio (35 miles north of Cincinnati) encompasses 2,138 acres and enrolls approximately 16,000 undergraduates and 2,250 graduate students. Regional locations include Hamilton, Middletown, and West Chester, Ohio, enrolling about 5,000 students combined. About 230 students per year study at Miami's [European Center in Luxembourg](#).

The [College of Engineering and Computing](#) (CEC) is one of six academic divisions at Miami University and is organized into four departments:

- Chemical, Paper and Biomedical Engineering
- Computer Science and Software Engineering
- Electrical and Computer Engineering
- Mechanical and Manufacturing Engineering

Housed within the four departments are ten undergraduate majors and four master's degree programs. Enrollment is approximately 2,000 undergraduates and 80 graduate students. The faculty is made up of approximately 60 full-time individuals.

Liberal education is at the heart of all of Miami's undergraduate programs. Immersing students in both academic and co-curricular experiences has enabled Miami to achieve a top-tier national ranking among universities that provide the best student outcomes. For example, [2016 U.S. News & World Report rankings](#) recognize Miami as the number one public university in the United States in the category of "Strong Commitment to Undergraduate Teaching." Only 19 national universities are noted for such commitment. Miami has appeared on this short, elite list since the inaugural year of the rankings in 2009, and has been in the top three among public universities for six years in a row.

### 1.2 Vision for a Grand Challenge Scholars Program

The following five major components, summarized in Figure 1, comprise the vision for our program:

- **Grand Challenge Scholar in Residence and Colloquium:** Each semester brings an individual with experience in a Grand Challenge theme to campus to interact with students and the university community.
- **Grand Challenge Experience Course:** Scholars enroll continuously in this course as an accounting mechanism to assure their participation in the program, monitor progress, and assess outcomes.
- **Grand Challenge Curriculum Framework:** Framework of requirements that address the five Grand Challenge program components.
- **Grand Challenge Steering Committee:** Committee that manages, monitors, and assesses the program.
- **Grand Challenge Peer Mentors:** Experienced GC scholars who provide resources and support to entering GC scholars through networking and will be a source of feedback to the Steering Committee.

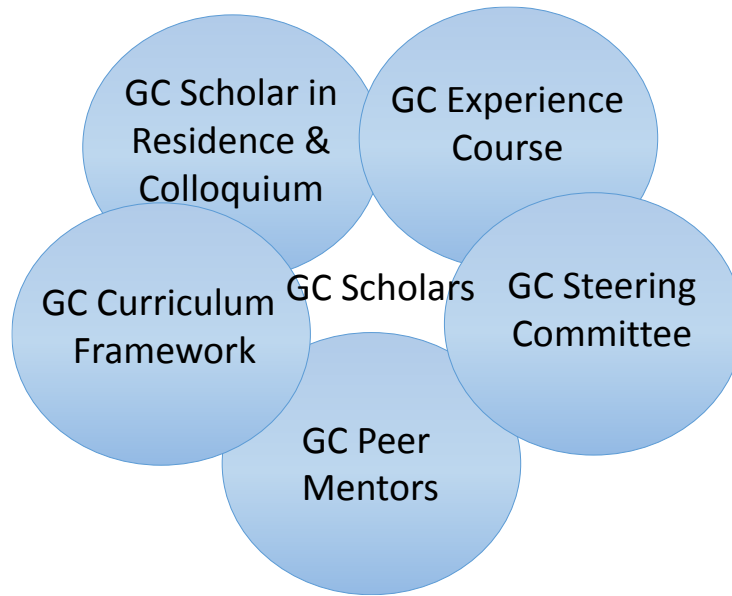


Figure 1. Vision for Miami University Grand Challenge Scholars Program.

Each component is described below.

Grand Challenge Scholar in Residence Program and Colloquium Series

The purpose of the GC Scholar in Residence Program is to:

1. Enrich the student’s experience within the GCS program components of research, engineering-plus curriculum, entrepreneurship, global dimension, and service by engaging students with outside experts.
2. Build community amongst the GCSP participants.
3. Raise awareness of the Grand Challenges in the university community and bring visibility to the Grand Challenge Scholars Program.
4. Assist the GC Steering Committee with assessment of the program.

The goals are elaborated below.

Goal 1 Enrich the student’s experience: The GC Scholar in Residence program will bring to campus, once each semester for two to four day visits, individuals who possess significant experience related to a Grand Challenge. These could be researchers, engineers, entrepreneurs, and leaders from business, government, non-governmental organizations (NGOs), or others working in a GC area. Visitors will meet with students in small groups, panel sessions, and one-on-one sessions, to address:

- Current research and challenges in addressing one or more GC problems.
- Challenges in working at the boundary of engineering and non-engineering disciplines, for example, business or entrepreneurial challenges in bringing solutions to market.
- Global dimensions, in practice, of the Grand Challenges.
- The role of NGOs or not-for-profits solving the Grand Challenges.
- Other relevant topics such as professional ethics, unintended consequences, responsible conduct or other topics in the visitor’s area of expertise.
- Provide advice and counseling to students on their GC projects and career plans.

Goal 2 Build community amongst the GCSP participants: Visitors will attend social events and meals with students, faculty mentors, and Grand Challenge Steering Committee members. All GC students will have the opportunity to participate in social gatherings and meals to help to build informal networks and strengthen the GCSP community.

Goal 3 Raise awareness of the Grand Challenges in the university community: The Grand Challenge Colloquium Series will be a university-wide talk, delivered by the Grand Challenge Scholar in Residence, related to the Grand Challenges. The colloquium series will serve to raise awareness of the Grand Challenges, and the GCSP, in the university community.

Goal 4 Assist with assessment and external review: Advise the GC Steering Committee on major issues and challenges in research, engineering, business, etc., related to the Grand Challenges and review selected GC capstone and research projects to provide feedback to the students and the steering committee on quality and applicability.

The Grand Challenge Scholar in Residence will be a joint program administered by the College of Engineering and Computing with support from other university offices such as Career Services, Alumni Relations, and Advancement.

#### CEC 140 Grand Challenge Experience Course

CEC 140 Grand Challenge Experience course is a zero credit-hour course required of all GC scholars as long as they are enrolled in the program<sup>1</sup>. The course is an accounting device to assure that all GC students meet particular non-course requirements such as submission of progress reports, submission of reflections, participation in the GC Scholar in Residence program, and participation in the peer mentor program. Progress reports and reflections are used for monitoring and assessment of individual student's progress, encouraging thematic connectivity across the students' experiences in the program, and for collecting data to assess the program as a whole.

GC students enroll in the course continuously (fall and spring semesters) and must maintain a passing grade to remain in the program. A passing grade requires completion of the non-course requirements that include:

- Participation in the Grand Challenge Scholar in Residence Program through attendance at presentations, seminars, meals, and other events.
- Attend required presentations such as capstone or research presentations.
- Each semester (fall and spring) submit a progress report, updated GCS plan of study, and reflection to the GCSP Steering Committee:
  - Progress reports will include any changes to the plan of study which must be approved by the GCSP Steering Committee.
  - Reflections will address how completed experiences connect with the scholar's grand challenge theme.

The GCSP Steering Committee will use student's progress reports and reflections to monitor progress toward completion of plans of study, identify possible areas where intervention is needed, and to assess overall effectiveness of the program

---

<sup>1</sup> 140 is the tentative course number, pending final assignment by the university.

### Grand Challenge Scholars Program Curriculum Framework

To assure that each GC scholar's experience is deep, broad, and coherent the following framework is used (see section 3 for specific requirements):

- Breadth: Each student will fulfill the minimum requirements in three of the following four areas:
  - Grand challenge research or project
  - Entrepreneurship
  - Global dimension
  - Service learning
- Depth: Each student will fulfill the depth requirement for the fourth area of the above.
- Interdisciplinary Component: Each student will identify at least one additional [Global Miami Plan](#) course to help develop their ability to work at the boundary between engineering and non-engineering disciplines.
- Component Connectivity: Students will enroll continuously in CEC 140 Grand Challenge Experience course which requires participation in the GC Scholar in Residence program, the peer mentor program, and regular progress reporting and reflection. Participation in the GC Scholar in Residence program will bring students into conversations regarding issues such as unintended consequences, responsible conduct in research, and professional ethics.

In their application each student will identify a Grand Challenge theme or problem of interest and will propose a plan of study to fulfill the framework outlined above (please see section 3 for detailed plan of study requirements). Proposed plans will be reviewed by the GC Steering Committee to assure continuity and connectivity to the student's Grand Challenge. Subsequent plan changes must be approved by the GC Steering Committee to assure continuing thematic continuity and connectivity.

### Grand Challenge Scholars Program Steering Committee

The program will be administered by the Grand Challenge Steering Committee composed of:

- GCSP Director, appointed by the Dean of the College of Engineering and Computing.
- One tenure-line faculty member from each of the four departments in the College of Engineering and Computing.
- Four GCSP students who will be recruited for diversity in terms of discipline and demographics.
- Other appointees at the discretion of the Dean such as staff from supporting organizations, for example the Office of Career Services.

The GCSP Steering Committee will be responsible for ongoing operation and assessment of the program including recruiting, processing applications, coordination of the GC Scholar in Residence Program, monitoring and assessing of the students and the program.

The GCSP Director is responsible for leading the program and chairing the steering committee. The director is also responsible for compiling the names and accomplishments of students who

receive Grand Challenge Scholar designation upon graduation and reporting this information to the national steering committee.

### Grand Challenge Scholars Program Peer Mentors

The Grand Challenge Peer Mentor program will pair experienced GC students with new students. Mentors will have participated in the program for at least two previous semesters. Mentees will participate in the program for at least two semesters. The goal of the mentor program is to (1) act as a source of networking and support to new GCSP students and (2) provide feedback to the GCSP Director to help identify problems or roadblocks early. The GCSP Director will meet with the mentors once per semester to help prepare them for their role and to solicit feedback to help identify potential problems in the program and improve the program. Peer Mentors may also assist with several of the intramural networking initiatives (such as social media presence) described in section 4.3.

## **1.3 Existing and planned GC-related activities**

### Global Miami Plan (interdisciplinary curriculum)

The liberal education core, called the [Global Miami Plan](#), is required of all undergraduates and is summarized as follows.

Academic Foundation:

- I. [English Composition](#) (3 credits)
- II. [Creative Arts, Humanities, and Social Science](#) (9 hours)
  1. Arts (3 hours)
  2. Humanities (3 hours)
  3. Social Science (3 hours)
- III. [Global Perspectives](#) (6 hours)
  1. Study Abroad OR
  2. Global Courses
- IV. [Natural Sciences](#) (6 hours)
  1. Biological Science (3 hours)
  2. Physical Science (3 hours)
- V. [Mathematics, Formal Reasoning, or Technology](#) (3 hours)

### Intercultural Perspectives (3 credits)

Each student must complete a course with this designation. These courses prepare students for effective citizenship in a diverse multicultural society in the US or beyond by helping students to recognize new perspectives about their own cultural rules and biases.

### Advanced Writing Course (3 credits)

Each student must complete a course with this designation. Most Engineering and Computing students complete ENG 313 Technical Writing.

### Experiential Learning Requirement (0 or more credits)

This requirement can be met through a Global Miami Plan course or course(s) in the major (at the lower or upper-division level) that has been approved for this requirement. Some of the approved courses include designated service-learning courses, credit- and non-credit-bearing internships, independent studies that involve significant independent work focusing on research and including a presentation, lab, or archive component.

### Service learning

Miami University, through its [Office of Community Engagement and Service](#), actively promotes service learning. As a result, Miami is nationally recognized for service learning. Miami was one of 361 universities to receive the prestigious Carnegie Classification for Community Engagement in 2015. As a recipient of this classification, Miami will be included in the announcement of the newly classified and re-classified campuses from the 2015 cycle. The classification is effective for 10 years. Miami has been named to The President's Higher Education Community Service Honor Roll every year since 2007. In 2012, Miami was recognized as one of only five recipients of The Presidential Award (Special Focus: Early Childhood Education). And in 2013, Miami was named to the Honor Roll with Distinction.

### Study abroad

Miami is recognized as a national leader in [Study Abroad](#) opportunities. In the latest Institute for International Education report on the number of students studying abroad, Miami ranks 2nd among public doctoral institutions nationwide. The latest figures (2015) show approximately 42% of Miami students study abroad before they graduate.

### Entrepreneurship

The [Institute for Entrepreneurship](#) at Miami University is a distinctive, internationally-recognized program emphasizing undergraduate teaching excellence and immersive, real-world learning opportunities in the areas of social, startup and corporate entrepreneurship. Notable recognition includes:

- Entrepreneurship faculty have been awarded more than 20 distinguished teaching awards.
- Ranked "Top 25 Best Undergraduate Entrepreneurship Programs" each of the last six years by *Entrepreneur Magazine* and *Princeton Review*.
- "Best Program in Social Entrepreneurship" in 2012 by the Global Consortium of Entrepreneurship Centers (GCEC).

### Startup Weekend

The annual Startup Weekend is a 54-hour event in which interdisciplinary teams create a business model from scratch. Students are given a crash course in how to turn business concepts into viable business realities. They then work in teams to brainstorm product ideas, conduct field studies, and present their findings / models before a panel of judges. Teams are not alone. They receive guidance and support from Startup Weekend mentors, all seasoned entrepreneurs. At the end of the weekend three finalists are chosen for awards.

### Faculty research

Faculty of the College of Engineering and Computing engage in research related to the Grand Challenges. The following are the areas of greatest activity. Please see Appendix A for a list of individuals and their areas of research.

- Advance Personalized Learning
- Enhance Virtual Reality



- Engineer Better Medicines
- Engineer the Tools of Scientific Discovery
- Make Solar Energy Affordable
- Provide Energy from Fusion
- Restore and Improve Urban Infrastructure

### Internships

The Office of Career Services has a multitude of resources to assist students to align an internship with a Grand Challenge of interest. Students may use one or more resources from Career Services including:

1. [Miami CAREERlink](#) (Miami CAREERlink is a database of full-time, part-time, seasonal and internship positions filtered and maintained by Career Services)
2. College of Engineering and Computing Specific Job [Links](#)
3. LinkedIn and the [LinkedIn Alumni Tool](#)
4. [Fall Career Fair](#)
5. [Spring Internship and Career Expo](#)
6. Individualized Career Advising\*
7. Networking through Employer Information Sessions (accessible via Miami CAREERlink)
8. Online Internship search [resources](#)

\*The Office of Career Services employs a full time staff member dedicated to the College of Engineering and Computing to advise on internship search techniques, resume and cover letter review, interviewing, full time job searching, major or career exploration, and graduate school selection and application.

### Student Professional Organization Chapters in the College of Engineering and Computing

Student organizations provide a platform for leadership development and service. Currently active organizations in the College of Engineering and Computing are:

American Institute of Chemical Engineers (AIChE)  
 American Society of Mechanical Engineers (ASME)  
 Association for Computing Machinery (ACM)  
 Biomedical Engineering Society (BMES)  
 College of Engineering Student Advisory Council (CECSAC)  
 Drone Sports Club  
 Engineers without Borders (EWB)  
 Formula SAE (FSAE)  
 Institute of Electrical and Electronics Engineers (IEEE)  
 IEEE-HKN  
 Kode2Learn  
 National Society of Black Engineers (NSBE)  
 SAE Baja  
 Society of Women Engineers (SWE)  
 Tau Beta Pi  
 Technical Association of the Pulp and Paper Industry (TAPPI)  
 Theta Tau

## **1.4 Program administration**

The program will be administered by the GCSP Director and the GCSP Steering Committee (described in section 1.2). The Dean of the College of Engineering and Computing will appoint the GCSP Director and Steering Committee members. The GCSP Director is responsible for overall administration, operation, assessment, and reporting. Operational duties will include program logistics, budget management, scholar selection, and monitoring progress of scholars. Assessment duties include assessment of attainment of learning outcomes for the program.

## **1.5 Program funding**

The College of Engineering and Computing is the primary source of funding. Funding will support:

- The GCSP Director position.
- Operation of the Grand Challenge Scholar in Residence and Colloquium program.
- Funding for Grand Challenge-related capstone projects.
- Funding for undergraduate summer research.
- Clerical support for maintenance of the GCSP website, documentation, reporting, budgeting, event planning, and other operational activities.

The University's Advancement Office will seek additional philanthropic support. However, the above funding is not dependent on donor support.

## **2. Grand Challenge Scholar Selection and Support**

### **2.1 Anticipated number of students involved**

Our goal is to graduate approximately 20 scholars per year. In the steady-state we anticipate between 40 to 60 participating students spread over the sophomore through senior years.

### **2.2 Selection of a diverse cohort of students**

The selection process consists of marketing to students, soliciting applications, and selecting participants from the application pool. Any Miami University undergraduate student in good standing can apply for admission to the program. A GCSP website, hosted by the university, will be established with program requirements, the GCSP application form, model plans of study, and contact information for the GCSP Director.

We will market aggressively in the first-year courses in the College of Engineering and Computing and to the university student body. Promotional activities will include:

- Engineering Grand Challenge Scholar in Residence Colloquium: Each semester the Engineering Grand Challenge Scholar in Residence will deliver a presentation to the university community. This university-wide presentation will bring visibility to the program. The GCS Director will promote the presentation through the university's marketing and communication department and through communication with individual university departments.
- University's First Year Research Experience (FYRE) program. The GCS Program will be introduced to all students in the university-wide FYRE program. All FYRE students enroll in the course EDL 260 Undergraduate Research. A presentation in EDL 260 will allow the GCS Director and GCSP students to explain the benefits of the program to a

diverse group of highly motivated first year students and encourage application to the program.

- College of Engineering and Computing first-year experience courses:
  - The course CEC 101 Computing, Engineering, & Society is required of all Engineering and Computing (CEC) majors, approximately 550 students per year. The GCS Director and GCSP students will introduce the program to all CEC majors in this first-semester course.
  - All second-semester CEC majors complete a first year course in their selected major (CSE/ECE 102 Introduction to Computing and Engineering, MME 102 Introduction to Mechanical and Manufacturing Engineering, and CPB 102 Introduction to Chemical and Bioengineering). The GCS Director will use this course to encourage applications to the program.

The application process will require students to submit a plan of study showing how they will complete the components of the program as specified in Section 3 of this proposal, as well as a statement of purpose. Students may apply at any time during their academic career but we anticipate that most students will apply in their sophomore year in order to show a viable plan of study and requiring a minimum of three semester participation in the program.

Applications will be accepted on a rolling basis and reviewed once each semester for admission. Deadlines and announcements will be established to facilitate student's academic planning schedule.

The GCSP Steering Committee, under direction of the GCSP Director, will review applications. Applications consist of a plan of study along with an essay in which students describe their desired outcomes from participation in the GCSP program. Review criteria will include:

- A coherent plan of study that supports the student's Grand Challenge theme.
- A plan that addresses all required GCSP framework components.
- Feasibility that the plan will be completed successfully.
- Required minimum three semester participation in the program.
- The student's motivation as evidenced by their essay.

The selection process will strive for an academically strong and diverse cohort of students.

**Although we anticipate the majority of applications to come from students with STEM majors, we will review applications from any major. Potential non-STEM applicants could be students with a minor in a STEM major (e.g. a music major with a minor in computer science who wants to secure cyberspace) or those with a vision to tackle a grand challenge (e.g. an education major who wants to advance personalized learning, a graphic design major who wants to enhance virtual reality, or business major who wants to make solar energy affordable). Non-STEM applicants' plans of study must show viable engagement with their chosen grand challenge. For example, a viable way to fulfill the research requirement is to participate on an interdisciplinary capstone or research team of STEM and non-STEM majors working on their chosen grand challenge. The selection**

**process and ongoing advising (please see the next section) will assure that non-STEM majors are fully engaged in the GCSP experience.**

### **2.3 Selection and training of faculty mentors**

**Scholars' primary source of mentorship and advising throughout their GCSP experience will be the GCSP Director, assisted by the administrative assistant. Each semester, the Director will review scholars' progress reports and updated plans of study to monitor progress toward completion of the program and will provide advice as needed to guide students toward successful completion of the program.**

**In addition, faculty mentors will be those with whom students engage in either capstone or research experiences related to their GC problem.** Each department in the College of Engineering and Computing will maintain at least one ongoing Grand Challenge-related, team-oriented, capstone project. The GCSP Director will assure that these faculty mentors know the requirements for the GCSP program and GCSP students who are engaged with them in capstones or research. Appendix A shows faculty and their Grand Challenge areas of work.

### **2.4 Assisting students with completing the GCSP requirements**

Students in the program will submit a progress report and reflection each semester to the GCSP Director. The progress report will include an updated plan of study showing completed requirements, raising issues that are blocking progress, and requests for changes to the plan of study when required. The Director will review the progress reports and provide feedback or intervention as needed to keep students on track to complete the program. Please note that submission of progress reports and reflections is one requirement of the course CEC 140 Grand Challenge Experience (students must complete the requirements for CEC 140 every semester to maintain good standing in the GCS program).

The reflection is meant to create greater connectivity between the scholar's Grand Challenge theme and the other program components such as coursework, experiences, and as participation with the Grand Challenge Scholar in Residence. As they progress through the program, students will reflect on learnings from these experiences how they support their Grand Challenge theme.

The Director will provide a summary report of each student's progress to the GCSP Steering Committee each semester. Any problem areas or blockers will be discussed with the Steering Committee in order to help identify solutions to keep scholars on a successful path toward completion of the program. All changes to the plan of study must be approved by the GCSP Steering Committee.

The Peer Mentor program, described in section 1, further assists students with completing the requirements. This program is (1) a source of informal peer support and (2) a source of feedback to the GCSP Director to identify problems and roadblocks in the program itself.

### 3. Execution and Completion of the Five Grand Challenge Components

#### 3.1 Learning Outcomes

- 1. Research or Project:** Demonstrate the ability to undertake research or a capstone project related to a Grand Challenge.
- 2. Interdisciplinary Component:** Demonstrate skills in, or knowledge of, working at the boundary between technical and non-technical areas when solving a Grand Challenge.
- 3. Entrepreneurship:** Demonstrate business or market-related skills and knowledge in solving a Grand Challenge.
- 4. Global Dimension:** Demonstrate skills in, or knowledge of, global issues in solving a Grand Challenge.
- 5. Service Learning:** Demonstrate ability to work within, or knowledge of, the social context in bringing to bear solutions to a Grand Challenge.

#### 3.2 GCSP Curriculum Framework

GC curriculum framework, introduced in section 1.2, is designed to assure depth, breadth, interdisciplinary, and connectivity with the Grand Challenges. The following table elaborates the framework requirements. To assure breadth and depth each student must fulfill a depth requirement in one area and the minimum requirements in the remaining areas. In the table, multiple options are available that allow students to select one from each area that will best meet their needs.

Breadth – Minimum Experience (fulfill 3)	Depth Experience (fulfill 4 <sup>th</sup> component)
Research: GC related 3-credit (or equivalent) capstone or equivalent research experience	Research: Extended research or project equivalent to 6 credits, or summer-long undergraduate research (6 credits), or relevant internship or co-op
Entrepreneurship: 1-2-credit hour course in business (entrepreneurship, marketing, etc.) or equivalent experience such as Startup Weekend	Entrepreneurship: 6 credits relevant business coursework, or participate in a business launch, or complete an internship or co-op experience related to Grand Challenge
Global Dimension: 2-3-credit hour course from Miami plan Foundation Area II, Global Perspectives, or a significant international experience equivalent	Global Dimension: 6 credits relevant global coursework (Foundation Area II or Global Perspectives), or semester study abroad, or international internship/co-op related to Grand Challenge

Service Learning: 2-3 credit relevant service learning course or 30 hours documented active and effective service relevant to GC theme	Service Learning: 6 credits service learning courses related to GC, or multi-semester participation as both a member and leader in service organizations related to GC theme, or significant service project related to GC theme (service/projects totaling at least 80 hours)
<b>Interdisciplinary Component: Students will design a plan of study that (1) identifies a GC theme of interest, (2) addresses the above requirements, (3) includes a course or courses from the Global Miami Plan that prepares students to work at the boundary between engineering and non-engineering disciplines, and (4) relates the plan to the GC themes of interest</b>	
<b>Connectivity: Continuous enrollment in CEC 140 Grand Challenge Scholar Experience which include participation in Grand Challenge Scholar in Residence event, regular progress reporting and reflection, and the peer mentor program</b>	

Notes:

- Proposed experiences can fulfill one requirement only. For example the same Engineers without Borders project cannot fulfill both the service and global requirements.
- Students may propose alternative experiences or courses for approval by the GC Steering Committee. For example, the depth requirement may be fulfilled by completion of a relevant minor or double major.
- A minimum of three semesters participation is required.

An example plan of study is shown in Appendix C.

#### 4. Assessment and Tracking of Grand Challenge Scholars

##### 4.1 Assessment and tracking

The GCSP Director is responsible for assessment and tracking students' progress in the program. As indicated in Sections 2.4, each semester GCSP scholars will submit progress reports and reflections to the GCSP Director, who will then prepare a summary report of each student's progress for review by the GCSP Steering Committee. This will aid in tracking each student's progress and assessing the health of the overall program.

To further aid assessment of the program, the GCSP Director will solicit feedback from students, capstone and research faculty mentors, peer mentors, the GC Scholars in Residence. Using data from these sources, the GCSP Director will prepare an annual report for review by the Dean and the Executive Council of the College of Engineering and Computing (composed of department chairs, associate dean, assistant dean, and the college's administrative staff).

##### 4.2 Promotion of early student engagement in GC-related activities

As indicated in section 2.2, we will introduce the Grand Challenges to first-year students in the College of Engineering and Computing and the First Year Research Experience (FYRE)

program through presentations in classes by members of the GCSP Steering Committee and current GC scholars. In order to allow engagement of non-engineering or non-FYRE students, we will hold an advertised information session each semester approximately two weeks before the application. Moreover, recruiting materials for future and current students will be developed for dissemination as well as advertised through the world wide web on the Miami University College of Engineering and Computing website (<http://miamioh.edu/cec/>) by including a section on the Grand Challenge Scholars Program.

We will engage with on-campus student organizations that traditionally focus on Grand Challenge type issues. Examples of the student groups include Miami's Engineers without Borders chapter, The American Society of Mechanical Engineering (ASME), Society of Women Engineers (SWE), and the Institute of Electrical and Electronics Engineers (IEEE).

The Grand Challenges will also be made visible to the university community through the Engineering Grand Challenge Scholar in Residence Colloquium series. Colloquia will be advertised campus-wide in order to promote the GCSP to non-engineering students as well as those in engineering.

#### **4.3 Fostering intramural and extramural networking among GC scholars**

Extramural networking will be promoted through a variety of means including:

- **Community Engagement:** We will work through Miami University's Office of Community Engagement and Service to partner with external sources on projects. This will put the GC scholars in touch with external organizations that share their passion, potentially leading for opportunities to fulfill the service learning requirement.
- **Grand Challenge Scholar Colloquium Series:** As mentioned above, colloquia will be advertised campus-wide to encourage broad engagement across campus with anyone interested in the Engineering Grand Challenges.
- **Miami University Alumni Network:** To foster extramural networking opportunities for our GC scholars we will leverage the over 200,000 living alumni around the world that have an interest in solving the Grand Challenges our scholars are tackling.
- **Grand Challenge Scholars Alumni Conference:** Once we've graduated a reasonable amount of GC Scholars, we would like to sponsor an alumni conference, or reunion, to allow current scholars to further connect with individuals already working in the field. This could be in conjunction with the Scholar in Residence Program, depending upon logistics. Events could include networking dinners, panel discussions, or maybe even some sort of an award for outstanding alumni in effecting change in one of the grand challenge areas.
- **Miami Grand Challenge Scholars LinkedIn Group:** This is just another way to connect current and alumni grand challenge scholars in a professional setting to allow for networking or even GC exclusive jobs/internships offered by alumni members. We have a Theta Tau LinkedIn group that works very well already for this purpose.
- **Miami University Grand Challenges Scholars Public Facebook page/Twitter/Instagram:** these accounts would be used to share news and accomplishments of our scholars, give information regarding application cycles, promote or GC Scholar in residence events/programming, and other related grand challenges

articles, publications, events, etc. These pages would be open to anyone for viewing/sharing. Page would most likely be updated/monitored by one of the student representatives on the steering committee and would be integral to the recruiting of our first GC scholars.

Intramural networking will be promoted through a variety of means including:

- **Events associated with the Grand Challenge Scholar in Residence Program:** Described in Section 2, this program will bring the students together in small group discussions, panel discussions, and social interactions with the visiting Scholar in Residence.
- **Graduating Senior Research/Capstone Presentations:** Graduating GC scholars will present their research to their peers using the “Three Minute Thesis” model. The aim of the Three Minute Thesis model is to encourage students to describe concisely their research to a non-specialist audience, crystalize their thoughts about their research, and to network with other GC scholars. These presentations can potentially be scheduled as part of the Grand Challenge Scholar in Residence Program, depending on scheduling considerations.
- **Miami University Grand Challenges Scholars Private Facebook Page:** this page, only viewed by GC scholars/mentors/faculty/steering committee/etc., could be used for scholars to ask questions about their plans to fulfill their framework, questions about the reflection/reporting process, promotion of scholars/mentors only scholar in residence events, etc. Again, would most likely be monitored by a student representative of the steering committee or the peer mentor group.
- **CEC 140 Grand Challenge Scholars Experience Canvas Page:** Canvas is Miami’s Learning Management System. In order to promote (or even require) frequent communication between scholars of all years and to facilitate an informal form of mentoring, we could make a part of the CEC 140 course to be posting or commenting on one discussion post on Canvas every week. Discussion posts could include things such as: questions about the GC program, a student’s new discovery of an experience to fulfill one of their framework requirements, a news article or blurb related to one of the grand challenges, etc. This also could potentially serve as a vehicle of the report/reflection process that the scholars must go through for assessment, but in a more public setting (allowing others to learn from the reflections/experiences of other students). This page would be monitored by the GCSP Director or the instructor of the CEC 140 course.
- **Semesterly Cookout, Holiday Party, Thanksgiving Potluck, Cornhole Tournament, or similar social outings:** We would hold at least one social oriented scholar’s event every semester to allow scholars and faculty to interact in a more laid back setting. This will also allow new scholars to form those first contacts with their fellow scholars, mentors, and involved faculty to allow them to be excited and more comfortable going forward in the program. These events could also be organized by a student member of the steering committee or the peer mentor group.



## Appendix A Faculty Research in the Grand Challenges

Overall GC Theme	Faculty	Grand Challenge Problem and Research Topic
Energy and Environment Grand Challenge Theme	Dr. C. Almquist, CPB	Restore & Improve Urban Infrastructure: Environmental catalysis and absorbents
	Dr. J. Berberich, CPB	Restore & Improve Urban Infrastructure: Green chemistry and foods safety
	Dr. M. Scott, ECE	Make Solar Energy Economical: Power electronics for photovoltaics/solar
	Dr. L. Kerr, CPB	Make Solar Energy Economical: Photovoltaics/Solar Energy
	Dr. M. Scott, ECE	Provide Energy from Fusion
Health Grand Challenge Theme	Dr. A. Shukla, MME	Engineer Better Medicines: Ultrasonic cutting tools for surgery
	Dr. F. Khan, MME	Engineer Better Medicines: Biocompatible polymers
	Dr. M. Bailey-Van Kuren, MME	Engineer Better Medicines: Assistive interfaces & devices
	Dr. J. Berberich, CPB	Engineer Better Medicines: Tissue engineering
	Dr. L. Kerr, CPB	Engineer Better Medicines: Drug delivery
	Dr. D. Rao, CSE	Engineer Better Medicines: Forecasting mosquito-borne virus including Zika
	Dr. J. Saul, CPB	Engineer Better Medicines: Biomaterials in tissue engineering
	Dr. J. Sparks, CPB	Engineer Better Medicines: Liver mechanobiology, patient simulators
	Dr. A. Yousefi, CPB	Engineer Better Medicines: Scaffold design for tissue engineering and gene therapy, and tissue mimicking phantoms
Joy of Living Grand Challenge	Dr. E. Bachmann, CSE	Enhance Virtual Reality: Large scale immersive environments

Theme	Dr. W. Brinkmann, CSE	Enhance Virtual Reality: Traditional augmented reality and social and ethical analysis of augmented reality
	Dr. A. Dollar, MME	Advance Personalized Learning: Engineering Statics course in Carnegie Mellon Open Learning Initiative
	Dr. K. Singh, MME	Advance Personalized Learning: Web-based Com-Ex learning modules for vibrations, controls & mechanics of materials courses
	Dr. J. Karro, CSE	Engineer the Tools of Scientific Discovery: Bioinformatics
	Dr. D. Rao, CSE	Engineer the Tools of Scientific Discovery: Simulations for epidemiological analysis
	Dr. J. Moller, MME	Engineer the Tools of Scientific Discovery: Simulation of thermal & mechanical processes
	Dr. A. Paluch, MME	Engineer the Tools of Scientific Discovery: Molecular simulation for property prediction of materials and solvents
	Dr. E. Caraballo, MME	Engineer the Tools of Scientific Discovery: Reduced order modeling its use in flow applications
	Dr. J. Sparks, CPB	Engineer the Tools of Scientific Discovery: Modeling of interstitial flow in liver and tissue engineering scaffolds

CPB = Chemical, Paper, and Biomedical Engineering  
CSE = Computer Science and Software Engineering  
ECE = Electrical and Computer Engineering  
MME = Manufacturing and Mechanical Engineering

## Appendix B Application Form

Name:

Major(s):

Intended year of graduation:

**Part I** – Proposed Plan of Study: Specify how you plan to fulfill each of the following requirements. A minimum of three semesters of participation is required.

Grand Challenge Problem:

Depth (circle one): Research    Entrepreneurship    Global dimension    Service learning

Research:

Entrepreneurship:

Global Dimension:

Service Learning:

Interdisciplinary Component:

Connectivity: Continuous enrollment in CEC 140 Grand Challenge Scholar Experience:  
Participation in Grand Challenge Scholar in Residence events and peer mentor program

**Part II** – Explain in two pages (a) what you hope to accomplish through participation in the Grand Challenge Scholars Program and (b) how your plan of study relates to your specific Grand Challenge theme and fulfills the student learning outcomes listed below.

**1. Research or Project:** Demonstrate the ability to undertake research or a capstone project related to a Grand Challenge.

**2. Interdisciplinary Component:** Demonstrate skills in, or knowledge of, working at the boundary between technical and non-technical areas when solving a Grand Challenge.

**3. Entrepreneurship:** Demonstrate business or market-related skills and knowledge in solving a Grand Challenge.

**4. Global Dimension:** Demonstrate skills in, or knowledge of, global issues in solving a Grand Challenge.

**5. Service Learning:** Demonstrate ability to work within, or knowledge of, the social context in bringing to bear solutions to a Grand Challenge.

## Appendix C Example Plan of Study

### Part I

Name: Miami Student

Major(s): Electrical Engineering

Intended year of graduation: May, 2019

GC Theme: Make Solar Energy Affordable

Depth Experience: Research

Grand Challenge Problem: **Make Solar Energy Affordable**

Depth Experience: Research Entrepreneurship Global dimension Service learning

Research:

Complete undergraduate Summer Scholars (summer of 2018), independent research exploring gallium nitride based power electronics with Dr. Scott (6 credits) and present results at Undergraduate Research Forum the following semester. Then in my senior year I plan to complete my capstone (ECE 448 – 449, 4 hours) requirement to build a photovoltaic based inverter.

Entrepreneurship: ESP 102 Startup Bootcamp: Inception to Prototype (1 credit)

Global Dimension: KNH 214 Global Well-Being (3 credits)

Service Learning: Chair a committee of CEC Student Advisory Council to put on an interactive engineering fair for school children during engineering week (min. 30 hours service). Serve as the chair of the pledge education committee for Theta Tau (min. 10 hours service).

Interdisciplinary Component: ECO 201 Principles of Microeconomics (3)

Connectivity: Continuous enrollment in CEC 140 Grand Challenge Scholar Experience: Participation in Grand Challenge Scholar in Residence events and peer mentor program

### Part II

My goal for participation in the Grand Challenge Scholars Program is to gain skills and insight into how to use my major in Electrical Engineering to help transition society to renewable energy and away from dependence on fossil fuels. Specifically I hope to learn how to overcome technical, economic, and social barriers to the widespread adoption of solar energy.

**1. Research or Project:** Demonstrate the ability to undertake research or a capstone project related to a Grand Challenge.

If accepted into the GCSP, I will work with Dr. Scott to explore gallium nitride based power electronics. Dr. Scott has agreed to support my application to the Undergraduate Summer Scholars program to begin this research topic with the goal of completing my capstone requirement by building a photovoltaic based inverter with maximum power point tracking capabilities.

**2. Interdisciplinary Component:** Demonstrate skills in, or knowledge of, working at the boundary between technical and non-technical areas when solving a Grand Challenge.

I propose to complete ECO 201 Principles of Microeconomics to help me to learn concepts and vocabulary associated with business and economics. I believe a basic understanding of Economics will help me to better understand and quantify the value proposition of renewable energy over fossil fuels. This course will also give me a basic prerequisite in business if I decide to pursue additional business courses, either at Miami or for a graduate degree.

**3. Entrepreneurship:** Demonstrate business or market-related skills and knowledge in solving a Grand Challenge. ESP 102 Engineering Bootcamp: Inception to Prototype is a course that immerses students in the methods and practices of starting a business. In the course students create a business plan that they pitch to real investors. I hope to use this course to gain an understanding of the tools necessary to succeed in an energy-related business venture.

**4. Global Dimension:** Demonstrate skills in, or knowledge of, global issues in solving a Grand Challenge. KNH 214 Global Well-Being is a Global Miami Plan Foundation IIIB (Global) course. It explores the concept of well-being within cultural and global contexts, both individual and societal. I believe that an individual person's state of well-being, as well as a society or culture as a whole's well-being, is tied to the availability of affordable and clean energy. I hope that this course will help me to understand some of the global forces influencing well-being especially in terms of availability of clean and affordable energy.

**5. Service Learning:** Demonstrate ability to work within, or knowledge of, the social context in bringing to bear solutions to a Grand Challenge.

I am a member of the College of Engineering and Computing's Student Advisory Council (CECSAC), which is an advisory group to our college's Dean. One major activity of CECSAC is planning and implementation of Miami's annual Engineers Week. One project of Engineers Week is that we sponsor an interactive Engineering Fair for children in the local school district. This is an outreach effort to introduce elementary-aged children to engineering. I have volunteered to chair the Engineering Fair project. I will be responsible for organizing a subcommittee, holding meetings, coordinating logistics with the local school district for the fair, assuring that we have needed resources, holding the fair, and doing follow-up assessment. I anticipate this will take at least 30 hours of volunteer work.

I also volunteered to chair our Theta Tau chapter's Pledge/Rush committee for the next school year. I will be responsible for planning and carrying out the biannual fall and spring rush, followed by basic pledge education. I anticipate that this will require at least 10 hours of volunteer work.