

GRAND CHALLENGES SCHOLARS PROGRAM
WRIGHT STATE UNIVERSITY

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I. VISION, MISSION, AND GOALS

The vision of the Grand Challenge Scholars Program at WSU (GCSP@WSU) is **“to offer its students the opportunity to train and provide meaningful contributions to society through programmatic components that target sustainability, health, security, and joy of living.”**

Wright State has exceptional research capabilities in 12 of the 14 listed grand challenge topics. Many research projects go well beyond the STEM perspective by connecting with Social Sciences and community outreach activities. Since we are already significantly active in these areas, we will be able to provide the NAE Grand Challenge Scholars an excellent curricular, co-curricular, and extra-curricular research experience. In addition to extensive research, we have a large number of strong programs in innovation, entrepreneurship, community engagement, and global awareness, which will be leveraged for this program.

The core values that will shape the priorities of the GCSP node at WSU are student awareness, research, creativity, entrepreneurship, global impact, multi-disciplinary and multi-cultural thinking. These values align with the official mission statement of Wright State University, which is to “Transform the lives of our students and the communities we serve” (<https://www.wright.edu/about/mission-vision-and-values>).

The following four aspects of this mission are emphasized.

- Build a solid foundation for student success at all levels through high-quality, innovative programs.
- Conduct scholarly research and creative endeavors that impact quality of life.
- Engage in meaningful community service.
- Drive the economic revitalization of our region and our state and empower all of our students, faculty, staff, and alumni to develop professionally, intellectually, and personally.

The university as a whole has identified the following as highest priority efforts.

- People: Success, diversity
- Learning: Discovery, innovation, scholarship
- Partnerships: Regional, entrepreneurial, global
- Relationships: Collegial, professional, ethical
- Sustainability: Social justice, economic opportunity, environmental protection
- Stewardship: Fiscal, intellectual

The specific mission of the College of Engineering & Computer Science (CECS) within WSU is to educate an enterprising community of leaders who seek to improve the human condition by bringing discovery and innovation to the world. The GCSP program is aimed at enhancing this mission. The GCSP program will add significant focus to our college and its students. We already

leverage hands-on education through various initiatives outlined later. Integrating these with emphasis on global awareness through student portfolios will enrich their overall understanding and professional preparation. Through the GCSP elements, they will be trained to apply their knowledge and experience to meaningful solutions for 21st century challenges.

In summary, the vision of WSU and this college are very much shaped by the history as well as the unique ecosystem elaborated in the later section. It can be seen that this complements the vision of the NAE Grand Challenge Scholars Program. The culture and infrastructure is also ready for supporting this across the board. This proposal aims to consolidate and leverage many of the existing initiatives and serve as a platform to launch the social entrepreneurs, out-of-the-box thinkers, and innovators of the next century.

II. ESSENTIAL ELEMENTS OF GCSP

A Grand Challenges Scholar Recruitment and Selection

The objective is to identify, recruit and select a diverse cohort of undergraduate students from a variety of disciplines. These students will be trained to design and create solutions for the 21st century along the Grand Challenges topics.

Recruitment Plan:

For the first year, we will focus our recruitment efforts on students who are already at Wright State. Our outreach strategy will include the following.

- Advertisement through freshman orientation folders
- Introductory classes
- Honors program office
- Academic Advising Center
- Student clubs
- Website and emails

Our recruitment efforts will target the following.

- Incoming students on the Valedictorian-Salutatorian and other Merit scholarship lists
- Incoming students whose ACT/Sat scores are above 27
- Sophomores with GPA's above 2.75 (students with lower GPA may be considered on a case by case basis)

In subsequent years, the plan is to adopt the following recruitment strategies along with the above.

- Include GCSP program flyers and brochures in High School Recruitment Folders
- Website linked to student application page
- Introduction to Grand Challenges, new 1-credit hour course offering to start in 2019: A tentative outline is given in the appendix. This will be a 1-credit course open to all students. It will be mandatory for students in the GCSP program, but will serve as an elective for others.

Application and Selection Plan:

We will create a web-based application portal for students to submit all the necessary information. It is planned that initial applicants for the 2018-19 AY will be from within currently enrolled students at the freshman-sophomore level. It is expected that students will start this at the sophomore level. In special circumstances, some students in their junior year may show strong interest, especially if they have already been engaged in meaningful activities that are relevant for GCSP. Such students may be accepted on a case-by-case basis, if the Steering Committee determines that some of the prior experiences can be counted in GCSP. For future years, incoming students, as well as existing students, will be made aware of this opportunity ahead of time. They can enroll in the introductory class outlined below, and even indicate an interest in the program during the university application process. The GCSP program will have two application deadlines every year, one month prior to the semester that the student wants to start.

The following Application materials will be needed in the application portal.

1. Completed online application form
2. Identification of a grand challenge subject area
3. Impact statement / letter of commitment justifying their topic selection
4. Letter of recommendation by a mentor or faculty advisor
5. A short statement outlining the activities that most interest the student in each of the five competencies. This is expected to be an initial reflection only, and does not have to be final. The student will need to develop a full plan within the first year and submit to the steering committee for approval.

The selection criteria will give preference to students with GPA above 3.0. Exceptions will be made for those with lower GPA's who show great interest and have a desire and ability to participate in solving one of the grand challenge areas, as elaborated in the application material. Examples include the following.

- Students with active participation in research labs
- Leadership experience in Student Clubs.
- Co-op or project experience.
- Unique community outreach or entrepreneurship experiences

The mentors in the student-mentor team will be selected based on the following criteria.

- Interest in one of the Grand Challenges topics
- Interest in supporting student research
- Track record of working with undergraduate students
- Familiarity with global issues and community engagement
- History of involvement in R&D and/or collaborative design projects
- Prior academic connection or discussion with the student

Starting in fall 2019, WSU plans to offer a 1-credit course called Introduction to Grand Challenges (Draft Syllabus attached in the Appendix). This course will be open to all students, irrespective of their intent to join the GCSP track. For students intending to join this program, this course will serve as a pre-planning guide. In future, this course will be cross-listed within the curricula of different departments, and made mandatory for future GCSP applicants and elective for others.

We are targeting to recruit 10-15 students per year in the first 2 years, with the cohort slowly increasing to 20 students per year in the subsequent 3 years.

For application review, the Director will form a 3-person Selection Committee each year from members of the Steering Committee. The Selection Committee will rotate among Steering committee members, and every effort will be made to balance the portfolios by selecting candidates from a diverse set of GC areas.

B. GCSP Experiences

The five GCSP experiences will be offered through the WSU-specific program criteria outlined below, and summarized in Table I. These are developed to leverage and strengthen multiple programs within WSU, and its collaborations across the local ecosystem, which consists of Federal and for-profit organizations described in Section D.

Within the first semester of starting the GCSP program, the student will be expected to develop a plan of activities that they will use to satisfy the five competencies. This plan will be reviewed by the mentor and approved by the steering committee.

The options available to the student for addressing the five required competencies are as follows:

1. Talent Competency:

The technical creativity of the GCSP student will be developed in this module. This will be closely mentored by the faculty advisor(s), who is either the GCSP mentor, or a close collaborator of the mentor. This activity will involve either a research project or design development related to the

student's selected Grand Challenges topic. It is expected to be at least a two-semester effort to ensure substantial output. Components of the WSU ecosystem that will be leveraged to strengthen the talent competency include the following.

- **Air Force Research Laboratory (AFRL) and Air Force Institute of Technology (AFIT):** Wright State's ties to the largest US-Department of Defense research complex is currently leveraged through the Southwestern Ohio Council of Higher Education (SOCHE) program. This is a regional consortium to promote educated, employed, and engaged citizens. They have a very active student research program, and WSU is the primary feeder school to provide a pipeline of STEM students into AFRL. A large number of our students have the opportunity to work year-round at AFRL and AFIT through this program.
- **R&D through Federal Contractors:** Many of our students have opportunities to work on projects funded by AFRL through their supporting contractors, many of which are closely related to Grand Challenges topics.
- **Environmental Protection Agency (EPA):** The National Risk Management Research Laboratory (NRMRL) of the EPA is located in Cincinnati, and maintains a close relationship with us through student hiring as well as facilities sharing. Several of our students obtain research experience through their direct student hiring options as well as the Oak Ridge Institute for Science and Education (ORISE) program.
- **Corporate Partnerships:** Several companies that sponsor projects for our students through cooperative and internship employment, as well as sponsorship of capstone design projects. Examples include:
 - Leidos
 - A. K. Steel
 - Emerson technologies
 - Heapy Engineering
 - Booz Allen Hamilton
 - Reynolds and Reynolds
 - BWI Group

Students will need to satisfy this criteria through the following:

- Involvement in a two-semester long basic research or creative design project directed or co-directed by the GCSP faculty mentor. Examples include:
 - Faculty-led research (e.g., NSF Research Experience for Undergraduates program or similar projects)
 - 2-semester capstone design project with added background analysis: This is required element of all engineering BS programs anyway, so if students pick any of the grand challenges topics as their project, they can use this as their research competency)
 - Honors project or thesis: This can be an option for honors student who join the GCSP program, not for non-honors students.

- Cooperative/internship-based project mentored jointly by faculty, and federal or industry collaborators.
- Periodic presentations at GCSP meetings and inclusion of these results in a final presentation of their GCSP portfolio before graduation.
- At least one of the following additional experiences:
 - Research showcased in a campus event
 - Research included in a peer-reviewed publication
 - Research presented in a professional meeting
 - Research showcase or similar professional events at WSU
 - Research showcase at local chapters of professional societies
 - Applying for invention disclosure or patent

Research experience and outcomes, along with accomplishments in the four other competencies, will be clearly described in the GCSP portfolio that the student submits. They will also present this to the final Committee meeting before graduation.

2. Multicultural Competency:

This will require **at least two courses on Human Cultural Diversity** (options listed in Appendix) **AND an agreed upon combination** of coursework, international program participation, study abroad program, or international outreach initiatives. Some experiential programs in this category require foreign travel. For students unwilling or unable to do that, active participation in one of the local chapters listed, or an additional course specifically related to global impact of their Grand Challenges topic will be acceptable.

Current examples of “Global Traditions” courses include the following:

- Technology and Society,
- Nonwestern Art,
- Global Econ Bus and Social
- Economic Systems of the Global South
- Regional Studies China
- Greek and Roman Culture
- Russian Culture
- Global Health
- Western Civilization.

Students will need to demonstrate in their portfolio how these or similar courses enhanced their perspective of the selected Grand Challenges topic.

Some international programs currently offered through WSU are listed below, and several others are available through NAE, local non-profits and Private Foundations.

WSU programs are:

a. **Engineers without borders:**

This is a WSU Chapter of the Engineers without Borders (EWB) USA, which is a service organization that participates in various outreach and project-related events throughout the year. They welcome all students, who demonstrate a genuine desire to serve the community.

b. **Study Abroad program at WSU:**

Wright State offers students three types of study abroad programs:

- **Ambassador Programs** provide an opportunity for students to study for short periods of time (1 – 4 weeks) during summer, winter, or spring break and are led by Wright State faculty members. Two examples are listed below.
 - BME/EGR 4610: Clinical Engineering in the Developing World, is a four-week course that provides College of Engineering and Computer Science, College of Science and Math, and School of Medicine students a chance to cultivate international teamwork experiences as they practice innovative technical problem solving while working in health care facilities to repair, install, and test medical equipment, as well as train local professionals on its use. Students are exposed to the culture of a developing African nation and learn how to live and interact with the residents there. This intensive and immersive learning experience is expected to broaden students' perspective and to improve their capability for effectively performing in the increasingly global field of engineering.
 - EGR 4980 WC1: Engineering Study Abroad: Jena, Germany provides students with an opportunity to learn the pertinent interpersonal and technical skills to enable one to live in a foreign city for an extended period, study engineering applications with international faculty and students, participate in an international engineering competition, and gain an appreciation of European manufacturing and engineering processes and methods.
- **Exchange Programs** allow students to travel to Wright State partner institutions. While many of the programs require the student to take classes in the foreign language of their host country, there are some programs that are conducted in English. Students have the option of studying abroad in the summer, for a semester, or a full year.
- **External Partner Programs** are programs offered by professional organizations and allow students to study for a summer, semester or an academic year. Through this option, students can study on six continents in 40 countries and in most cases without prior language experience. These programs include courses for most Wright State majors/minors.

- **Model United Nations Program** at Wright State is built around a three-credit hour spring semester course in Political Science. PLS 4860/6860 emphasizes skills of teamwork, problem-solving, diplomacy, public speaking, technical writing, and research. The seminar is used to prepare students for the week-long National Model United Nations Conference, held in New York City. For 39 straight years, Wright State University’s delegates have earned top awards at the National Model United Nations Conference—a winning streak unmatched by any other university.

Student will need to satisfy this criteria through one of the following:

- At least two Courses on cultural diversity/global traditions
- In addition, one of the following
 - Study abroad
 - Junior United Nations
 - Local collaboration with international initiatives
 - Additional course related to global implication of grand challenges
 - WSU Ambassador program
 - International exchange program

After completing this module, the student will demonstrate their understanding and sensitivity to cultural issues among different communities (within USA and across the globe), and how that is essential for viable Grand Challenge solutions.

3. Multidisciplinary Competency:

Students will experience and document multidisciplinary character through coursework in breadth areas and through documented collaboration with students and mentors from other disciplines. As part of the general education components that are mandatory for all engineering students, WSU offers an extensive choice of multidisciplinary courses in the following categories. The student will have to take at least three from these, four if they are not involved in multidisciplinary research or design. A partial list of courses is provided below, and a more complete list is available at the academic advisor’s office:

- Arts /Humanities:** Examples in this category include African-American Literature, The Hispanic World: Cultures in Motion, Great Books Classics, Comparative Literature Series, Music in Western Culture, Studies in Humanities, and Philosophy of State and Society
- Social Sciences:** These can range from Principles of Microeconomics, Personal Financial Decision Making, Political Life, Introduction to Sociology, Introduction to Psychology, to Approaches to Women’s Studies
- Global Traditions:** Several Courses are available, as discussed in the earlier section (Multicultural competency). One example of a course that will be highly recommended to

students in this program is CS 1000 – Technology and Society. This course examines and evaluates the consequences of technology on individuals, organizations and society to recognize its benefits, potential, and limitations. Explores current social, ethical, legal and philosophical topics to understand how the Digital Revolution impacts society.

- d. **Business and Economics:** Several options are discussed in the next section (Innovation and Entrepreneurship).

In addition to coursework, it is very likely that the student’s technical project (discussed in the Talent Competency) will involve non-engineering and non-academic mentors or peers from a different background. This will help reinforce multi-disciplinary competency in our GCSP scholars. In the case that a student does not get multi-disciplinary experience through their project or research, they will take an additional non-engineering course that will be related to the Grand Challenges topic of their choice. They will highlight this connection in their portfolio.

In summary, the Multidisciplinary competency is satisfied by completing all of the following:

- At least 3 non-engineering courses (from humanities, social sciences, natural sciences and Math/stat or data analyses). It is expected that the student will pick the courses in such a way that at least two of these can also be applied to satisfy their General Education requirement.
- Discussion of interdisciplinary perspective in portfolio
- One more activity/exposure such as
 - Working with interdisciplinary team (spanning across 2-3 disciplines) during research, service learning or entrepreneurship effort.
 - Additional non-engineering course related to Grand Challenges topic

In the final portfolio, the student will clarify their understanding of interdisciplinary team work, and include an essay related to how they expect different disciplines to address their selected Grand Challenge topic.

4. Innovation and Entrepreneurship:

Students will develop understanding of business and entrepreneurship areas through participation in coursework and/or mentored exercises to generate viable business model(s) for successful implementation of Grand Challenge solutions. GCSP students will demonstrate that they have an understanding of how to implement innovative ideas. Each GC scholar must will participate in experiences that involve some aspect of translating an invention/innovation into a viable business model. This may range from risk-taking commercial ventures to implementing beneficial solutions for non-profits.

The first criteria to satisfy is for the student to take at least one course in the area of social or commercial innovation and entrepreneurship. Additionally, the student will choose one more activity such as: immersion in an enterprise or startup activity, certificate in innovation and entrepreneurship, Entrepreneurship Minor, WSU Entrepreneurship Club or active participation (equivalent of 40 hrs.) in one of the many local area innovation hubs.

Additional achievement(s) that will be regarded as extra credit for this competency are: application for invention disclosure, patent or other form of intellectual property, and participation in a student business case or start-up competition. Such accomplishments related to a grand challenges area can be considered to overlap with the Research competency.

Some examples of existing programs that offer ample opportunities for coursework and experiences to satisfy the specified requirements are listed below:

- a. **Undergraduate Certificate in Innovation and Entrepreneurship in High Technology:** The purpose of this certificate program is to enhance the technical expertise and business acumen of undergraduate students, regardless of professional pursuit.
- b. **Engineering and Innovation Entrepreneurship Program** offered by College of Engineering in collaboration with College of Business: Even though this is an MS level program, several upper class undergrads take courses offered by this program.
- c. **Entrepreneurship Minor** offered by marketing Department in College of Business: This is open to all students who meet the basic qualification, and many engineering students take this.
- d. **The Entrepreneurship Club** is an official chapter of the Collegiate Entrepreneurs' Organization. They are open to students from all colleges and majors. They work with the Dayton region's business and entrepreneurs, as well as academic program leaders.

In summary, the Innovation and Entrepreneurship competency can be satisfied by completing all of the following experiences/activities:

- At least one course on entrepreneurship or social entrepreneurship (this may also serve as a breadth course for the student, depending on his/her BS program)
- One or more additional activity such as:
 - Deep immersion into a semester- long involvement with an enterprise or a startup.
 - Undergrad Certificate in Innovation and Entrepreneurship
 - Entrepreneurship Minor
 - Active role in WSU Entrepreneurship Club
 - Participation in local area innovation hub or competition
 - Federal/State innovation programs such as NSF-I Corps or equivalent
 - Additional course related to entrepreneurship or innovation

5. Social Consciousness:

Students will deepen social consciousness and motivation to address 21st century issues. This competency will be addressed through one or more course(s) on ethics and 80 hours of outreach activities. This may include service learning, volunteerism, mentoring K-12 students, or equivalent.

Wright State University is consistently listed in the President's Higher Education Community Service Honor Roll for its support of volunteering, service-learning, and civic engagement. The Office of Student Activities helps all students and student organizations to become involved in community service. Notable WSU programs that will be leveraged include the following.

a. Center for Service-Learning and Civic Engagement: <https://www.wright.edu/center-for-service-learning-and-civic-engagement>

This center focuses on three areas of development for participating students: (i) Develop knowledge and skills for effective citizenship; (ii) Understand the resources and needs of their local, national, and/or international communities; and (iii) Engage with those communities to enact positive change. This center offers the following high-impact programs:

- Service Learning Internship
- Newman Civic Fellowship Program
- Engaged Citizenship Studies Certificate
- Youth and Community Engagement Minor
- Summer Service Abroad Opportunities

b. We Serve U at WSU

This program recruits and supports Wright State staff to provide their time and skills to engage in significant community service opportunities. They provide the logistics, support and connection to participate in different voluntary initiatives such as crayons to classrooms, box-top for education etc.

c. Friendship Food Pantry

The Wright State University Friendship Food Pantry provides emergency food and referrals primarily to students in times of need by helping them to stay in school and meet their educational goals. The pantry is also dedicated to assisting faculty, staff, and community members in need of emergency food and referrals in order to relieve food insecurities and their underlying causes in the Dayton community.

d. Engineers without Borders

The WSU chapter of Engineers without Borders was formed in Fall 2013. They have had a number of successful projects over the last few years, and are partnering with Madibira, Tanzania for the next five years to help provide a more accessible water supply for community school use.

- e. WSU recently opened a chapter of the United Nations International Children's Emergency Fund (UNICEF). This chapter, led by students at WSU's Boonshoft School of Medicine, provides a pathway for WSU students to participate in its worldwide outreach activities. UNICEF has helped save more lives than any other humanitarian organization by providing health care and immunization, clean water and sanitation, nutrition, education, emergency relief and more.
- f. The College offers several K-12 outreach, mentoring, and tutoring programs that the GCSP scholar can participate in. Some examples are listed below.
- The College of Engineering and Computer Science Student Ambassadors are a select group of student leaders who assist with recruitment, outreach, and retention activities. A few examples include high school visits, Raider Open House, FIRST Lego League competitions, and TechFest.
 - Student Organization Outreach
 - Phi Sigma Rho is a sorority for women in technical studies serving our sisters and the community by promoting high standards of personal integrity, respect, and character. We aim to create lifelong bonds of sisterhood, to uphold professional excellence with a social balance through shared experiences, common bonds, and recognition of service and achievement.
 - National Society of Black Engineers has a mission to increase the number of culturally responsible black engineers who excel academically, succeed professionally, and positively impact the community through service, leadership, and cultural diversity.
 - Society of Hispanic Professional Engineers is focused on empowering the Hispanic community to realize its fullest potential through science, technology, mathematics and engineering (STEM). SHPE offers professional development in technology and leadership to undergraduates, graduates and practicing STEM professionals at regional and national conferences.
 - Society of Women Engineers (SWE) is the driving force that establishes engineering as a highly desirable career aspiration for women. The Wright State branch of SWE aims to expand the image of the engineering profession while demonstrating the value of diversity. SWE is active in supporting the Wright State Trebuchet Competition, Girl Scout Day and also runs High School Women in Engineering Day.
- g. Local charities open for Wright State student participation (already accepted by some colleges such as WSU Boonshoft School of Medicine to qualify for 15 credits of service learning):
- Foodbank
 - Habitat for Humanity
 - House of Bread

- Boonshoft SOM Pre-Med Mentoring
- Reach Out of Montgomery County
- BOGG Food Ministries Food Delivery
- Saint Vincent de Paul Tutoring
- Special Olympics Skating Coaching
- Spring Break New Orleans
- The Ladder
- Thurgood Marshall Pipeline Mentoring

In summary, the Social Consciousness competency can be demonstrated by completing all of the following:

- At least one course touching upon ethics and/or civic engagement
- Additional 80 hours of experiential activity through any combination of a variety of different experiences below.
 - Service learning options
 - Volunteerism
 - K-12 outreach in STEM
 - Leadership role at community-centered organization
 - Engineers without borders
 - WSU chapter of UNICEF
 - 2 semesters of any service learning project course offered by any accredited institution

Table I: Summary Table for GCSP student competencies

(Student needs to complete the specified core, then pick 1 or more of the Elective activities)

	Creative Talent	Multicultural	Multidisciplinary	Business Viability Entrepreneurship	Social Consciousness
Core Requirement	<p>1. Research or creative design project -Capstone Design (required for BS programs) -Co-op with Federal or Private partner -Honors Report (for Hons students in GCSP)</p> <p>2. Presentation at GCSP Meeting</p>	<p>At least two Courses on cultural diversity/global traditions [Note: Some courses will simultaneously satisfy the General Education(GE) requirement]</p>	<p>1. At least 3 non-engineering courses [Note: At least two should simultaneously satisfy other BS program requirements]</p> <p>2. Essay on how student developed interdisciplinary perspective</p>	<p>At least one course on entrepreneurship or social entrepreneurship (partial list in Appendix)</p>	<p>At least one course touching upon ethics and/or civic engagement</p>
Additional Elective (select 1 or more)	<p>Research Showcased in campus event</p> <p>Peer-reviewed publication</p> <p>Research presented in professional meeting</p> <p>University competitions</p> <p>Professional competitions</p> <p>Applying for invention disclosure or patent</p>	<p>Study abroad</p> <p>Junior United Nations</p> <p>Local collaboration with international initiatives</p> <p>Additional course related to global implication of grand challenges</p> <p>WSU Ambassador program</p> <p>Exchange programs</p>	<p>Interdisciplinary research with co-op mentors</p> <p>One non-engineering Course related to Grand Challenges topic</p>	<p>Deep immersion into a semester- long involvement with an enterprise or a startup</p> <p>Undergrad Certificate in Innovation and Entrepreneurship</p> <p>Entrepreneurship Minor</p> <p>Active role in WSU Entrepreneurship Club</p> <p>Federal/State innovation programs such as NSF-I Corps or equivalent</p> <p>Additional Advanced Course</p>	<p>Service learning options (see page 11)</p> <p>Volunteerism</p> <p>K-12 outreach in STEM</p> <p>Service/ Leadership role at community-centered student organization</p>

C. Thematic Continuity and Connectivity

The student's mentor, in consultation with the Steering Committee, will ensure that the selected Grand Challenge problem is consciously embedded within each of the five GCSP competency pathways that the student chooses. It will be highly advantageous to the student if development of a single competency is explicitly linked to development of one or more of the other competencies. The student will discuss with his or her mentor(s) to define a "Statement of thematic continuity and connectivity", where they indicate how their thematic experiences are specifically linked to the Grand Challenge problem they are developing their talent in.

As part of the very important transition to college, all new engineering and computer science students are required to complete an online Academic Integrity Orientation (AIO). The AIO has been designed by the Office of Community Standards and Student Conduct, and provides an overview of the University's policy regarding Academic Integrity. In addition, students in the College of Engineering and Computer Science are required to review an internal academic integrity policy approved by the college faculty. (Please see appendix.)

Some of the basic ethics and integrity aspects of an engineering professional, such as responsible conduct of research, plagiarism avoidance and respect for intellectual property are again addressed in the mandatory Capstone Design course, and by the Career Center as well as the Office of Research and Sponsored Programs. Since the GCSP students will be linked with more than one of these offices, they should get a clear understanding, and address in their portfolio how these issues come into play in all the GCSP competency sections. Since "ethics and professional responsibility" are required outcomes for all of our ABET accredited engineering programs, each program should be able to indicate how those are addressed.

D. Programmatic and Individual Student Assessment

The GCSP scholar will work with his/her mentor throughout the program. The mentor can reach out to the Steering Committee members or the Director for advice/feedback, and the office staff for logistic support.

At the beginning of the program, the student will meet the mentor and submit an assessment plan, similar to a "Program of Study" form that they normally submit for their degrees. This, along with student updates, will be reviewed annually by the Steering Committee, and feedback will be provided to the mentor-scholar team.

The mentor will continue to oversee the student's progress and ensure the successful completion of the requirements. Each mentor will serve as a counselor to guide the student through the program while being a motivational force to achieve the best results and meet all the required competencies. The student may periodically sign up for independent study credit (suggested at least 1 credit/year) with the mentor to evaluate and fine-tune his/her GCSP portfolio.

In the final semester, the student will submit their portfolio describing his/her experiences and demonstrating their accomplishments, along with lessons learned. Figure 1 provides a suggested timeline for the student to follow. This is flexible, and can be modified by student in consultation with the mentor.

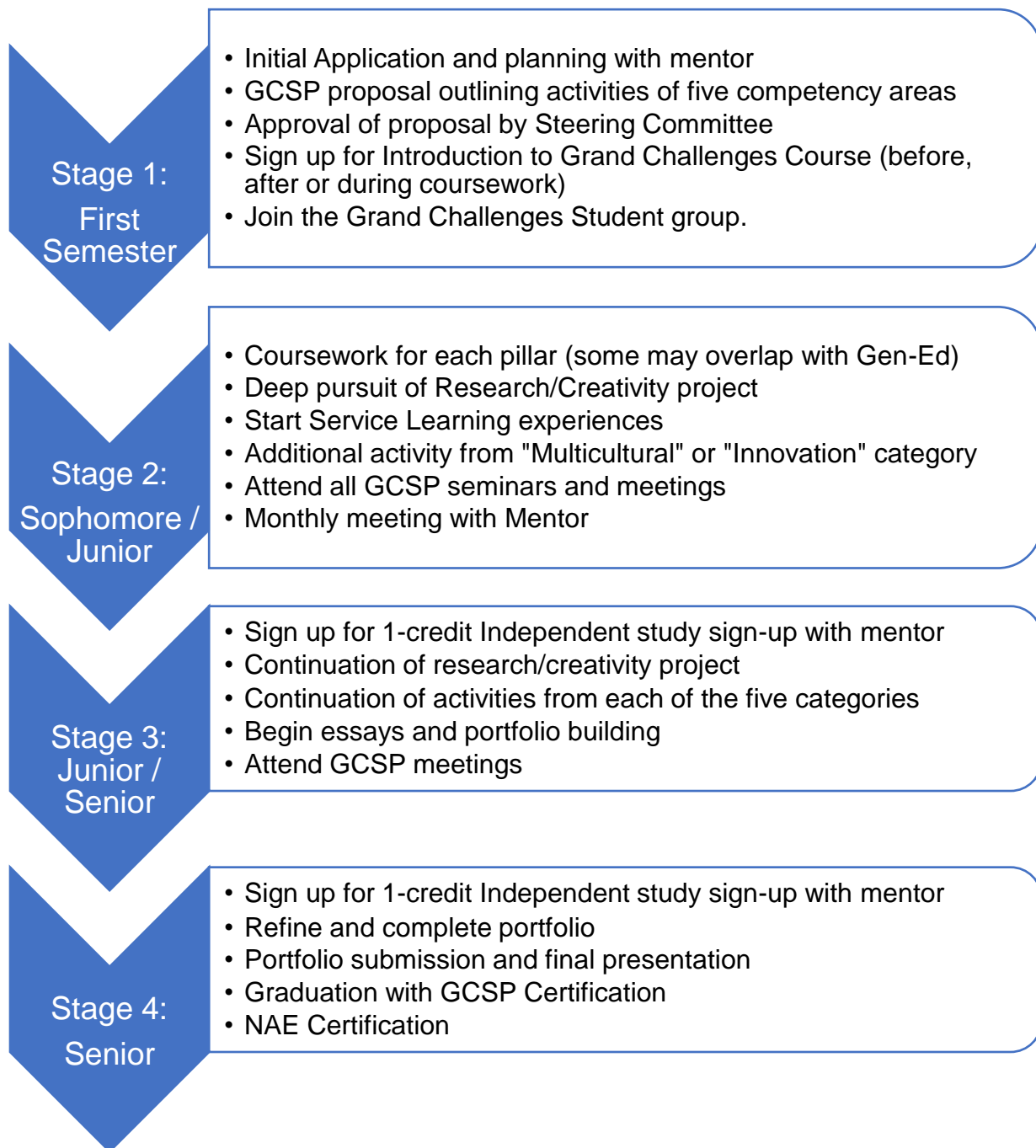


Figure 1: Suggested GCSP Progress Timeline

E. Institutional GCSP Governance and Sustainability

The GCSP Program at Wright State will be led by a Program Director, in collaboration with a University Steering Committee (USC) and an External Advisory Board (EAB)

The University Steering Committee (USC) will be composed of:

- GCSP Program Director
- Dean, College of Engineering and Computer Science (CECS)
- Director of the University Honors Program
- Representatives from other colleges: College of Science and Mathematics (COSM), Boonshoft School of Medicine (BSOM), Raj Soin College of Business (RSCOB) and College of Liberal Arts (COLA)
- Undergraduate student representatives (Initially nominated by the dean's office, subsequently elected by GCSP students in the program)
- Undergraduate Faculty Advisors (from participating degree programs)
- Recruitment advisor(s) at college and departmental levels
- WSU Director of Development and Outreach

The External Advisory Board (EAB) will include representatives from the following organizations that are currently supporting this effort.

- Air Force Research Laboratory (AFRL) – Materials and Manufacturing Directorate
- Air Force Research Laboratory (AFRL) – Human Effectiveness Directorate
- Air Force Research Laboratory (AFRL) – Sensors Directorate?
- Southwest Ohio Council for Higher Education (SOCHE)?
- Environmental Protection Agency (EPA)
- Local Industries such as A.K. Steel, Proctor & Gamble etc.

Responsibilities:

USC members will meet every semester to perform the following regular tasks:

- (a) Serve as a catalyst in connecting the scholars to research groups
- (b) Identify and select students into this program

The full GCSP Board (consisting of USC and EAB members) will collaborate to perform the following additional tasks

- (c) Serve as judges in the local competitions/presentations
- (d) Solicit guest speakers (or serve as speakers) for the Introduction to GCSP course and the seminar series
- (e) Provide guidance/feedback to mentors and GCSP scholars

The entire committee will meet at least once a year for self-assessment of the program and provide recommendations for further improvements.

Committee members will have 3-5 year terms with staggered rotation, so that only 1/3 of the Steering Committee can turn over in a given year.

Financial Sustainability:

Since the major aspects of this program are being compiled from currently active programs at WSU, up-front costs and funding needs are minimal. Currently existing and funded WSU programs that will be leveraged include the following:

- Research and student internship options through SOCHE, REU and Co-op programs
- Study abroad options (reduced cost on part of student)
- Center of Service Learning and Civic Engagement
- Faculty Incentive awards
- Presidential Lecture Series for inviting high visibility speakers to campus
- Student Recruitment office for marketing GCSP to incoming students
- WSU Foundation for charitable fundraising
- Funding for Student Chapters

Once the program is in place, funds that will eventually be base budgeted in subsequent fiscal years include the following:

- (a) Director and Supporting Personnel
- (b) Support for participating students to complete and present their portfolios.
- (c) Travel expenses for the GCSP Director and perhaps faculty and students to attend a national GCSP event each year.
- (d) Course release or stipend for the GCSP Director and/or active faculty.
- (e) Food costs for GCSP meetings and events
- (f) Guest speaker travel expenses and honoraria.
- (g) Funds to enable GC Scholars to participate in service learning experiences: Office of Service Learning will be engaged with this effort.
- (h) Funds to enable GC Scholars to participate in research.
- (i) Part time staff assistant to help in recruitment, application, maintain student portfolio, event planning and organization.

F. Mentorship for GCSP Faculty and Students

WSU will establish practices that support development of GCSP-affiliated faculty and advisors, so that they make effective mentors for the students. Within the first year, we plan to form a GCSP Member Club, which may be a sub-set of the Honors club. Wright State has a robust and active

University Honors Program (<https://www.wright.edu/honors>) that offers students a variety of advantages and benefits in curriculum, scheduling, advising, and scholarships. The GCSP Honors Club will overlap with some of these, and bring additional programming related to the Honors Credit courses and/or the Introduction Grand Challenges Course. It is expected that there will be at least four external speakers and panelists per year through the Honors Institute, Presidential Seminar series, and College of Engineering Seminars. It is expected that speakers and panelists will touch upon different Grand Challenges topics, holistic educational practices, business, industry, or public policy issues related to specific competency areas. In addition to the students, faculty mentors will also be expected to attend these events. Each faculty mentor may also be requested to lead one or more of these GCSP club events by inviting speakers, leading panels etc. By the end of the program, each student will have three symposiums in their portfolio, and may be asked to comment on what the student gained from these events.

In addition to Advanced “Honors” type activities, the GCSP community will be connected to the different resources on campus that are being leveraged for the five competency areas (as discussed in the earlier section). Figure 2 shows a schematic of the overall connectivity of the GCSP Community.



Figure 2. GCSP Community and Resources

G. Student Recognition

After the student presents the final portfolio to the GCSP committee and their written portfolio document is approved, the student will be certified to have completed the Wright State University GCSP program. Students who successfully complete their portfolios will receive a Certificate of Distinction of Grand Challenge Scholar, recognized at graduation. In addition, the following distinguishing features will be provided:

- The GCSP designation will be added to the student's transcript.
- Students will wear a medallion as part of their regalia at graduation.
- The scholars will be invited to a special reception with our external advisory boards.
- Selected students may receive funds to attend the NAE-GCSP meet that occurs annually in DC and several cities around the world.

After GCSP completion at WSU, the student's package and information will be forwarded to the National Academies, and they will receive a letter of recognition from the President of the National Academy of Engineering as a Grand Challenges Scholar. The student's profile will be included in the annual NAE Grand Challenges Scholar press release and web listing of all scholars. This is a great honor for any engineering graduate, because it puts them in the list of world-class engineering leaders for the next several decades.

III. UNIQUE ASPECTS

In order to understand the unique aspects of this program at WSU, it is essential to look into the history and ecosystem of our institution. Historically speaking, the Dayton region has introduced the world to major innovation breakthroughs such as the airplane, spark plug technology, can opener, and cash register. That infrastructure has catalyzed an enormous local network of non-profit and for-profit organizations in advanced engineering technologies. The Dayton Development Coalition, a local non-profit that advocates for this region and is closely linked with our activities says on its website: "We once built it (airplane) from wood and fabric; today we build it from advanced composites and carbon fiber. We create a network of fiber and data like no other in the world."

A major geographical advantage for us is our proximity to the **national headquarters of the Air Force Research Laboratory (AFRL), and five of its directorates**. There, they employ more than 10,000 personnel. Latest publicly shared data show some interesting facts (taken from <https://www.daytonregion.com/dayton-region/rd-innovation>):

Of the 10,000 + employees at AFRL, over 6,000 are engineers or scientists, and more than 80% have a Master's Degree or Ph.D. The anchor directorates that employ them are:

- The Aerospace Systems Directorate, which brings together world-class facilities, including a fuels research facility, structural testing labs, compressor research facility, rocket testing facilities, supersonic and subsonic wind tunnels, flight simulation lab, and many other cutting-edge research labs. Among the technologies in development in the Aerospace Systems Directorate are scramjet engines, alternative fuels, unmanned vehicles, hypersonic vehicles, collision avoidance and aircraft energy optimization.
- The Materials and Manufacturing Directorate focuses on materials, processes, and manufacturing technologies. Current research activities focus on thermal protection materials, metallic and nonmetallic structural materials, nondestructive inspection methods, materials used in aerospace propulsion systems, and electromagnetic and electronic materials.
- The Sensors Directorate focuses on sensors for air and space reconnaissance, surveillance, precision engagement, and electronic warfare applications. Its specific areas of interest include radio frequency sensors and countermeasures, electro-optical sensors and countermeasures, and automatic target recognition and sensor fusion.
- The 711th Human Performance Wing, headquartered at WPAFB, is a unique combination of three units: the Airman Systems Directorate, the US Air Force School of Aerospace Medicine (USAFSAM) and the Human Systems Integration Directorate. The synergies of combining the ideas, resources and technologies of these units position the 711 HPW as a world leader in the study and advancement of human performance and augmentation.

Many of our students work within the AFRL complex through funded research projects, local contractors as well as the Southwestern Ohio Council for Higher Education (SOCHE). This organization has an internship program (<https://www.soche.org/socheintern/>) that has been providing extensive connections between AFRL and WSU, which are located within a mile of each other.

In addition to AFRL, we are within a 50-mile radius of large number of manufacturing entities such as Proctor & Gamble, AK Steel, GE and other federal entities such as EPA.

The EPA laboratory in Cincinnati, OH is a major federal facility that includes a large Office of Research and Development (ORD). This has three major impacts:

- **Research:** Research conducted by scientists in Cincinnati has broad impacts at local, regional, and national levels. “Among many different areas of study, ORD scientists develop methods, models, and tools that help states and communities assess environmental risks and, ultimately, make decisions to manage chemical risks, clean up hazardous waste sites, and safeguard water quality, public water systems, and public health.
- **Community Engagement:** These scientists are developing water quality monitoring, modeling and management practices in partnership with the East Fork Watershed Cooperative, a multi-agency group focused on improving water quality in this local, mixed-

use watershed. EPA is also a technical anchor for Confluence, the Water Technology Innovation Cluster for the Ohio River Valley Region, which helps draw companies to the region to collaborate on water technology.

- **Economic Impacts:** The EPA Cincinnati facility has a total federal payroll of over \$58 million. The 980 people working there provide a total of \$88.6 million dollars that are injected into the local economy where workers buy goods and services in the community, supporting additional jobs and spending and increasing overall economic output for the community. EPA also works with outside innovators seeking to collaborate on R&D or to license an EPA-patented technology for research or commercialization. These collaborations provide commercial and job creating opportunities for the private sector.

Needless to say, this university campus which is within a mile of these facilities provides a unique opportunity for students to connect with world-class technologies, and their local and global outreach activities.

This provides many unique opportunities for non-engineering students from medical, business, social sciences and public policy to be recruited in this program. Accepted students can receive scholarships from not just the WSU scholarship pools, but from the SOCHE, ORISE and other programs outlined earlier. While our GCSP students have the option of participating in on-campus special programs such as University/College Honors, student ambassador, Model United Nations, Engineers without Borders, WSU UNICEF chapter, Entrepreneurship Club etc., they can also actively participate and assume leadership roles in local chapters of Professional Organizations such as ASM, AIAA, ACerS, MS&T, IEEE, Founders Institute etc.

IV. OTHER: Strategic Initiatives at WSU

A unique situation at WSU that will help to expand this program is that we are currently in the process of setting our strategic goals through 2025. The university community has completed a year-long process of campus-wide summits and debates. Details are available at the following website: <https://www.wright.edu/strategic-planning/documents-and-resources#docs>

During this exercise, it is becoming clear that many of the emerging strategies proposed by diverse working groups appear to have strong overlap with the priorities of the GCSP. Therefore, it is very likely that the GCSP program, once introduced at the college level, will get university-wide attention, and has a high probability of university-wide growth in the coming years. A few prioritized action items under consideration by WSU leadership, which will directly help the GCSP program, are briefly listed below:

Establish/Support New Office of Strategic Initiatives and Collaborations

Create an office (with a leadership-level position and additional supportive assistance) that is responsible for monitoring the pulse of research frontiers (e.g. National Academies of Science,

Engineering and Medicine, National Research Council). This office will monitor research frontiers (such as Grand Challenges) to be able to identify emerging opportunities, and assemble responsive collaborative teams (e.g. connecting WSU investigators with internal collaborators and external federal, industrial, and academic partners), and will oversee development of additional IP policies/strategies conducive to industry-university research and development partnerships, prime-funded by industry (e.g., provides companies with a variety of joint research agreements and ownership/licensing options).

Organizing to Confront Challenges and Respond to Workforce Needs

Wright State University faculty experts historically have pursued a diverse portfolio of research efforts across campus, much of which if harnessed collaboratively, could be applied in an effort to address grand challenges (https://en.wikipedia.org/wiki/Grand_Challenges) facing the region and nation. This interdisciplinary approach to confronting grand challenges could also result in the establishment of dynamic enterprises which incorporate research, workforce training and professional development, product/equipment testing, and commercialization efforts. Building efforts on this scale would initially require internal funding and small external

Co-Curricular Transcripts (CCT) – Documenting Student Learning Outside the Classroom

In order to enhance the Wright State experience the University will provide co-curricular transcripts (CCT) to students to complement their academic transcript. This will serve as a formal record of accomplishments including community service, awards, leadership, organizational involvement, and attendance at educational/professional programming.

Reviews, Standards and Certifications of WSU’s International Education Program

Standards and certifications exist for institutions, programs and personnel (both faculty & staff) involved in International Education. Goal ensures WSU compliance with, or meeting of, all standards & best practices related to the field of International Education. Focus will be upon two areas initially: the institution in general and Education Abroad program specifically.

WSU Entrepreneurship Center

Space designated to encourage cross-pollination between disciplines. Students work across disciplines to close gaps in their innovative activities, try to develop commercially viable goods and services, and start businesses that produce them. Faculty, research staff, and external partners will use the space in the same manner. Students access resources and get referrals to organizations that help commercialize innovations and start new business. Workshops, speakers, competitions, co-working space, and other events will occur at this center. The Entrepreneurship Club can make its home at the center.

The Entrepreneurship Center must derive most or all of its financial support from external partners interested in interacting with the talent on our campus

Embed Innovation and Entrepreneurship into Undergraduate Student Education across Campus

More of a Goal than a Specific Idea: Students will learn how to put into practice the core concepts of innovation and entrepreneurship in a manner that benefits the organizations to which they belong.

Develop curricula, experiential learning experiences, and/or other class activities that embed problem solving, entrepreneurial approaches, and creativity into undergraduate programs. The need for collaboration and experiences with collaboration will key to the success of this project.

Modular, Inter-collegiate Undergraduate Programs

Many twenty-first century jobs require acquisition of knowledge and skills across academic disciplines. WSU should implement modular inter-collegiate undergraduate degree programs that allow students to pursue programs of study integrating diverse disciplines.

V. APPENDICES

Appendix 1

EGR XXXX – Introduction to Grand Challenges in Engineering

DRAFT Syllabus for 1-credit course

COURSE DESCRIPTION:

This course will introduce students to the complex issues facing the world. Students will learn more about global grand challenges, possible approaches of addressing them, and skills needed by future professions who are called upon to lead these efforts. This will also serve as a pathway for students to participate in the Grand Challenges Scholar's Program of the National Academies.

TEXT:

- Handouts provided
- Misc. Reports from World Economic Forum, Think Tanks and National Academies

TOPICS (Tentative):

- Overview of Grand Challenges: Local and Global perspectives
- Five essential attributes of future leaders in knowledge professions:
 - Research/Creativity
 - Multi-disciplinary training:
 - Business/Entrepreneurship:
 - Global/Multicultural Issues
 - Social consciousness
- Intro to selected topics of the 21st Century Grand Challenges
 - Providing access to clean water;
 - Preventing nuclear terror;
 - Engineering better medicines;
 - Advancing health informatics;
 - Making solar energy economical;
 - Developing carbon sequestration methods;
 - Securing cyberspace;
 - Reverse-engineering the brain;
 - Managing the nitrogen cycle;
 - Providing energy from fusion;
 - Restoring and improving urban infrastructure;
 - Engineering the tools of scientific discovery;
 - Enhancing virtual reality; and
 - Advancing personalized learning.

TERM PAPER:

Each student will need to create a short term paper related to one of the Grand Challenges topics. The term paper is meant to test your ability to think about and address a modern engineering problem.

- Towards the end of the term, each student will make a short presentation of his/her topic for open discussion in class.
- In lieu of a written report, you are expected to turn in your presentation slides one week before the presentation. They will be shared on PILOT for your peers to read ahead of time, so they can comment and discuss after your presentation.
- Term Paper will be evaluated using the following criteria:
 - Student's ability to extend the concepts discussed in class to specific applications
 - The relevance of the overall scope, and the five GCSP elements
 - Research/Creativity
 - Multi-disciplinary training:
 - Business/Entrepreneurship:
 - Global/Multicultural Issues
 - Social consciousness
 - Clarity of presentation and interest generated among peers

ATTENDANCE POLICY:

Students are expected to attend all lectures. If absent, it is the student's responsibility to catch up the material covered. No late exams/make-ups or quizzes will be allowed except in case of verifiable emergency.

Appendix II

The Wright State Core

The Wright State Core is an integrated program of courses and experiences that provides students with the breadth of skills, knowledge and understanding expected of university graduates. A university degree goes beyond preparing graduates for a profession; it transforms their lives and their communities. The Wright State Core helps students develop the knowledge and skills essential for critical thinking, creative problem solving, meaningful civic engagement, multicultural competence, appreciation for the arts, and life-long learning. Wright State graduates will have the ability to apply insights from multiple disciplines to engage effectively with a diverse world. A few sections have been taken out of the brochure and included below. The entire Core brochure may be found at:

ELEMENT 3: GLOBAL TRADITIONS

Historical analysis and global perspectives necessary to understand our diverse world

- Critically describe some of the political, social or economic systems, historical, cultural or spiritual traditions, and/or technological innovations around the world
- Demonstrate an awareness of the diversity of people or traditions in our world in ways that promote effective engagement, both locally and globally
- Use political, social, economic, historical, cultural, spiritual or technological knowledge to evaluate contemporary issues

ELEMENT 4: ARTS AND HUMANITIES

Tools for analysis and appreciation of the arts, philosophy, and religious thought

- Critically analyze significant creative, literary, philosophical or religious works
- Understand and discuss the complex blend of imaginative vision, socio-cultural context, ethical values, and aesthetic judgment in creative, philosophical or religious works
- Recognize, evaluate and respond to creative, philosophical or religious works
- Develop appropriate and ethical applications of knowledge in the humanities or the arts

ELEMENT 5: SOCIAL SCIENCE

Perspectives on human behavior and culture informed by the disciplines of the social sciences

- Critically apply knowledge of social science theory and methods of inquiry to personal decisions, current issues, or global concerns
- Explain and critique the methods of inquiry of social science disciplines
- Demonstrate an understanding of the ethical issues involved in the acquisition or application of social science knowledge
- Demonstrate, from a social science perspective, an understanding of the responsibilities of an informed and engaged citizen to the success of democratic society

ELEMENT 6: NATURAL SCIENCE

Introductions to the scientific understanding of the physical and biological phenomena

- Understand the nature of scientific inquiry
 - Critically apply knowledge of scientific theory and methods of inquiry to evaluate information from a variety of sources
 - Distinguish between science and technology and recognize their roles in society
 - Demonstrate an awareness of theoretical, practical, creative and cultural dimensions of scientific inquiry
 - Discuss fundamental theories underlying modern science
-

APPENDIX III:

Business and Entrepreneurship Courses

2XX level: Without Business prerequisites (Student can take this as first course)

- Accounting Principles I
- Accounting Principles II
- Financial Management I
- Introduction to Business Statistics
- Quantitative Business Modeling Credit Hour(s)
- Principles of Marketing Credit Hour(s)

Upper level: with one of the above course as prerequisite (This can be the optional second course)

- Entrepreneurship
 - Small Business Management
 - Applied Business Planning for Commercialization
 - Creativity, Problem Solving, and Communication
 - Entrepreneurial Finance
 - Small Business Marketing Planning
 - High Performance Teams
 - Positive Group and Organizational Development
 - International Management
 - Consumer and Organizational Buyer Behavior
 - Principles of Selling
 - Digital Marketing
 - Marketing Analytics
 - Management Accounting
 - Managerial Economics and Strategy
 - Business Analytics
 - Human Resources Management
-

Appendix IV

ACADEMIC INTEGRITY POLICY

The faculty in the College of Engineering and Computer Science at Wright State University are committed to educating students in keeping with high ethical standards of professional engineers and computer scientists and recognize the university academic integrity guidelines outlined below:

onest at all times.

irly toward others. For example, do not disrupt or seek an unfair advantage over others by cheating, by talking or by g at other individuals' work during exams.

roup as well as individual responsibility for honorable behavior. Collectively, as well as individually, make every to prevent and avoid academic misconduct, and report acts of misconduct that you witness.

t turn in the same work in more than one class unless permission is received in advance from the professor.

s permitted by the instructor, do not collaborate with others on graded course work, including in-class and take-home papers, or homework assignments.

what plagiarism is, and take steps to avoid it. When using the words or ideas of another, even if paraphrased in your words, cite the source(s).

that policy, ignorance is no defense. If you have any questions regarding academic misconduct, contact your instructor. who violate campus rules are subject to disciplinary action.

College Policy

The College of Engineering and Computer Science recognizes that society must trust the integrity of its graduates, since frequently society may be incapable of understanding and verifying the engineer's work. Therefore, the CECS faculty have approved the following policy concerning academic integrity:

As a Professional Engineer, I dedicate my professional knowledge and skill to the

- *To the advancement and betterment of human welfare; To give the utmost of performance;*
- *To participate in none but honest enterprise;*
- *To live and work according to the laws of man and the highest standards of professional conduct;*
- *To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.*

1. The college may impose the most severe penalty possible within the university policy on academic integrity. Please see University Code of Conduct: Section X.

2. The college may dismiss any student found guilty of 2 or more violations of the university policy on academic integrity.

Students demonstrate their understanding of the above policy by signing and dating below.

I have read the above policy and understand its implications.

Name (Please Print)

Signature

Date

