

Operational Plan for Engineering Program

Section A

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Welcome to Engineering Program!

Greenville University offers a quality engineering program that prepares students for rapidly advancing technological changes. Students will receive hands-on training and personal attention in small classes from top-notch faculty and get research and practical experiences through advanced laboratories, summer research, internship, and practicum opportunities. The program is equipped with a mechanics lab, an electronics lab, computer labs, a machine shop, a nanotech lab, and an optics & quantum information lab. The graduates move on to nation's top graduate programs, national labs, or industries. The engineering program offers several scholarships specifically dedicated to students in the Engineering program, such as the Siefken Scholarship, the Tomaschke Scholarship, and the Twichell Scholarship.

GU offers 4-year Bachelor of Science in Engineering (B.S.E.) degree program with electrical or mechanical concentrations. In addition, we also offer dual-degree programs with the Washington University in St. Louis.

Program Mission Statement

The Greenville University Mission Statement is, “Greenville University empowers students for lives of character and service through a transforming Christ-centered education in the liberal arts, sciences, and professional studies.” Therefore, the Engineering program strives to provide students with quality education in Engineering in a caring Christian environment, to help them develop their Christian worldview in Engineering contexts, and to provide opportunities for students to use their Engineering knowledge and skills to serve humanity.

Programmatic Faith Integration

The Engineering and Physics Department has three key goals in integrating the discipline and Christian faith. First, we want our students to see the created order beyond materialistic and naturalistic philosophies and to see it in light of a well-informed Christian worldview.

Second, we want to help our students to see God’s power and to understand the divine nature through the things God has created. Finally, we want to inspire our students to be humble, life-long seekers of God’s truth. Christian engineers see and appreciate God’s designs and materials in nature. The GU Engineering program trains engineers to become creative and skillful doers as God commanded us to “Love the Lord your God with all your heart and with all your soul and with all your mind and with all your strength.” We are not only called to be good stewards of God’s creation but also blessed by God to ‘fill the earth and subdue it.’ The program instills in our students a Christian view of the world and helps them to be skillful engineers who serve the world with passion and integrity that stem from a Christian mind and character. Relevant issues arise naturally in courses such since ENGR352 Engineering Project Management as management of people is a key aspect of the course or in ENGR360 Engineering Ethics since worldview obviously informs our ethical behavior because these deal with discussion and analysis of a variety of case studies.

Section B

Program/Major Objectives: *Qualities and competencies expected in graduates from this program/major*

At the close of their degree, students should be able to demonstrate:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
8. a commitment to serve the world with passion and integrity that stem from a Christian mind and character.

Note: Program Objectives #1-7 are adopted from the ABET Engineering Student Outcomes.

Greenville University Student Learning Outcomes

Greenville University's General Education Program reflects the institution's belief in holistic education that builds Christian character, expands the mind to consider broad perspectives, develops awareness of a global community and beckons students to consider questions critically, creatively and through a Christian lens.

The following Student Learning Objectives guide the Greenville University General Education Program and the aims of Departmental Programs:

1. CRITICAL SELF-AWARENESS – Recognize and develop personal strengths, subjecting individual ideas and expression to critical analysis and revision.
2. KNOWLEDGE AND SKILL - Employ truth-seeking measures through the use of critical inquiry, including appropriate and relevant research.
3. COLLABORATION AND COOPERATION ACROSS DISCIPLINES - Collaborate and cooperate effectively with others, based on open dialogue and mutual respect.
4. COMMUNICATION - Communicate effectively, using written, oral and creatively artistic methods.
5. CULTURAL AND AESTHETIC VALUES - Recognize the value of diverse cultures and their contributions.
6. CHARACTER AND APPLICATION OF CHRISTIAN VIRTUES - Articulate the integrating of Christian faith with living and learning.

Mapping of GU SLOs to Engineering POs

GU Student Learning Outcome	Engineering Program Objective(s)
1	7, 8
2	1, 2, 6, 7
3	5
4	3
5	4
6	8

Engineering Program Fulfillment of the SLOs

Through our engineering program, we are enabling students to fulfill the mission of GU through transforming Christ-centered education. We do this by paying attention to students' individual needs as we help them recognize that God has created each of us uniquely with specific talents, interests, and calling.

POs 1, 2, 6 and 7 support SLO #2 as students need to master the content of the major. PO #1, which deals with problem solving, is addressed in nearly every course, and it is assessed using homework and exams. Problem solving intrinsically requires critical inquiry and relevant research. PO#2, which deals with design, is addressed in ENGR101, ENGR110, ENGR332, and ENGR401 and is assessed through design project reports and/or presentations in ENGR101, ENGR332, and ENGR401. PO #6, which deals with experimentation, also supports SLO #2 because design projects intrinsically involve critical inquiry, relevant research, and testing (experimentation). Experimentation is addressed in PHYS200, ENGR230, ENGR308, ENGR332, and ENGR402. It is assessed in PHYS200, ENGR332, and ENGR402. PO # 7, which deals with acquiring and applying new knowledge, clearly supports SLO #2 as well. It is addressed in ENGR240, ENGR340, ENGR352, and ENGR401 and assessed in ENGR240 and ENGR401 through design reports, and in ENGR340 through researching, critically analyzing, and applying environmental laws and the principles of sustainability. PO #3, which deals with communication, obviously supports SLO #4. Communication is assessed in part from homework problems submitted in courses, but primarily from project reports and presentations, research papers, and short essays. PO #4, which deals with ethical and professional responsibilities, addresses SLO #5 regarding cultural and aesthetic values because engineering solutions to problems must consider many factors, such as global, economic, environmental, and societal contexts. It is addressed in ENGR101, ENGR352, ENGR360, and ENGR402 and assessed in ENGR101 and ENGR402 through design reports, and in ENGR360 through case analyses. PO #5,

which deals with functioning effectively on a team, clearly supports SLO #3. It is addressed in ENGR101, ENGR240, and ENGR402. It is assessed primarily through design reports. In addition to supporting SLO #2, PO #7, which deals with acquiring and applying new knowledge that must be subjected to critical analysis, also support SLOs #1. It is addressed in ENGR240, ENGR340, ENGR352, and ENGR401 and assessed in ENGR240 and ENGR401 through design reports, and in ENGR340 through researching, critically analyzing, and applying environmental laws and the principles of sustainability. Finally, PO #8, which deals with Christian character, obviously supports SLO #6. It also supports SLO #1 since we hope Christian character strengths are developed as students advance through the program. PO #8 is addressed in ENGR101, ENGR340, ENGR352, and ENGR360. It is assessed in ENGR101, ENGR340, and ENGR360.

The University's general education requirements align primarily with Engineering POs #1, 3, and 5. Hence the Engineering program POs and the general education program fully support GU's student learning outcomes.

Engineering Program Connections to Greenville University as a Whole

Christians are called to serve the world in all areas of life. Engineering is one of the most essential sectors of human society that needs to be transformed by Christ-centered education and practices. The Engineering program helps fulfill Greenville's mission by producing transformative and creative, skillful doers who are equipped with Christian ethics, a creative mind, and a serving heart. It expands the reaches of Greenville's Christian Liberal Arts education into more practical areas of life. Our Engineering curriculum is based on the long tradition of Greenville's broad education that includes the humanities, social sciences, management skills, and environmental and

sustainability concerns. We strive to make our Engineering program to be a source of inspiration for a quality Christian engineering education.

Section C

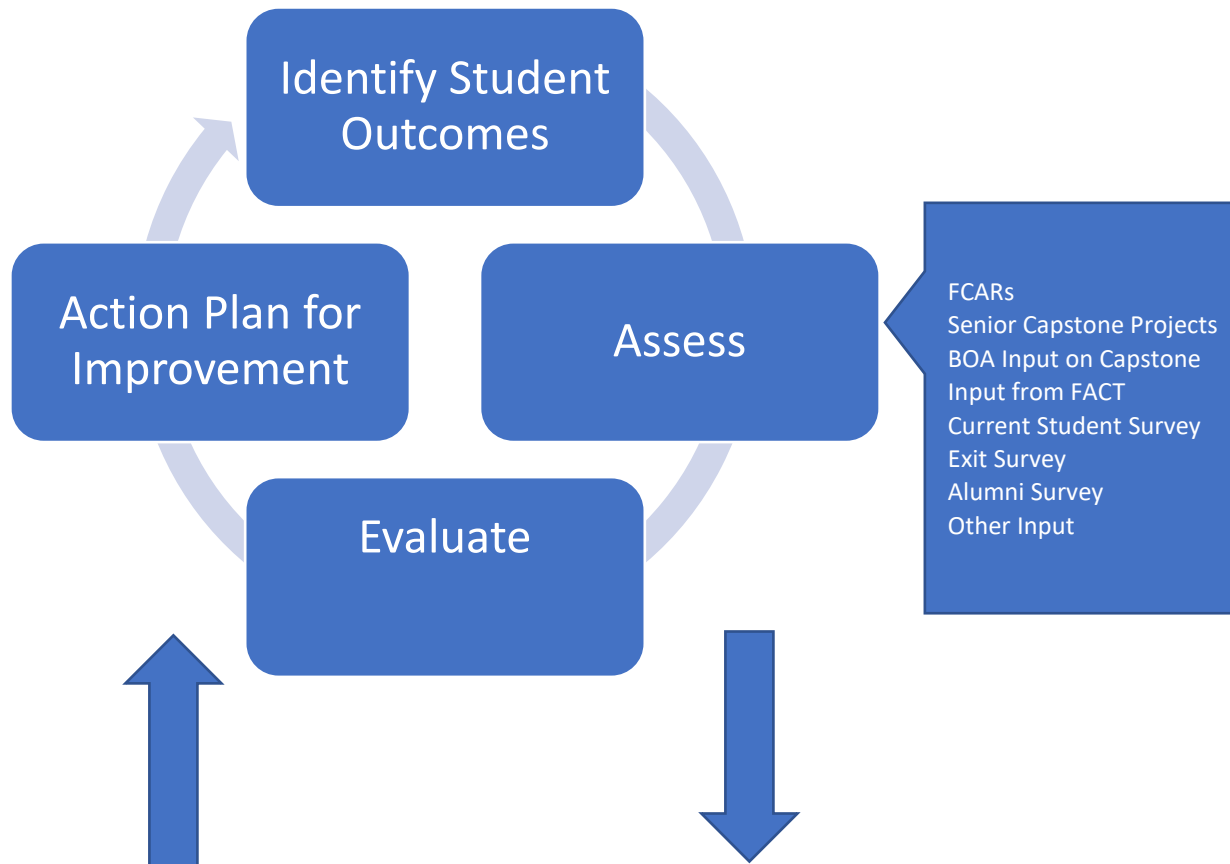
PO	Required Courses / Learning Opportunities														Elective Courses/Learning Opportunities																
	101 Intro to Engr	PHYS 200 Univ Phys I	110 Intro to Prog	230 Electrical Circuits	240 Engr Dsgn & CAD	250 Statics	260 Dynamics	308 Engr Thermo	322 Mech of Mats	332 Mechatronics	340 Environ & Sustain	352 Project Mgmt	360 Engineering Ethics	401 Senior Design I	402 Senior Design II	302 Digital System	306 Fluid Dynamics	312 Mfg & Matls	316 Machine Dsgn & Mnt	318 Nanotechnology	320 Optics & Photonics	310 Materials Sci and Eng	325 Heat Transfer	326 System Design	330 Electronics	334: Comput Modeling	338 Microcont & Emb	ENGR3XX Vehicle Dynam	ENGR3YY Mach Learn & Aut	Other	
1		I*	I	D		D	D	D	D	D*					M*	D	D			D	D		D	D	D	D	D	D	D		
2	I*		I		D					D*				M*		D		D	D		D				D		D		D		
3	I*			D	D*	D	D	D			D	D			M*	D	D				D			D		D	D	D			
4	I*											D	D*		M*											D					
5	I*				D*										M*	D	D				D			D	D	D	D		D		
6		I*		D				D	D*	D					M*	D	D	D							D	D	D				
7					I*						D*	D		M*													D				
8	I*										D*	D	M*																		
Key: *Assessed I – Introduced D = Developed M = Mastered																															

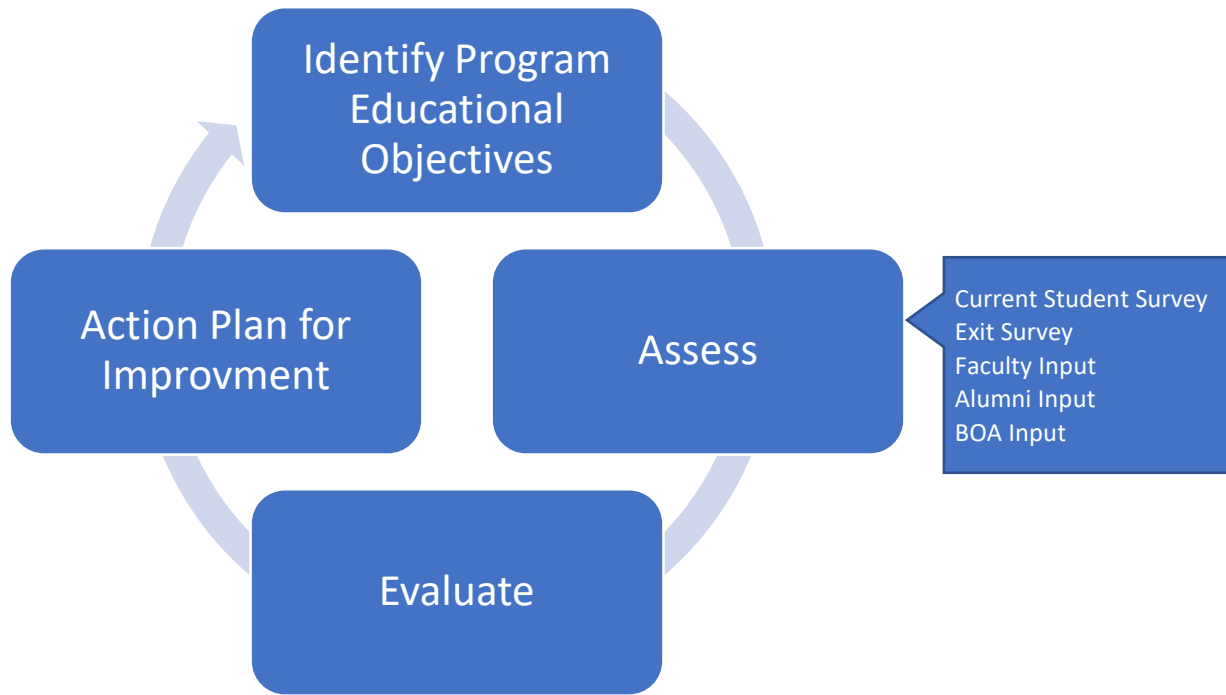
Section D

SLO	PO	Level of Mastery (IDM)	Term	Course number	Learning Activity	Benchmark	Assessment method
Year One							
2, 4, 5	1, 2, 3, 4	I	Fall	PHYS200, 101	PHYS200: PO 1 (I)-Sect. II of Final ENGR101: POs 2,3,4 (I)-Essays, Projects, HW, Service Project	>75%	Scores on each activity.
		D	Spring	240, 332, 360	ENGR240: POs 3,5,7 (D)-Project Reports and Presentations, Teamwork, CAD Project ENGR332: POs 1,2,6 (D)-HW, Projects, Exams ENGR360: POs 4 (D), 8 (M)-HW, Exams, Sevice Project	>75%	Scores on each activity.
		M	Fall	401	POs 2,7 (M) PDS, CDR	>75%	Scores on each activity.
		M	Spring	402	POs 1,3,4,5,6 (M)-Reports, Presentations, Teamwork	>75%	Scores on each activity.
Year Two							
1, 2, 3, 6	5, 6, 7, 8	I	Fall	101, PHYS200	ENGR101: POs 5,8 (I)-Essays, Projects, HW, Service Project PHYS200: PO 6 (I)-Lab Reports	>75%	Scores on each activity.
		I	Spring	240	PO 7 (I)-CAD Project	>75%	Scores on each activity.
		D	Spring	240, 332, 340	ENGR240: PO 5 (D)-Teamwork ENGR332: PO 6 (D)-Projects ENGR340: POs 7, 8 (D)-Final Project, Midterm Assignment	>75%	Scores on each activity.
		M	Fall	401	PO 7 (M)-Presentations, Reports	>75%	Scores on each activity.
		M	Spring	360, 402	ENGR360: PO 8 (M)-Service Proj. ENGR402: POs 5, 6 (M)-Final Rep.	>75%	Scores on each activity.
Year Three=Year One							
Year Four=Year Two							
Annual Indirect Assessment Methods							
	All		Spring		Board of Advisors Meeting		
	All		Spring		Current Student Survey (So, Jr, Sr)		
	All		Spring		Senior Exit Survey		

Description of Assessment (Data Collection) and Evaluation (Data Analysis) Processes

The full assessment process is shown in flow-chart form below followed by a narrative explaining the details.





Continuous Improvement Process

Assessment Process	Frequency	Assessor	Who is Assessed/Surveyed
Faculty Course Assessment Report (FCAR)	Every semester	Instructor	Students in the course
Course Portfolio	Every semester	Instructor	Students in the course
Exit Survey	Spring semester	Chair/BOA	Graduating senior
Exit Interview	Spring semester	Chair/BOA	Graduating senior
Graduate Placement	Spring semester	Chair/BOA	Graduating senior
Current Student Survey (So, Jr, Sr)	Every 3 Years	Chair	Current Students
BOA Survey	Every 3 Years	Chair	POs and PEOs
Fundamentals of Engineering Exam (once accredited)	Spring semester	NCEES & State Engineering Board	Graduating Senior
Board of Advisors Meeting	Spring semester	N/A	N/A
Senior Project Presentation	Spring semester	Faculty, BOA	Students in ENGR 402

Quantitative (Direct) Processes

Faculty Course Assessment Report (FCAR):

The table above shows the POs addressed by each course. All course syllabi must be based on the Greenville University standard course syllabus template, which includes explicit reference to student outcomes expected for engineering courses. All faculty members use a variety of traditional assessment and grading methods (exams, quizzes, projects, and other assignments). Each course syllabus contains a table showing the correlation of these artifacts with course objectives (COs), program objectives (POs i.e., ABET student outcomes, SOs), and Greenville University Student Learning Outcomes (SLOs). Tailoring a selection of the grading activities to the specific assessment(s) of student performance with respect to the specific POs assigned to a course is the duty of each individual faculty member. Each faculty member is responsible to collect the data and submit it to the ABET Assessment Coordinator (currently the department chair) using the Faculty Course Assessment Report (FCAR).

D2L has the capability to collect assessment data and artifacts, which can then be used for assessment and evaluation of POs. The Department hopes to make use of this feature for both of its programs to further automate the assessment process, but currently the process is primarily a manual one.

The plan is for faculty members to use the D2L system to evaluate the effectiveness of their courses in achieving the POs assigned to them every semester. Each one of the POs will have a set of two or three potential Key Performance Indicators (KPI) from which faculty may choose for assessing a particular PO (e.g., a test or test question, a homework assignment, etc.).

Qualitative (Indirect) Processes

Survey of Current Students

Every three years, current sophomores, juniors, and seniors will be surveyed to provide their thoughts on the appropriateness of the POs and of the ABET Program Educational Objectives (PEOs).

Exit Surveys and Interviews of Graduating Seniors:

The department chair will conduct exit surveys and possibly interviews with all graduating students. These surveys will provide information on the overall experience of the students in the program and on their perception of the strengths and weaknesses of the program. The surveys will also provide information on student perceptions of their achievement of the POs and the appropriateness of the ABET PEOs. Finally, it will provide the most current information on the placement of graduates.

The Board of Advisors (BOA) serves as critical source of feedback information on the effectiveness of the program in fulfilling needs of local industry. The BOA includes all of the program's external constituencies, including alumni and members of regional industries who may employ our students. Members of the board also offer a special perspective on the skills and capabilities that graduates need to succeed in the industries they represent. For that reason, the members of BOA will be asked every Spring to conduct, as a small group, a face-to-face exit interview with all graduating students. The process will be unscripted; BOA members will simply be requested to discuss with the students their experiences in and reactions to the Engineering program as they are about to graduate, and to provide their reflection regarding the preparedness of graduates to enter the local work force. Members of the BOA will be asked to summarize the important facts and comments from the interviews and to offer any suggestions that may arise from these interviews. The summaries will be forwarded to the Faculty Assessment and Continuous Improvement Team (FACT) for consideration and action as appropriate.

Survey of the BOA

Every three years, the BOA will be surveyed to provide information on the appropriateness POs and of the ABET Program Educational Objectives (PEOs).

Evaluation of Attainment of Student Outcomes

The Faculty Assessment and Continuous Improvement Team (FACT) for the Engineering program (currently the entire faculty) is responsible for:

- Establishing and disseminating the PEOs of the program, and periodically reviewing and updating those objectives based on assessment information.
- Establishing and disseminating the POs expected of the students, and periodically reviewing and updating those outcomes to ensure they support the current program objectives.
- Establishing those courses and activities in the program curriculum that are to be the primary means by which POs are attained by students.
- Developing and maintaining standard course outlines for all technical courses in the curriculum.
- Reviewing, approving, and disseminating standard course outlines to faculty.
- Receiving, reviewing, responding to, and acting on faculty recommendations for curriculum change and improvement.
- Evaluating program-related assessment information from various assessment systems (current students, exit surveys; advisory board inputs; FCARs, etc.).
- Recommending actions directed toward the improvement of the program to the entire faculty.

Program Improvement

At the end of each academic year during May Convention, the FACT for the Engineering program submits the Year End Assessment Report to the Dean of Assessment and Institutional Research.