

## End of Year Assessment Report for Programs

Program: Bachelor of Science in Engineering

Semester/year: Spring 2018

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### Program Mission Statement

Engineering Program strives to provide students with quality education in engineering in a caring Christian environment.

### Program Objectives

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

1. Apply knowledge of mathematics, science, and engineering practice (ABET a; GU SLO 1.4)
2. Design and conduct experiments, as well as to analyze and interpret data (ABET b)
3. Design a system within realistic constraints. (ABET c; GU SLO 3.2)
4. Function on multidisciplinary teams (ABET d)
5. Identify and solve engineering problems (ABET e; GU SLO 1.3)
6. Understand professional and ethical responsibility (ABET f; GU SLO 2.2)
7. Communicate effectively (ABET g; GU SLO 2.1)
8. Understand the impact of engineering solutions in a larger context. (ABET h; GU SLO 1.2)
9. Recognize the need for, and engage in life-long learning (ABET I; GU SLO 1.1)
10. Demonstrate knowledge of contemporary issues. (ABET j; GU SLO 4.4)
11. Use techniques, skills, and modern tools for engineering practice. (ABET k)
12. Serve with passion and integrity stem from Christian mind and characters. (GU SLO 4.2, 4.3)

## Assessment Methods and Benchmarks – SPRING SEMESTER

Program Objective	Introducing	Developing	Mastering
PO1. Apply knowledge of mathematics, science, and engineering	ENGR 201 – Assignment 3	ENGR250 - Exam 3	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO2. Design and conduct experiments, as well as to analyze and interpret data	<i>Not taught this semester</i>	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO3. 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	ENGR 201 – Final Assignment	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO4. Function on multidisciplinary teams	<i>Not taught this semester</i>	ENGR 301 - Teamwork	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO5. Identify, formulate, and solve engineering problems	<i>ENGR 201 – Project</i>	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO6. Demonstrate an understanding of professional and ethical responsibility	<i>Not taught this semester</i>	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO7. Communicate effectively	ENGR 201 – Final Assignment	ENGR 301 – Project Presentation	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO8. Demonstrate the understanding of the impact of engineering solutions in a global, economic, environmental, and societal context	<i>Not applicable</i>	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark:	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO9. Recognize the need for, and an ability to engage in life-long learning	<i>Not taught this semester</i>	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO10. Demonstrate knowledge of contemporary issues	<i>Not applicable</i>	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark:	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO11. Use the techniques, skills, and modern engineering tools necessary for engineering practice	MATH 170 – Final Project	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$
PO12. Serve with passion and integrity stem from Christian mind and characters.	<i>Not taught this semester</i>	<i>Not taught this semester</i>	<i>Not taught this semester</i>
	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$	Benchmark: $\geq 75\%$

## Assessment Findings – SPRING SEMESTER

### PO1.

- A. Introducing: ENGR 201 Assignment 3 On the Assignment 3, 12 of 15 students (80%) met the objective with a score of 75% or better.
- B. Developing: ENGR 250 Exam 3. On the Exam 3, 12 of 15 students (80%) met the objective with a score of 75% or better.
- C. Mastering: N/A

### PO2.

- A. Introducing: N/A
- B. Developing: N/A
- C. Mastering: N/A

### PO3.

- A. Introducing: ENGR 201 Final Assignment. On the Exam 3, 12 of 15 students (80%) met the objective with a score of 75% or better.
- B. Developing: N/A
- C. Mastering: N/A

### PO4.

- A. Introducing: N/A
- B. Developing: ENGR 301 Teamwork Assignment – students had to evaluate their team and themselves while completing Design Project together. Students gain an experience in teamwork that translates into future Capstone Project participation. On the Teamwork Assignment 12 of 12 students (100%) met the objective with a score of 75% or better.
- C. Mastering: N/A

### PO5.

- A. Introducing: ENGR 201 Project Assignment – learned how to model, assemble and draw parts using SolidWorks. Students gain an experience in Solid Modeling/Assembling/Drawing that translates into future Design related courses. On the Project Assignment 13 of 15 students (87%) met the objective with a score of 75% or better.
- B. Developing: N/A
- C. Mastering: N/A

### PO6.

- A. Introducing: N/A
- B. Developing: N/A
- C. Mastering: N/A

PO7.

- A. Introducing: ENGR 201 Final Assignment. On the Exam 3, 12 of 15 students (80%) met the objective with a score of 75% or better.
- B. Developing: ENGR 301 Presentation Assignment – students presented their design ideas and discussed ways of improving it. Students gain an experience that translates into future Capstone related courses. On the Final Assignment 12 of 12 students (100%) met the objective with a score of 75% or better.
- C. Mastering: N/A

PO8.

- A. Introducing: N/A
- B. Developing: N/A
- C. Mastering: N/A

PO9.

- A. Introducing: N/A
- B. Developing: N/A
- C. Mastering: N/A

PO10.

- A. Introducing: N/A
- B. Developing: N/A
- C. Mastering: N/A

PO11.

- A. Introducing: MATH 170 Final Project Assignment. On the Final Project Assignment 14 of 15 students (93%) met the objective with a score of 75% or better.
- B. Developing: N/A
- C. Mastering: N/A

PO12.

- A. Introducing: N/A
- B. Developing: N/A
- C. Mastering: N/A

## **Analysis of Assessment Findings – SPRING SEMESTER**

Engineering program at Greenville is currently approaching the end of the second year. The courses offered to the students represent a combination of introductory and intermediate level classes. The following are introductory level courses: ENGR101 (Fall 2017), ENGR201 (Spring 2018) and ENGR 240 (Spring 2018). Intermediate level classes are ENGR 250 (Spring 2018) and ENGR 301 (Spring 2018). Engineering program at GU continues to follow ABET student outcomes which constitute Engineering Program Objectives with an addition of Greenville's Christian mission objective. Students' recommendations via FCARs were incorporated into the courses previously run by the Department (ENGR 201).

Following the suggestions in FCAR for ENGR201 from Spring 2017, the number of the topics studied was reduced from four to two. This allowed for more in-depth learning of Robotics and 3D modeling. Students' feedback indicated better response comparing to the previous course. Overall Summative Rating went from 3.5 to 4.3 and Challenge and Engagement Index – from 4.5 to 5.7. However, further Engineering Curriculum development partially inspired by the feedback requires modification in the design stream sequence.

ENGR240 ran for the first time with all course objectives were met. Students feedback via FCAR indicates slower first half of the class which would benefit from slightly faster pace. As the sequence of programming courses will be changed in the new engineering curriculum closer monitoring will be required.

ENGR301 was offered for the first time with all course objectives were met. Students feedback via FCAR indicates that the course was well received. Suggested modifications include potential slight increase in pace for initial SolidWorks training and allocation of additional time for Design Project (Final Design phase).

## **Sharing and Discussion of Assessment Findings – SPRING SEMESTER**

FACT (Faculty Assessment and Continuous Improvement Team) has met twice during Spring 2018 semester (January 5<sup>th</sup> and May 22<sup>nd</sup>) to assess the engineering program with all the FCARs prepared. The achievements of the Program and concerns following 2017-2018 academic year were discussed. Possible improvements to the program and pedagogy were shared. Here are the findings discussed at the meeting:

1. Procedure for collecting students' feedback was discussed with the desire to follow ABET's guidelines.
2. Curricular changes were discussed and implication for current students – freshman and sophomore.
3. Robotics Projects from ENGR 201 will be introduced in ENGR 101.
4. Mathematics course incorporating MATLAB will be offered to sophomore student (MATH 199) while Intro to Programming with C++ will be offered to freshman students during Spring semester.

ENGR 201:

Comparing to the last years reflection (Overall Summative Rating of 3.5, Challenge and Engagement Index of 4.5) the course got better response from the students this year. This means that the corrective actions to reduce the number of topics studied and provide more time for the remaining topics were better received by the current class. Nevertheless, comments from the current class suggest that further separation of SolidWorks modelling (Design) and Robotics Project would be desirable. Also, students' feedback doesn't seem to be well consolidated due the lack of explanation provided to the

students prior to writing evaluations. The class was taught by two instructors and some of the students seemingly write feedback only on the second part of the class (they were evaluating the first half of the course early-March, prior to Spring break), where others provide feedback for both instructors.

**ENGR 240:**

As the course was taught first time, there was no prior actions or changes made. Based on the students' feedback and their grades, most of the students found the course reasonably challenging (not too much) and commented about their experience in the positive way. However, students' comments suggested that first half of the course was relatively slow and faster pace was recommended. Some students' comments suggest more homework over in-class quizzes and readiness assessments.

**ENGR 250:**

Overall, I feel that the students grasped the topics covered despite my lack of experience as an instructor. Improvement increased with time in the classroom.

**ENGR 301:**

As the course was taught first time, there was no prior actions or changes made. Based on the students' feedback and their grades, most of the students found the course reasonably challenging and commented about their experience in the positive way. However, students' comments suggested that initial SolidWorks training was relatively slow and faster pace was recommended. Also, additional time would be beneficial at the end of the course to tackle Design Project (modelling part).

### **Use of Assessment Findings for Program Improvement (Action Plan) – SPRING SEMSTER**

The following suggestions/recommendations were made for program improvement:

**ENGR201:**

Based on the feedback provided by students it's recommended to further separate the two main elements of the current course ENGR 201: SolidWorks modelling and Robotics Project. Robotics Project will be introduced to the students as a part of their freshman years engineering experience in ENGR 101 and SolidWorks modelling will become a part of Engineering Design course ENGR 301 (currently). Furthermore, ENGR 301 class will change its code to ENGR 201- Engineering Design & CAD and will be offered in Fall of Sophomore year.

- Robotics Projects will become a part of freshman year experience and will be offered in ENGR 101
- SolidWorks modeling will be taught in ENGR 301. ENGR 301 will change its code to ENGR 201.

**ENGR240:**

Based on the students' recommendations, it's suggested to improve the pace at which the first half of the class runs and incorporate more practical activities to reinforce the theoretical knowledge. Nevertheless, modifications in physics and engineering curriculums call for ENGR 240 to be introduced at the freshmen year as an introductory programming class. All students in the current (SP 2018) class had exposure to MATLAB programming prior to taking ENGR 240. The curriculum change will only affect the students taking the class in SP 2019. Hence, close monitoring of students' performance will be required for the first half of the course to gauge the progress and adjust the pace accordingly. In-class quizzes and

readiness assessments are deemed necessary and suggested replacement with extra HW would not reflect the desire of fair assessment of students' performance. It's recommended to keep these elements of assessment.

- Increase the pace for the first half of the class.
- Closely monitor students' performance as majority of them wouldn't have prior programming experience (MATLAB class will not be offered before ENGR 240 starting 2018-2019 academic year).

#### ENGR250:

Agreed that more and consistent homework assignments are needed to better convey the topics. The adding of more "real world" applications would help many of the students grasp the ideas better. Ending the semester with a sort of "class project" is needed.

- Increase number and consistency of homework assignments.
- Improve the delivery mode and incorporate "real world" problems.
- Number of problems solved/discussed in class to be increased.

#### ENGR301:

Based on the students' recommendations, it's suggested to improve the pace at which initial instructions on SolidWorks modelling are done. Time gained would provide an opportunity to increase the design/modelling portion of the Design Project. Furthermore, additional instruction on the design process and the importance of it in engineering practice should be emphasized more strongly.

- Increase the pace of delivering introductory SolidWorks modeling techniques.
- Allocate more time for the Design Project (specifically the final design phase/modelling).

### **Full Year Reflection – FALL/INTERTERM/SPRING TERMS**

The data collected during the Fall and Spring semesters of 2017-2018 academic year provided fruitful feedback from our students and is deemed as mostly fair reflection of their needs. Further development of individual courses and the engineering program as a whole is anticipated based on the actions proposed. Program learning objectives were met in each of the courses offered in both semester, yet further improvements are expected (reflected in the action plan). Continuous improvement of data collecting system is necessary to adhere to ABET (Engineering accrediting body) standards. This will be done in consultation with external experts and implemented by FACT (Faculty Assessment and Continuous-Improvement Taskforce) made up of Physics and Engineering faculty.

### **Supporting Documents**

The FCARs for the following courses are used in the analyses above: ENGR201, ENGR 240, ENGR250 and ENGR 301 for Spring 2018. We also have the first 2 FACT meeting minutes. These documents are available upon request.