**A.1.2 Overview of the Primary and Secondary Student Measures**

The assessment plan includes two sets of outcomes measures: a primary set and a secondary set. The primary set of outcome measures has prescribed acceptance criteria (i.e., a rubric). If the rubrics are not met, action must follow (typically a root cause identification, and modification of the curriculum if the measure and measurement tool are appropriate). The secondary set of outcome measures does not contain specific rubrics. These data are used to help determine the possible reasons why the primary outcome measures were not met, if applicable, and point to possible remediation measures. For example, one primary outcome measure used was a rating of student performance on the Senior Design Project by the faculty who serve as advisors. If, over the course of one year of student design projects, the rating for a specific outcome does not meet the rubrics, then the secondary measures are used to determine where in the curriculum that outcome is not being covered adequately. The secondary outcomes measures are, for the most part, tied to specific courses. Each of the courses, in turn, has course outcomes that relate to SLOs. We then look at the courses that contribute to that outcome and analyze the secondary outcome measures to determine where changes in the program may result in improvement of that SLOs. Each of the seven SLOs is evaluated similarly and independently.

The primary set of outcomes is assessed during the summative years of the undergraduate program, while the secondary set of outcomes is assessed across the formative and summative years of the undergraduate program. **Table 3.2** summarizes the current primary and secondary student outcome measures.

**Table 3.2 Primary and Secondary Student Outcome Measures**

|  |  |
| --- | --- |
| **Primary Outcome Measure** | **Secondary Outcome Measures** |
| * Senior Design Project Evaluation (Faculty Assessment)
* Senior Design-1 Course Assessment
* BME Lab Course Assessment
* Student Exit Survey – indirect measure
 | * Course outcomes for BME 1xxx-4xxx level core courses
* Transcripts
* Course Outcome Surveys
* Student Resumes
* Senior Design Project External Evaluation
* Self-Assessment Student Surveys (since Fall 2021) – indirect measure
 |

**A.2 The Primary Student Outcome Measures are as follows:**

The four primary outcome measures are derived from student performance on the Senior Design Project (from Senior-2 or BME 4908 and Senior-1 or BME 4800C), BME lab courses (BME 4050L and BME 4051L), and student exit surveys; and are used to measure student achievement of outcomes. The FIU BME curriculum is designed such that all knowledge gained through the formative years of the curriculum is put into practice via this set of senior-level courses (BME 4050L, 4051L, 4800C, 4908) apart from the indirect measure via exit surveys. Therefore, all these measures combined encompass the entire set of SLOs.

**(i) Senior Design Project Faculty Assessment**

Each Senior Design Project team is assigned a faculty advisor/mentor. The faculty advisor employs a rubric to assess the quality of the project and assign a grade. Each item on the rubric assessment tool is assigned a grade of A-F (Outstanding, Very Good, Good, Acceptable, and Unacceptable) that is then converted to a quantitative score from 4-0. Each of these items in turn contributes to a score for each program outcome, also on a 4.0 scale. Faculty members complete their assessments using the same taxonomy as do external evaluators. This results in a direct measure of each program outcome based on specific performance on the senior design project. Student Learning Outcome E (ability to function on multidisciplinary teams) is partially assessed through a separate Self and Peer Evaluation tool (within the senior design project teams). This assessment tool is given to each student team member to fill out upon completion of the project.

**(ii) BME Senior Design-1 Course Assessment**

Each BME student is required to complete Senior-1 (BME 4800+ BME 4880, or BME 4800C since Fall 2019) prior to Senior-2. The SLO that are high in priority for Senior-1 are assessed and used as primary measures.

The Senior Design-1 Instructor uses the Senior Design-1’s course assessment tool to assess the quality of the initial phase of their senior-design project’s design and assign a grade. Each item on the assessment tool is assigned a grade of Outstanding, Very Good, Good, Acceptable and Unacceptable, which is then converted to a quantitative score from 4-0. The students/teams are assessed based on the evaluations done by the course instructor (e.g., quizzes, mid-term exam, in-class activities/presentations, final exam, project proposal presentation to the department faculty, peer review, and/or a written proposal). Each ABET outcome that is supported with high degree of relevance by this course is measured using examples selected from the evaluations.

**(iii) BME Lab Courses Assessment**

Each BME student is required to complete BME lab courses (BME 4050L and BME 4051L) during the senior year. The SLOs that are high in priority for these lab courses are assessed and used as primary measures.

The laboratory instructor uses the lab course assessment tool to assess the quality of the laboratory work and assign a grade. Each item on the assessment tool is assigned a grade of Outstanding, Very Good, Good, Acceptable and Unacceptable, which is then converted to a quantitative score from 4-0. Each of these items in turn contributes to a score for each program outcome, also on a 4.0 scale. This results in a direct measure of each program outcome based on specific performance in the two BME lab courses.

**(iv) Student Exit Survey (Indirect Measure)**

Each graduating senior is required to complete the Exit Survey. This survey asks each graduate to assess his or her own capabilities and rate the level of achievement of the outcomes, in his or her opinion, after completing the entire curriculum. Survey items use a scale 1-4, where 1 indicates “strongly disagree,” 2 indicates “disagree,” 3 indicates “agree,” and 4 indicates “strongly agree.”

**A.3** **The Secondary Program Outcome Measures are as follows:**

1. **BME 1xxx-4xxx Core Course Outcomes**

All BME required courses from 1xxx-4xxx levels are assessed here. Excluding the Senior Design Project (BME 4908) and Senior Design-1 (BME 4800+4880 or BME 4800C), and BME lab courses (BME 4050L and BME 4051L), all BME 4xxx level core courses are assessed for the respective SLOs, which is in high priority in the respective courses.

Each BME 1xxx, 2xxx, 3xxx and 4xxx core course outcome has an associated student output (homework or exam question, part of written report, etc.) that is used to assess the student’s ability to master that capability. The course instructor uses these data as a discussion item during the course review at the Faculty and Staff Annual Retreat; discussion is intended to contribute to continuous improvement in the formative years and improved summative assessment (in our primary outcome measures).

1. **Transcripts**

Since each course has outcomes that contribute to the overall SLOs, the grades each student earns in the required BME courses are also a measure of a student’s ability to master the expected capabilities.

1. **Course Outcomes Surveys**

At the end of each course, students are surveyed as to their opinion of their own mastery of the outcomes stipulated for each course. These data are quantified (achieved – 1.0, partially achieved – 0.5, and not achieved – 0.0) and used as another discussion item for each course review at the BME Annual Faculty and Staff Retreat.

1. **Student Resumes**

At the time of graduation from the program, each student is expected to provide a professional resume to the department after review by personnel from the university’s Career and Talent Development Center or qualified industry professional, research mentor, or internship supervisor. Their resumes contain extracurricular activities that contribute to the demonstration of their experiences and capabilities. Examples of such activities include participation in student organizations, working in research laboratories, and internships or co-op experience.

1. **Senior Design Project External Evaluation**

 At the end of each Fall and Spring term, student teams completing their Capstone Senior Design Projects present their projects at the annual Biomedical Engineering Expo and Competition. This event, which is open to the public, comprises student presentations of projects. These projects are evaluated by a panel of judges who are practicing engineers and scientists from the medical device manufacturing industry, clinicians and, occasionally, legal experts on intellectual property. Judges evaluate students’ engineering competence, product development acumen, ability to communicate technical information, and ability to respond to technical interrogation. Then, judges determine winners of the competition, who are recognized by the department and their peers, and are awarded prizes for first-, second-, and third-place finishes. The judges also rate the student teams on their ability to demonstrate, through activities required to complete the design project, all FIU BME SLOs. The presentations are 10-12 minutes in length, followed by 10 minutes of questions from the judges. Each judge receives a four-page executive summary and additional project documentation approximately a week in advance. Based on this input, the judges rate the student team’s ability to demonstrate each Student Learning Outcome on a scale of 4-0 (Excellent, Very Good, Good, Fair, and Poor). To ensure that evaluations are consistent, judges receive a taxonomy defining these terms and their relationships to expected student performance. Projects are also evaluated with respect to SLOs A-G, and results are recorded and evaluated by the department’s Undergraduate Program Committee.

 **(vi) Self-Assessment Student Surveys (Indirect Measure)**

In Fall 2021, the department began administering self-assessment student surveys across the formative and summative years of the students. These self-assessment surveys are initiated in the first few weeks of the semester to sophomores, juniors, seniors, and graduating seniors in BME 2740 (Modeling & Simulation), BME 3404 (EABS-2), BME 4800C (Senior Design-1), and BME 4908 (Senior Design-2). The same set of questions that relate to the SLOs is asked of students across different stages of the BSBME program. During BME 4908, the survey is given at the beginning and end of the course as well. The survey uses a scale of 1-5, where 1 indicates “novice,” 2 indicates “advanced beginner,” 3 indicates “competent,” 4 indicates “proficient,” and 5 indicates “expert.” This is an indirect measure that spans the formative and summative years of the BSBME program.